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CE PROGRAM FAQs



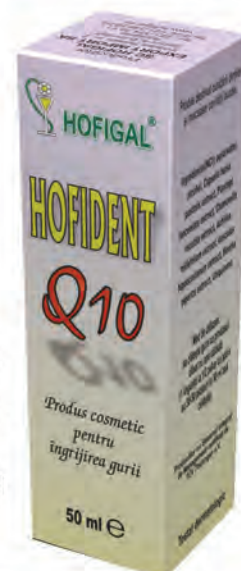
Hofident Q10

Product presentation: Solution for oral hygiene.

Composition (INCI): aqua/water, alcohol, *Capsella Bursa Pastoris* extract, *Plantago Lanceolata* extract, *Chamomilla Recutita* extract, *Achillea Millefolium* extract, *Aesculus Hippocastanum* extract, *Mentha Piperita* extract, Ubiquinone.

Action: The product has antiseptic, healing, hemostatic, anti-inflammatory action, it acts as a antioxidant, detoxifier, deodorant. It is strongly recommended in gingivitis, stomatitis, thrush, compression pain caused by dental prostheses, after tooth extraction, in case of nipple lesion, bleeding gums, mouth and gum ulcers.

Recommendations: It delays dental plaque formation, it prevents bad odour and provides daily mouth hygiene.



HofImun® FORTE

Product presentation:

Chewable tablets to stimulate the immune system

Composition: Each chewable tablet contains raspberry fruit extract (*Rubii idaei fructus*), Echinacea extract (*Echinacea purpurea*), concentrated extract of licorice root (*Glycyrrhiza radix*), magnesium ascorbate and excipients.

Action: It stimulates the immune system, it is antiinflammatory, antiviral, antiseptic, it fluidifies the bronchial and pharyngeal secretions, antioxidant, cardioprotective, vasoprotective, it has antineoplastic antileukimic action, (due to the ellagic acid), it contributes to wound healing, fortifies and remineralizes (it regulates the potassium balance), it has antiulcer effects and is an overall body tonic.

Recommendations: to supplement the diet with nutrients and bioactive substances in: acute and chronic infections of the upper airways (angina, pharyngitis, laryngitis, bronchitis), prophylactic during periods with increased risk of infection with influenza viruses, it has sweating effects in fever, in recurrent herpes episodes of mucocutaneous rash, frequent urinary tract infections, inflammatory urogenital processes; immunodepression after radiotherapy or chemotherapy, bacterial skin infections, psoriasis, neurodermitis, chronic cardiovascular diseases associated with hypercholesterolemia, adjuvant in the diet indicated in the treatment of gastroduodenal ulcers, tonic during periods of physical and mental strain, exhaustion.



Bucoprotect gel

Product presentation: Gel for oral hygiene.

Composition (INCI): aqua, *capsella bursa pastoris*, *calendula officinalis*, *achillea millefolium*, *hippophae rhamnoides*, *olea europea*, *hypericum perforatum*, carbomer, triethanolamine, collagen, *foeniculum vulgare*, *mentha piperita*, *citrus amara*.

Action: Antiseptic, anti-inflammatory, healing, stimulates the inside lining of the mouth and gums trophicity, reduces pain caused by specific oral diseases (gingivitis, stomatitis, lesions of the prosthesis, thrush, periodontitis).

Recommendations: Fights against bad breath (halitosis).

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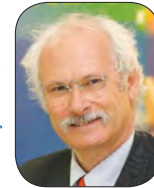
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Consensus – an alternative way to generate Evidence for practitioners to use (or Evidence based revisited)

Jean-François ROULET
DDS, PhD, Dr hc, Prof hc, Professor
Editor-in-Chief



Dear Readers,

Clinical dentistry is a difficult topic because little is either black or white, instead there are many, many grey areas. Practitioners and dental students know that if you present a case to 6 different dentists you will probably generate six different treatment plans, five of which will be similar and one will likely be radically different. Therefore, it is understandable to search for guidelines that are based on sound science. The modern way is to look for reproducible Scientific Evidence (Evidence Based Dentistry). As we know from the Cochrane Collaboration, the highest evidence is given by meta analyses of random controlled double blinded prospective studies (RCT), which is called a systematic review. This should eliminate all bias and produce a trustworthy conclusion.¹ Unfortunately, this approach can introduce at least four more fundamental complications:

1. Not every clinical question can be tested with a RCT. Ethical norms and sometimes costs can severely limit the possible options.²
2. By limiting the analysis to just RCT and excluding all other information, the analysis is often limited to a few studies with an end result that severely reduces the reliability of the outcome. Often there is no clear evidence of which option to choose and the conclusion of the systematic review is that more research is needed to answer the question.^{3,4,5}
3. Sometimes the inclusion-exclusion criteria are so strong that the articles that are problematic are filtered out, thus diminishing the value of the data.
4. Long observation times (e.g. at least 5 years or more) are preferred, with the assumption that the conditions under observation do not change. This may be true if someone is comparing two drugs or two different surgical techniques. But in restorative dentistry things are different. With evidence based medicine, basically a procedure or medication is administered to the human body and the outcome measure is the reaction of the human body, usually over time (e.g. survival of the individual, blood pressure, mobility of an articulation, etc). However, in restorative dentistry the dentist introduces into the oral cavity a foreign material (e.g., a direct restoration, crown, removable or fixed dental prosthesis). The outcome measure is then how this foreign body behaves under stress in the oral cavity. This is problematic, because its behavior is dependent on many factors: for example patients change their lifestyle over time, and this can have a strong influence on the stress level (e.g., diet may change or a divorce may create bruxing habits). Furthermore it is known that the dentist is the most significant variable when looking at the longevity of the restorations.^{6,7,8,9} For these reasons, I personally think that this approach may not be the best, when it comes to giving practitioners the most trustworthy information how to best carry out certain procedures.

Since 2014, I have participated in four “Northern Lights Conference”, key opinion leader conferences held at Dalhousie University in Halifax organized by Dr. Richard Price. So far the objective has been to obtain a consensus about a topic related to light curing. Dr. Richard Price’s recipe is simple and successful. He brings together groups of individuals with high knowledge and diverse interests: Members of the industry who manufacture light curing units and resin

composites, university professors researching and teaching light curing and composites, dental practitioners using these techniques and materials and editors or communication specialists who want to disseminate important information. As a first step, experts present the state-of-the-art knowledge to be discussed. Then in a very open atmosphere the facts are discussed under every possible aspect and finally conclusions are formulated, again in an open discussion forum that takes into account the diverse points of view of the different individuals belonging to different interest groups. It was always very interesting to observe how shifts occur in all directions so that the group could come up with a consensus that was first formulated verbally and later on converted into a more graphic internationally understandable way using pictograms. After the conferences, these consensus papers are circulated among the participants, for fine tuning before they are published.

Consensus was obtained and published in 2014 and 2015 on how to use curing units to optimize their efficiency. The group discussed the performance of light curing units following the same scheme and guided through discussions by Dr. Richard Price and his team. The resulting consensus was summarized again in a simple graphic display that fitted onto one page. Furthermore, the consensus information was published in the Journal of Adhesive Dentistry¹⁰, Operative Dentistry,¹¹ the Journal of the Canadian Dental Association,¹² Dental Materials,¹³ Revista Brasileira de Odontologia,¹⁴ Revista APCD de Estética,¹⁵ Quintessenz¹⁶ and the Dental Advisor.¹⁷

By November 2016, bulk filling composites had become quite popular, and this triggered the group to examine if light curing of bulk fill composites was different from regular composites. After long discussions, a consensus was finally reached that has already been published in the Canada Dental Association Oasis.¹⁸

The topic this year was dealing with the influence of light curing on adhesion. Since the meeting has only recently taken place, the consensus is still in its state of being formulated and refined by the group.

This novel approach of key opinion leaders, researchers, educators, academics and manufacturers who all got together and came to a common consensus has proven to be successful. Based on the dissemination of the information on all possible channels, including social media, practitioners are becoming aware of the problems associated with inappropriate light curing, and more dental schools are explicitly teaching the nuances when it comes to light curing of resins. Thus, based on common sense, worldwide the quality of resin composite restorations should improve. However, the proof of this must come from longevity studies based on large population samples.

Sincerely yours,
J-F Roulet
Editor-in-Chief

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A Greater Uniformity in the Continuing Education Program of the European Community Dental Practitioner

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Editor-in-Chief



Dear Readers,

Man evolved by observing, learning from the environment and other humans, shaping his intellect, and being in a permanent war with anything and anyone who stood in the way of his decision to find his identity.

When we decided to be of use to those around us, and to help our fellow humans, in dealing with diverse medical-dental conditions, in particular, the “oral cavity”, we did it even though perhaps we did not wonder, as the Chinese philosopher Confucius (551 BC-479 BC) did, about the “pleasure of studying and then practice what we had learned”. We are, however, in agreement with Aristotle (384 BC-322 BC), the Greek philosopher, who proclaimed, “Pleasure in the job puts perfection in the work”.

We did find out much later from thinkers like Dr. Greene Vardiman Black (1836-1915) that: “The professional man has no right to be other than a perennial scholar”. With these ideals in mind, we strived to learn, improve, and practice as much as possible, before being able to offer our patients the best we could, while facing the realities of a “free labor market”.

The General Assembly of the Association for Dental Education in Europe, at its annual meeting held in Cardiff, in September 2004, approved “the profile and competences for the European Dentist”. The document would assist dental schools in Europe, to further harmonize and improve the quality of their curricula. Also, it established norms and regulations meant to describe the competency of the European dental professional: I Professionalism; II Interpersonal, Communication and Social Skills; III Knowledge Base, Information and Information literacy; IV Clinical Information Gathering; V Diagnosis and Treatment Planning; VI Therapy: Establishing and Maintaining Oral Health; VII Prevention and Health Promotion.

The Association for Dental Education in Europe (ADEE), through a group of dental educators, mainly from (ADEE), has been vigorously pursuing the objectives set out in the third phase of the DentEd III project (2004-2007). The plan was designed to facilitate convergence towards higher standards in dental education and professional training, and outlined to promote, through its working groups, the commonly agreed profile of the European Dentist. ADEE was best placed to implement in the European Union Member States:

- The development of an agreed approach on competences and curriculum structure.
- The development of an agreed approach to the implementation of the European Credit Transfer System (ECTS).

In 2008, the American Dental Education Association (ADEA), and the ADEA House of Delegates, established the general dentist as the primary oral health care provider nationally, and defined the areas of competence for the dental professional: 1. Critical Thinking; 2. Professionalism; 3. Communication and Interpersonal Skills; 4. Health Promotion; 5. Practice Management and Informatics; 6. Patient Care: A. Assessment, Diagnosis, and Treatment Planning; B. Establishment and Maintenance of Oral Health.

To arrive at this profile during the learning and evaluation process in dental medicine, it was necessary to introduce first a problem-based learning (PBL) curriculum, and the “MEDICOL (Medicine and Dentistry Integrated Curriculum Online) system” was chosen as a standard. MEDICOL, a system used at The University of British Columbia, is a tool that provides

secure access to learning materials such as lecture notes, handouts, schedules, presentations, lecture recordings and videos.² Despite the young people's ability to use IT, and although it is increasingly used for practical training in universities, Computer Assisted Learning (CAL) and Computer Assisted Simulation (CAS) systems continue to be underutilized in dental education.³

As such, it stands to reason that Computer Assisted Learning, and Computer Assisted Simulation systems, could be successfully used in achieving a standardization of the "Continuing Education Program" in Dentistry, throughout the countries of the European Union.⁴

This proposal is supported by the fact that there are a number of preclinical and clinical disciplines such as: histology, dental materials, statistics, evidence-based dentistry, cariology, endodontics, periodontics, aesthetics, orthodontics, prosthodontics, occlusion, oral implantology and oral pathology, which use information technology already.

In the process of "continuing education" dentists with the right to free practice are mandated, continuously and throughout their professional activity, to follow the forms of continuous medical-dental education and to accumulate a minimum number of credits, established by the College of Dentists, in the country where they work. In the European Union, this annual minimum is variable from country to country (up to 200 credits in 5 years) and in US from state to state (from 15 to 72 credits a year).⁵ The lack of the minimum number of continuing medical-dental education credits would allow the Licensing Association to temporarily suspend the right of practice until the obligation established by the College of Dental Practitioners is fulfilled.

During this period, in a global and free society, we all have the opportunity to professionally improve our skills, in order to better serve our patients. In this effort, the use of information platforms has become essential, crucial and indispensable.

Established in 1993, the ADA Continuing Education Recognition Program (ADA CERP) provides ADA members and the dental community a mechanism to select quality continuing dental education (CE). In US, aside from the Universities, there is an entire list of other organizations, and approved dental providers, having also a role in the "continuing education process" providing lectures, webinars, conferences and seminars.

Starting with the 1st issue of 2017, more than 105,000 readers of the Stomatology Edu Journal, have gained free access to the first JADA CE Credits article. Licensed US, dentists can earn up to three (3) continuing education credits every month through the JADA Online Continuing Education Program. Although a great opportunity, the credits offered by ADA, are yet to be recognized in Europe.

The international economic crisis has highlighted the necessity for inter-state and inter-institutional co-ordination and cooperation, quick political decisions, unity and coherence of the EU. In order to ensure the quality of life of the European citizen, a greater coherence must be provided in the placement of the young practitioner in the competitive labor market, by ensuring and implementing, for the providers of continuous dental education, a common e-learning base at European level. There are a number of global actors, such as the World Dental Federation (FDI), the World Health Organization (WHO), and the International Federation of Dental Educators and Associations (IFDEA) which together with Regional Organizations, the European Regional Organization for FDI (ERO), the Council of European Dentists (CED), formerly the EU Dental Liaison Committee (EU DLC), the Federation of European Dental Competent Authorities and Regulators (FEDCAR), the Council of European Chief Dental Officers (CECDO), the Association for Dental Education in Europe (ADEE) and the European Dental Students Association (EDSA), which have the capacity and competence, must find the availability, coherence and determination to enable the European dentist access to a common and unitary working tool, an e-learning platform, for continuous dental education.

Sincerely yours,

M-V Constantinescu

Editor-in-Chief

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International Recognition of the Complex Activity of Prof. Dr., Dr. h.c. Jean-François Roulet



Prof. Jean-François Roulet and EFCD President Prof. Lorenzo Breschi.

Each year, after a rigorous selection, Conseuro (European Federation of Conservative Dentistry (EFCD) awards a single award of excellence.

The Excellence Award is awarded as recognition of remarkable contributions to Conservative Dentistry over a period of more than 30 years in one or several areas of clinical practice, education, research, contributions to society, leadership and promotion of professional standards. Normally, the prize is given to a prominent European in the field, but it can also be awarded to an internationally acclaimed international personality in Conservative Dentistry.

The Prize for Excellence Award Committee examines the candidates and selects only three. The Chairman of the Committee informs the President of the Federation of the agreed rankings. The President of the Federation will submit the standings to the board of directors to be adjudicated. At the 19th International Congress of the Academia Italiana di Odontoiatria Conservativa e Reastaurativa (AIC) and Conseuro (European Federation of Conservative Dentistry (EFCD) on Saturday May 13th 2017 in Bologna (Italy) EFCD President Prof. Lorenzo Breschi awarded the prize of excellence for 2016 (the 2016 EFCD Award of Excellence) to Prof. Jean-François Roulet. The Excellence Award of the European Conservative Dentistry Federation (EFCD) was awarded to 11 personalities.

Laureates of the EFCD Award of Excellence: Ivar Mjör (2005), Carel Davidson (2006), Edvina Kidd (2007), Erik Asmussen (2008), Ole Blok Fejerskov (2009), Jacob Martin ten Cate (2010), Gottfried Schmalz (2011), Gunnar Bergenholtz (2012), Jens Ove Andreasen (2013), Guido Vanherle (2014), and Thomas Imfeld (2015).

Prof. Lorenzo Breschi

EFCD President

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Myanmar Dental Expo 2017 - The 5th International Exhibition and Conference on Pharmaceutical and Medical Industry for Myanmar

Date: 05 - 07 July 2017
Location: Yangon, Myanmar
Event types: Conference, Exhibition
Visit event website: pharmed-myanmar.com

JD Symposium 2017

Date: 07 - 08 July 2017
Location: Rome, Italy
Event types: Conference, Exhibition
Visit event website: www.jdentalcare.com/?q=en

28th Asia Pacific Congress on Dental and Oral Health

Date: 10 - 12 July 2017
Location: Kuala Lumpur, Malaysia
Event types: Conference, Exhibition
Visit event website: <http://www.dentalcongress.com/asia-pacific/scientific-program>

ITI Education Week London

Date: 10 - 14 July 2017
Location: London, UK
Event types: Conference, Hands-on
Visit event website: https://www.iti.org/EW2017_London

Simplified Common Sense Orthodontic Biomechanics

Date: 14 - 15 July 2017
Location: Sydney, Australia
Event types: Conference, Hands-on
Visit event website: www.adansw.com.au/CPD/Courses/Simplified-Common-Sense-Orthodontic-Biomechanics.aspx?eventid=C261

2 day Basic Oral Surgery Skills and Atraumatic Extraction Techniques

Date: 14 - 15 July 2017
Location: Stevenage, UK
Event types: Conference, Hands-on
Visit event website: <https://dentalcircle.com/organiser/dental-circle/>

Aesthetic Restorations with IPS e.max® Utilising the NEW Power Range

Date: 14 - 15 July 2017
Location: Auckland, New Zealand
Event types: Conference, Hands-on
Visit event website: <https://www.dentevents.com/new-zealand/aesthetic-restorations-with-ips-emax-/e10012525>

AGD 2017 - Academy of General Dentistry

Date: 13 - 15 July 2017
Location: Las Vegas, USA
Event types: Conference, Exhibition
Visit event website: <http://www.agd.org/am2017.aspx>

23° CIORJ - CONGRESSO INTERNACIONAL DE ODONTOLOGIA DO RIO DE JANEIRO 2017

Date: 15 - 22 July 2017
Location: Rio de Janeiro, Brasil
Event types: Conference, Exhibition
Visit event website: <http://riocentro.com.br/en/events/192>

23rd Global Dentists and Pediatric Dentistry Annual Meeting

Date: 17 - 18 July 2017
Location: Munich, Germany
Event types: Conference, Exhibition
Visit event website: <http://annualmeeting.conferenceseries.com/dentists/scientific-program>

MIDEC 2017 - Malaysia International Dental Exhibition and Conference

Date: 27 - 30 July 2017
Location: Kuala Lumpur, Malaysia
Event types: Conference, Exhibition
Visit event website: www.mda.org.my

Asia Pacific Dental Student Association Annual Congress

Date: 01 - 04 August 2017
Location: Hong Kong, Hong Kong
Event types: Conference, Exhibition
Visit event website: www.apdsahk.com

HKIDEAS 2017

Date: 04 - 06 August 2017
Location: Hong Kong, China
Event types: Conference, Exhibition
Visit event website: <https://www.hkideas.org/programme.php>

ITI Education Week Hong Kong

Date: 13 - 18 August 2017
Location: Hong Kong, China
Event types: Conference, Hands-on
Visit event website: <https://www.iti.org/EW2017HongKong>

ICOI World Congress XXXV

Date: 17 - 19 August 2017
Location: Vancouver, Canada
Event types: Conference, Exhibition
Visit event website: <http://www.icoivancouver2017.com/>

4th Asia & 15th Global International Edition CAD/CAM Digital Dentistry 2017 Conference & Exhibition

Date: 19 - 20 August 2017
Location: Singapore, Singapore
Event types: Conference, Exhibition
Visit event website: capp-asia.com

ADEE Annual Conference

Date: 23 - 25 August 2017
Location: Vilnius, Lithuania
Event types: Conference, Exhibition
Visit event website: <https://www.adee.org/meetings/vilnius2017/programme.html>

FDI World Dental Congress

Date: 29 August - 01 September 2017
Location: Madrid, Spain
Event types: Conference, Exhibition
Visit event website: <http://www.world-dental-congress.org/index.php/en/programme/programme-at-a-glance>

2nd Canterbury Conference on OCT

Date: 06 - 08 September 2017
Location: Canterbury, United Kingdom
Event types: Conference, Exhibition
Visit event website: <http://2ccoct.aogkent.uk/programme/>

29th International Conference on Maxillofacial Prosthodontics

Date: 11 - 12 September 2017
Location: Edinburgh, Scotland
Event types: Conference, Exhibition
Visit event website: <http://oral-maxillofacialsurgery.conferenceseries.com/scientific-program>

Dentsply Sirona World 2017

Date: 14 - 16 September 2017
Location: Las Vegas, NV, USA
Event types: Conference, Exhibition
Visit event website: <https://www.dentsplysironaworld.com>

ICD 2017 International Conference on Dentistry and Oral Health

Date: 14 - 16 September 2017
Location: Valencia, Spain
Event types: Conference, Exhibition
Visit event website: <http://dental-conferences.magnusgroup.org/uploads/files/v08HaTentative%20Program%20for%20ICD%202017.pdf>

30th Annual Conference on Dental Practice and Oral Health

Date: 18 - 19 September 2017
Location: Macau, Hong Kong
Event types: Conference, Exhibition
Visit event website: <http://dentistry.dentalcongress.com/scientific-program>

26th American Dental Congress

Date: 18 - 20 September 2017
Location: Philadelphia, USA
Event types: Conference, Exhibition
Visit event website: <http://www.dentalcongress.com/america/scientific-program>

From The Journal of the American Dental Association



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INCOME INEQUALITY IN THE UNITED STATES AND ITS POTENTIAL EFFECT ON ORAL HEALTH

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HOW TO SET UP, CONDUCT AND REPORT A SCIENTIFIC STUDYJean-François Roulet^{1a*}¹Department of Restorative Dental Sciences, College of Dentistry, University of Florida, Gainesville, FL-32610, USA^aDr med dent., Dr hc, Prof hc, Professor, Director of Center for Dental Biomaterials

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ABSTRACT

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This continuing education paper gives some guidelines on how to write a scientific paper. A good paper begins with a high quality experiment! Therefore, based on an idea, authors should first inform themselves by reading the literature, refine their idea and convert it into a scientific question. This is all laid down in the first draft of the "Introduction" of the future paper.

The authors must seek for ways to answer the scientific question stated above, which is done by describing it in detail in the "Material & Methods" section of the paper. This may require a pilot study. Once the experimental design, the parameters to be measured and the materials involved are known, it is good practice to consult a statistician in order to determine the statistical method to be used for analyzing the results.

The execution phase is dominated by meticulously applying the methods described above and documenting everything in detail. Once results are obtained, they should be first displayed in a descriptive manner to determine the final quantitative analysis, which leads to tables and figures showing the significant differences.

What is left at this point is to write a "Discussion", which should be well structured and then to compile the whole manuscript in the format required by the journal of choice to submit to.

Finally some hints are given how to successfully deal with reviewers.

Conclusion: Following the recommendations given, the probability to obtain acceptance of a paper may be quite good.

Keywords: experimental design, scientific writing, publishing.

1. Introduction

Performing a scientific study is basically the same as running a project. Therefore all rules regarding project management apply to scientific studies as well. Most projects, especially larger and more complex ones are run by teams. In teams the individual players which are unified to achieve the same common objective (successful completion of the given task) give up some of their individuality and at the same time bring in their competence. To guarantee the well functioning of the team, each member should comply to commonly defined rules. Most of these rules govern compliance and communication. For me the most basic rule is the following: "I say what I think and I do what I say". In scientific projects usually a multitude of players are involved, especially in a teaching institution. Researchers interact with other researchers, with students, lab technicians, statisticians, administrators, and industrial partners or grant administrators etc. Therefore, to be successful, open and straightforward communication is indispensable as well as the establishment of a framework in which the team is able to perform.

An analysis of successful and failed projects reveals several general patterns¹ (Fig 1).

A plot of resources spent versus times revealed that most of the effort in successful projects is spent at the beginning of the process.¹

This means that the information is properly collected, the objectives are well defined, everything has been thought through as well as possible based on the actual knowledge and the task ahead is well defined. Then the "machine" can be started and the project runs as perceived in the creative phase. During the execution phase usually the effort diminishes and the preplanned tasks can be accomplished without surprises. In product development I have learned that following a well thought and structured scaffold is a good strategy for success. On the other hand, projects that have failed show a pattern that is quite different. With a brilliant idea the project is just started with the anticipation that it will work. So the start is nice, because without too much effort the project is moving forward, usually with lots of enthusiasm. However, when the project is usually on its way, unanticipated problems arise that require more

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Figure 1. Effort time plot of successful (green) and failed (red) projects.

input in effort and resources. Due to the lack of knowledge or good strategy, this process is usually repeated multiple times with increasing effort and resources to be consumed (with budget amendments), until a point is reached, where the success point has moved into the distant future and the required resources cannot be estimated anymore. This is usually the moment where there is a danger that the management or the team involved may decide to abort the project.

Before anyone engages into a scientific study, the reasons and objective should be clearly stated. There are many reasons that motivate people to conduct research, such as:

- obtain a title
- obtain/maintain a position
- apply for grant money
- become rich
- know more
- target an academic career
- change the world!

It is important to be personally very clear about the objectives, since sooner or later the task will become tougher and this may require extra efforts. This means that more motivation is required to continue the research project.² It requires more than motivation to stimulate the researcher to spend night after night above the microscope while other team members, not involved in the research, may go partying to have a good time in the local bars.

Once you are clear with yourself about the task at hand to run your research project the next step is very important. The question why to publish must have been deeply understood by the researchers. A research project is only completed, once it is published. Why? If the outcome of an experiment is not published, no one will ever know it. "L'art pour l'art" is the most stupid thing I have ever seen - it is a waste of time and effort. Let other people know what you have found and hopefully your activity will improve the way we treat our patients. However publishing is not equal publishing. If you have a question, the modern way to approach it is to search the internet. If the question means to find a publication, then there are powerful data bases such as pubmed or google scholar, which can guide you quickly to a high number of references.

If you just search the internet (e.g. google.com) the yield is much better. However there is no way to validate and verify the information.³ This becomes obvious, when you search a topic that you know yourself well. There comes the peer review process, which will be discussed later. This is a mechanism, which, if well done, should lead to a better report, enhanced in several of its categories, as contributed to by those performing the review. While many of the statements made remain the responsibility of the author, there is the expectation that the review paper guarantees that it is correct and does not contain methodological errors or biases. Andreas Lindhe, the Editor of the Scandinavian Journal of Dental Research has once stated in a continuing education: "Nothing is scientifically "shown" or "proven" before it has been published in a SCIENTIFIC journal subject to peer review, so one can critically judge WHAT has been done, HOW it has been done and evaluate HOW SOLID it is!"³ This is very true, but only if the peer review was performed well.³ Unfortunately in the last 10-15 years more and more so called open access journals have been created pursuing the idea that knowledge should be publicly available for free - in itself a very noble idea.^{4,5} Publishing is a big business, and targeting profit has undermined the solidity of the peer review process.⁶

One experiment had shown this quite clearly. A researcher had constructed a scheme which he modified in order to create 304 fake studies which had built in several faults, and it was expected that a reviewer should have detected this. Then the researcher invented author names and universities and departments in cities placed mainly in the upcoming world. These manuscripts were submitted at a rate of 10/week to open access journals, with the result that 157 manuscripts (52%) were accepted, and only 98 manuscripts were rejected (32%).⁷

In dentistry and medicine the information should be, if possible, evidence based, which makes a lot of sense. Clinicians treat patients and the quality of the treatment should be based on clinical studies. This has generated the evidence based approach^{8,9} and a hierarchy of the quality of evidence putting expert opinion at the bottom and systematic reviews of prospective randomized double blinded clinical studies on the top^{10,11} (Fig. 2). Unfortunately there are errors and dangers of bias clearly present here as well.^{12,13}

An infrastructure is needed to perform research. Researchers need a laboratory, access to a clinic or a dental office as well as access to regulatory institutions (e.g. institutional review board), and to literature. As described above, the first step is a literature search done via internet. However it is highly recommended to complement this with a manual search, which requires access to a good library.

Finally for young researchers having a mentor is essential and for the researcher this should be beneficial. It is a good idea to check out potential mentors, which should be competent in the field of the potential research. It is important to know if the mentor has enough time to deal and consult the mentee. A good mentor should always be accessible and available to read every document/draft submitted within a rather short time (better days than months) and return feedback with

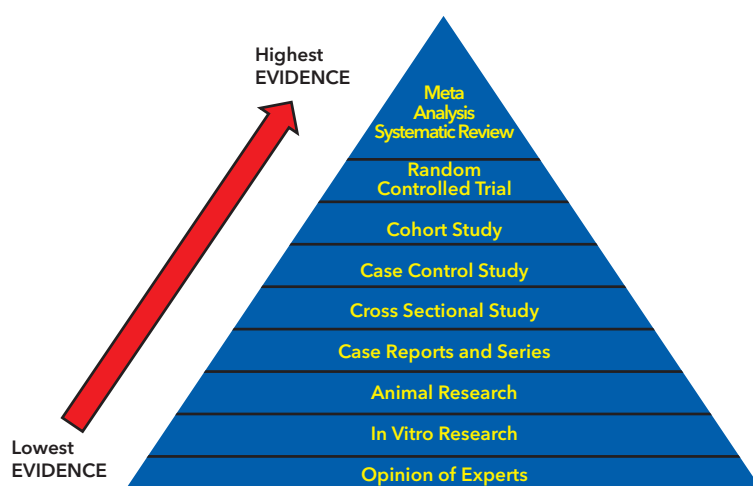


Figure 2. Pyramid of Evidence.

detailed comments. It would be beneficial for the mentee, if the mentor could provide guidelines, instructions for use and templates. On the other side the mentee cannot expect from the mentor that he/she would do the work. All he/she can do is to consult, open doors and provide connections. As a mentor I like it very much, when the mentee comes up with his/her own idea for a project.

2. Structure of a scientific paper

A scientific paper always has the same structure:² After the title with the authors and their affiliations and contributions usually the paper should start with an "Abstract". The body of the paper is opened with an "Introduction", followed by "Materials & Methods". Then a chapter "Results" should be followed by a "Discussion" and "Conclusions". Finally a "Literature" list should complete the paper. This basic framework can be modified depending on the type of publication. In a thesis the introduction serves more than introducing the reader into the topic. The other purpose is that the author must demonstrate his/her competence in the field. Therefore the "Introduction" includes usually an extensive literature review, that may be structured as a subchapter. Also "Materials & Methods" is usually more detailed than in a paper published in a scientific journal. If a thesis deals with multiple experiments it is highly recommended to treat every experiment like a single publication and use a general "Introduction" at the beginning and an all-over "Discussion" with conclusions at the end as a big clasp to keep the whole project together. Finally Industrial Reports have slightly different objectives. Usually the manufacturer wants an answer to a specific question, such as the in vitro wear rate of a material and/or the failure rate and reasons after a specific clinical service time. The "Introduction" of an Industrial Report can be very brief, because one must be assured that the financing partner has done its homework before agreeing to spend money on a study. On the other hand, the chapter "Materials & Methods" cannot be detailed enough. This is important to realize,

because if poor results occur it is important to know exactly what has been done. This is the only way to improve the material or the procedure.

3. Creative phase

The creative phase is usually the most thrilling part but usually the most difficult as well. It starts with an idea, which most of the time is quite vague. Therefore the first step is to write it down as precisely and clearly as possible. "An idea that cannot be put on paper is not a good idea".¹

The next step is to collect information about this idea. See if someone else had exactly that idea or a similar idea. Determine what is really new with the idea and where from the idea can be developed further. The answers to these questions lie somewhere in the world literature. Therefore a literature search is unavoidable. The literature found should flow into the personal data bank of the researcher. Modern computer programs like Endnote are very helpful, because they allow easy insertion of literature quotes into a manuscript. Usually such a search starts on the internet and may yield much more papers that one can read. Therefore the search strategy may be refined, which usually parallels refinement of the idea. Once an overseeable number of papers has been found, the articles must be checked whether they are within the scope of the idea, which is usually done by reading the abstracts. The ones that were positively selected should be read. Most information can be extracted from the chapters "Materials & Methods" as well as from the "Result" section. However reading the "Introduction" may reveal more information about the topic of interest and the "Discussion" may contain helpful thoughts to refine the own question. If the search has found review papers it is a very good start. The next step is a manual search by scanning through the literature lists at the end of the read papers. This may reveal more useful sources. Some of them may not be available on the internet, which requires the physical presence of the researcher in a good scientific library.

The above mentioned search of the literature has two functions: one to acquire information and two, to trigger the brain to think more about the original idea. This is the moment to start with writing the Introduction of the planned scientific study. A good way to organize the thinking process is to generate a "mind map" which is a graphical display with textboxes, key words or symbols with lines and arrows that symbolize connections (Fig. 3). This mind map should be the backbone or skeleton of the Introduction since it helps to fulfill the task of informing the reader that never has the idea of the planned study been approached before, about what it is. Beginning very wide and narrowing it down towards more and more specific contents is focusing more and more towards the own project. By definition the last sentence of the Introduction should start with the words: "The objective of the present study is...". Once the researcher has reached that point usually the originally vague idea has become crystal clear and even more has morphed into a precise scientific question. This question should be the logical consequence of the content of the text above. A very common error is that the research tool used is part of the objective. This may never be the case. First there is the question/problem. Only in the next thought a solution is looked for, which is then described in "Materials & Methods". In experimental papers the formulation of the objective should be followed by a null hypothesis, which later on can be rejected or

accepted. An example for a null hypothesis would be: "All tested composites showed equal wear rate". Writing an introduction means scientific writing which is full of traps, pitfalls and difficulties, especially for a less experienced writer. What is most important is the clarity of the content. Scientific language does not mean complicated language, the contrary is true. The simpler the formulation, the better the understanding. A handicap for most authors of scientific papers is that usually they must be written in English which usually is not their mother tongue. The nomenclature of technical terms must be correct and metric units should be employed¹⁴ (Tab. 1 a-d). Furthermore abbreviations should be explained the first time they are introduced and synonyms should never be used for the same thing. The impersonal form is preferred ("it was done" rather than "I did") and the use of tempora is clearly defined. Everything that was in the past (results from other researchers, things the authors did etc.) is put in the past tense (e.g. Van Meerbeeck et al reported that self etching adhesives yielded a thinner hybrid layer than etch & rinse adhesives) and only things that are generally accepted should be written in the present tense (eg. saliva is a buffer or chloroform is a solvent). Every statement in an introduction must be backed with a literature quote. At this stage it is recommended to put the literature quotes in parentheses with just the author names and

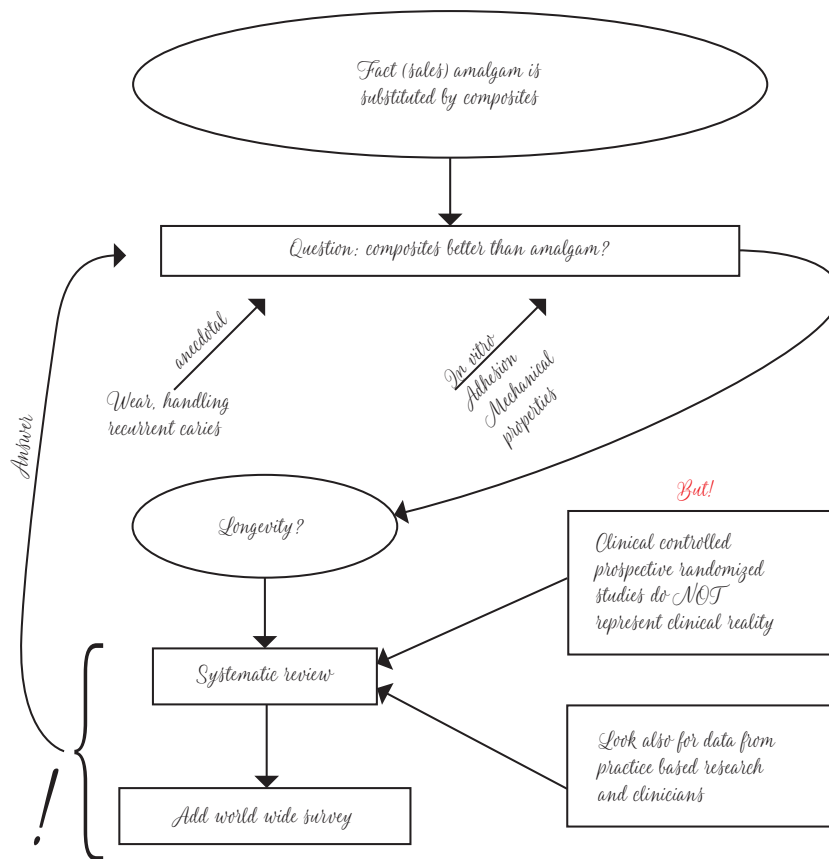


Figure 3. Mind Map. The present format is only for better readability set in the computer. Mind maps are dynamic and should be done by hand on a note pad or a black board. The content of this mindmap is hypothetical, its purpose is to show the principle only.

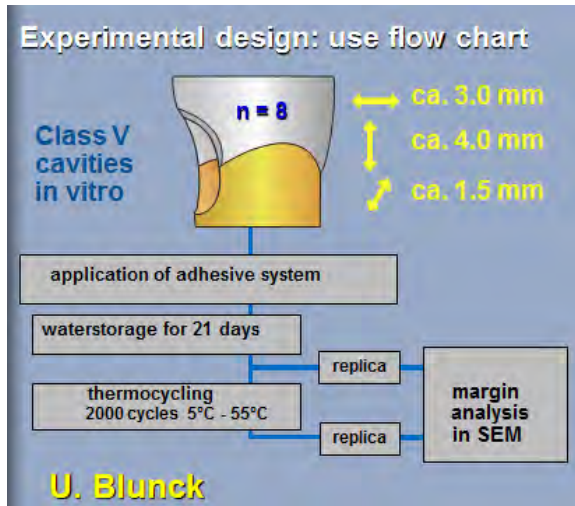


Figure 4a. Graphical display of experimental design (Courtesy of Dr. Uwe Blunck, Berlin).

the year. If the same author has published more than one quoted paper in the same year, then the specific article may be identified with letters: a, b, c, etc.). This leads to the question what should be quoted and listed?

- Earlier work in the area
- Methodology used
- Other publications of importance
- ONLY publications actually used in text!

Common errors are that the literature search has failed to find relevant papers to the topic. Often secondary literature is quoted instead of the original source (e.g. Roulet described the use of Silane in composite formulations in his thesis, referring to Pluddemann et al as the inventors of Silane. An author uses Roulet as a reference for Silane). Another error is quoting a paper for a certain fact that was not described in the quoted paper and finally the quote of opinion instead of experimentally based facts is not correct as well. Today more and more publishers use software to detect plagiarism. This reveals yet another common error: that of the simple use of copy paste to insert

text fragments from other articles (even your own!) into your own paper without putting the text in "" and quoting the source. Finally not acknowledging work of your competitors and quoting only your own papers is not an error per se, but a fact that sheds a bad light on your person.

Once the objective is clear, the author must provide a way to solve the problem. This is described in "Materials & Methods". What to do must be described to the smallest detail BEFORE the experimentation begins and once it has been defined it may NOT be changed, because the situation most likely occurs that the results cannot be correlated to the investigated parameters anymore; the change has introduced another variable. This is big trouble.

If a standard method is used, it is sufficient to describe it and to refer to its source. Furthermore it is highly advisable to practice it before it is used for the experiment. If this is ignored, bias is introduced, because the inevitable learning curve is included into the results produced. Very often some new equipment or procedures are used to address a research question and the usefulness is not known. Therefore in these situations usually a pilot study should be performed. It should be dealt with identically to the real experiment, but with a substantially smaller sample size (feasibility study). The outcome of the pilot study may lead to modifications of the "Materials & Methods" of the main study.

The report of a pilot study may either be inserted after the "Introduction" reporting its "Materials & Methods" and "Results", or the pilot study may be just mentioned in the discussion.

Writing "Materials & Methods" usually begins with describing the experimental design. This is the phase where the most intellectual power and creativity enter into play. The experimental design must be set in order to, without any doubt, be able to answer the research question. Therefore it is important to eliminate all known confounders that may cloud your data. (A confounder is a variable that is not measured, but influences the outcome that is measured). Furthermore randomization is

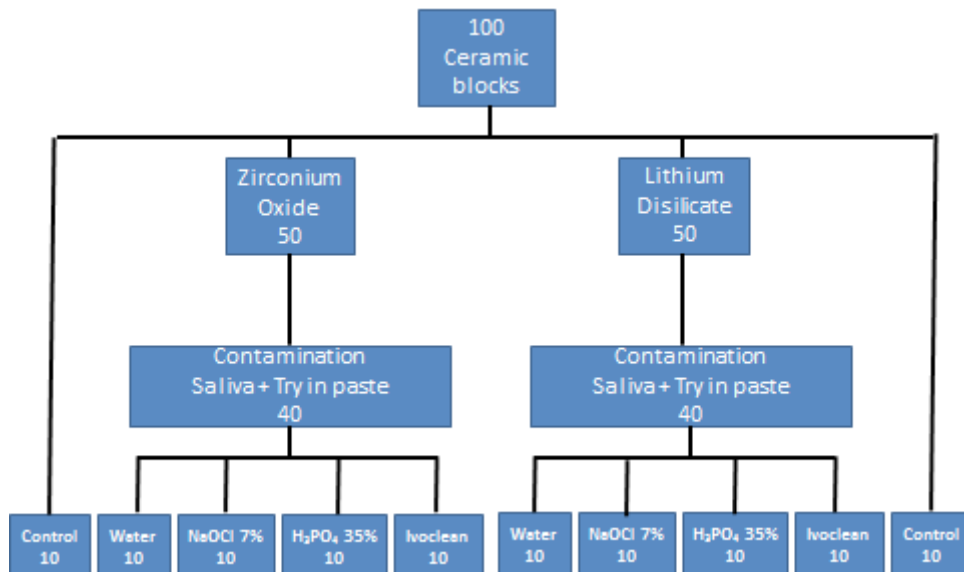


Figure 4b. Graphical display of balanced experimental design.

always a good thing to do, because it may allow for generalization of the results, because the sample used was representative for the population of interest. A figure of the experimental design would be helpful for the reader to understand what was done (Fig. 4a and b). The materials used (incl. composition, manufacturer and lot #) are best summarized in a table. Then the experimental groups must be described in detail including the # of samples. The procedures/group must be described as detailed so in case the author quits, the person that takes over can continue the experiment under identical conditions. This means that ingredients must be described precisely (e.g. concentration with upper and lower limits, times, batch numbers and decision rules, when to accept or reject the outcome of a process). Not only how samples are made and what is done to them (e.g. fatigue test or exposure to any agent or cell cultures etc.) must be described in detail, but also how the outcome is measured.

Also in this phase all legal requirements must be clear and accounted for. This is very important; because some may lead to a not publishable manuscript and may put the author in big trouble (e.g. Editors of most medical journals have agreed not to publish any clinical study that was not registered with www.clinicaltrials.gov). Every experiment involving human subjects or animals is regulated by institutional review boards (IRB) in order to make sure that the declaration of Helsinki is observed.¹⁵ Therefore IRB approval is mandatory before ANY action is started. Working with dangerous bacteria or viruses requires formal training and permission as well as using radioactive materials. Finally the planned statistical analysis must be outlined in the chapter "Materials & Methods". The type of test and the software used should be mentioned. Therefore it is a very good idea to consult a statistician in this phase of the project.

4. Execution phase

Once everything is clear and written down, the experimentation can begin. The written chapter Materials and Methods must be used as an instruction set for the experimentation. Furthermore it would be a good idea to prepare templates for inserting and collating results and having them in the correct format for the statistical evaluation. Such templates can easily be created using excel spread sheets.

During the experimentation, documentation is the most important thing. Samples must be labelled in a way that they cannot be mistaken for another one. Furthermore the identifiers must be physically indestructible. Physical engraving is superior to "permanent" marker, since the latter can be erased by a passage through alcohol! Furthermore what ever is done must be protocolled in written (The GMP (Good manufacturing practices) mantra is: "What is not written down has never happened").¹⁶ Therefore maintaining a record of steps in a scientific diary is highly recommended. If something goes wrong, the only way to decide if the data are still useful, is to exactly know what has been done. It is recommended as well to document redundantly, eg. using more than one of the paper and computer protocols, photos stored in data base and printed etc. Photos should

be taken in order to document what was done as well. This will be useful in the reporting phase.

Once data are produced, it is recommended as a first step to test if they are normally distributed.¹⁷ This will determine which statistical tests must be used, as well as which form of graphic display of the data would be most suitable (normal distribution: mean \pm SD, not normally distributed: box plots with median and 25th and 75th percentile).¹⁸ To preliminary check the data, it is recommended to display them graphically in order to recognize where there are differences. Then a first statistical analysis should be performed to determine where significant differences are found. This is the moment to decide, if groups should be pooled (remember: this is only correct if there are no significant differences between the pooled groups).

Once the statistical analysis has been finished the outcome should be carefully interpreted. In a balanced design the best possible outcome is to report main effects (e.g. if you looked at sales of wine as a function of the bottle shape and its position on the shelf, a main effect is, if, regardless of the shape, bottles on the top shelf sell the best and regardless of the position cylindrical bottles sell the best as well). In the ANOVA this is reflected by not having significant interactions (Fig. 5). If significant interactions occur, then only comparisons between single cells may be done, which is performed with post hoc tests (Bonferoni, Scheffee or Tukey).¹⁹ Usually the level of significance is set before the analysis e.g. $p < 0.05$. If this level is not met the differences observed are NOT significant, this means that the observed differences cannot be accounted for due to the experimental conditions, but are random. Therefore it is not correct to talk about a trend, when the significance level has slightly been missed.

4.1. Reporting phase

Now that results are available it is time to think where to publish. The best chances for acceptance are if the scope of the Journal of choice is congruent with the topic of the paper to be submitted. The first step should be to read the guidelines for authors. Most Journals require that the text is on a separate file and require specific fonts and line spaces (e.g. 1.5). Figures and Tables should be on separate files and there are minimum requirements for the resolution of the figures. Usually Legends are required to be on a separate file as well. A submitted manuscript must comply to a 100% to these guidelines. If it does not follow them meticulously, then the chance of outright rejection before the review process is high. All the recommendations given above to write the "Introduction" and "Materials & Methods" apply of course. There are a few more however. The working title must be now converted into the final title of the publication. Some journals limit the number of words. A title is the first thing a potential reader sees. Therefore it should be appealing and motivate the reader to continue. The title should:

- Be concise, precise
- Adequately represent the contents of the article
- May not promise something it can not deliver
- Must specify animal species/clinical, in vivo/in vitro, methodology

Key words must be assigned to the paper.

The authors sequence is a topic that often raises

The ANOVA Procedure					
Dependent Variable: FLEX					
Source	DF	Squares	Mean Square	F Value	Pr > F
Model	3	278439.288	92813.096	7.55	0.0002
Error	60	737511.323	12291.855		
Corrected Total	63	1015950.611			
	R-Square	Coeff Var	Root MSE	FLEX Mean	
	0.274068	16.03280	110.8686	691.5114	
Source	DF	Anova SS	Mean Square	F Value	Pr > F
HEAT	1	6305.4617	6305.4617	0.51	0.4766
SURFACE	1	249691.7826	249691.7826	20.31	<.0001
HEAT*SURFACE	1	22442.0436	22442.0436	1.83	0.1817

Figure 5. Analysis of Variance (ANOVA) of flexural strength of Zirconia specimen bars as influenced by surface grinding (surface) and heat treatment (heat). Note that heat has not a significant influence but surface condition has. There are no significant interactions.

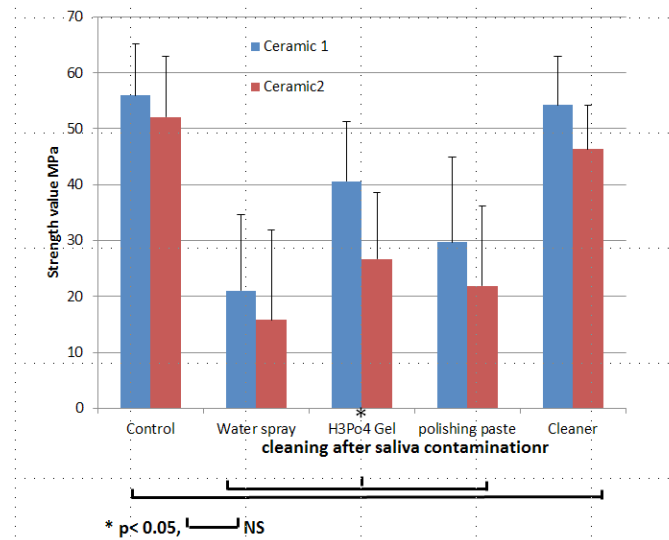


Figure 6a. Example of reporting parametric data as bar graphs with standard deviation. Tensile strength of composite bonded to two ceramics after different cleaning procedures of saliva contaminated ceramics.

conflicts, despite the fact that the rules about who should be where are obvious.²⁰ Only persons who have contributed to a significant degree scientifically/intellectually to the paper are included in the author line. Other contributions can be accounted for in the Acknowledgements at the end of the paper. Each author should know the article and be able to take on scientific responsibility for it. Who had the most scientific/intellectual input should be the first author. Conflicts may occur in mentor-student situations. My personal view here is that the amount of contribution of the student should determine whether he/she is first author or not. If the idea came from the student, the mentor helped and advised, the student performed the experiment and wrote the manuscript (even with help of the mentor), then it is clear that the student is the first author. On the other hand, if the idea and the experimental design are from the mentor, the student performed the experiment, but the mentor wrote the manuscript, then the mentor should deserve the first place in the author's list. To avoid conflicts more and more journals require disclosure of the contribution of every author. The next thing to write is the "Abstract". This is

a difficult task for many reasons. Very often the journal guidelines restrict its number of words and imply a specific structure. The abstract must summarize in a very condensed form the objective, what was done, how it was done and the results. Usually a conclusion is the final point of an abstract. It is important to include the statistics and hard numbers of the results.

If a reader has been drawn into the paper by the title, then the abstract is the next thing he/she will look at. Therefore it is important that the abstract is well done and informative, because it will then motivate the reader to continue reading. Furthermore abstract, title and keywords are extremely important for the paper to be found in databases, since only these are used to index the paper.^{21, 22, 23}

The chapters "Introduction" and "Materials and Methods" are already done, so in the phase of writing the first version of the manuscript, they can be taken with only slight modifications. So the next chapter is "Results". Here the results are displayed in form of tables and figures. Examples are shown in Tab 2, Fig. 6a and b. The text can be short and should mention the outcome of the statistical analysis as

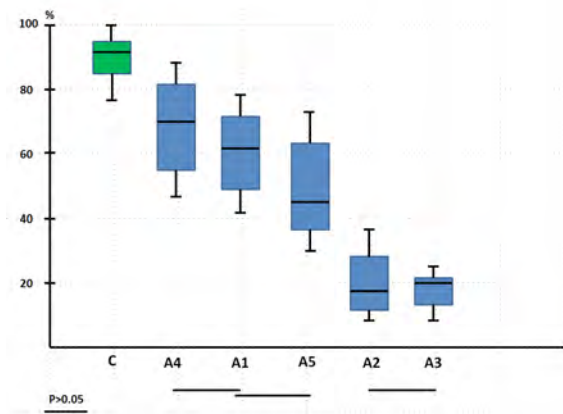


Figure 6b. Example of reporting non parametric data as box plots. Margin quality (% of excellent margin) of six different adhesives (c=control).

well which can be printed as a table. Furthermore the text should point to the reader some specifics of the results and highlight important outcomes. No explanations and interpretations should be given in the chapter "Results". Common errors are that the data are directly copied from the statistical

analysis, where the computer calculates as many digits after the dot as instructed thus suggesting a precision which does not reflect the data ($5,79438 \pm 3,22459$ instead of $5,8 \pm 3,2$). The graphic display of the data should correspond with the type of analysis: bar graphs with mean and SD for results of parametric tests and box-plots for non parametric tests. It is not recommended to use 3D graphics unless there is a need for (displaying the relationship of 3 parameters in one graph). And finally table and graphics must contain information about the statistical analysis, the minimum being the p value and showing where the significant differences are.

The "Discussion" is the only place, where interpretations, explanations and maybe speculations are allowed. Very often discussions are difficult to follow because the reader is not as familiar with the topic as the authors and, on top of it all, there is a lack of structure. It is recommended to discuss first "Materials & Methods": Why were the materials used, why was the used method selected and which are its advantages/disadvantages or limitations. Compare your method with methods of other investigations etc. Only then in a second subchapter must the results be discussed: Here the null hypothesis can be accepted or rejected

Table 1a-d: SI Units (Taylor and Thompson 2008)

Table 1a. SI Base Units.

Base quantity		SI base unit	
Name	Symbol	Name	Symbol
length	<i>l, x, r, etc.</i>	meter	m
mass	<i>m</i>	kilogram	kg
time, duration	<i>t</i>	second	s
electric current	<i>I, i</i>	ampere	A
thermodynamic temperature	<i>T</i>	kelvin	K
amount of substance	<i>n</i>	mole	mol
luminous intensity	<i>I_v</i>	candela	cd

Table 1b. Examples of coherent derived units in the SI expressed in terms of base units.

Derived quantity		SI base unit	
Name	Symbol	Name	Symbol
area	<i>A</i>	square meter	m ²
volume	<i>V</i>	cubic meter	m ³
speed, velocity	<i>v</i>	meter per second	m/s
acceleration	<i>a</i>	meter per second squared	m/s ²
wavenumber	$\sigma, \tilde{\nu}$	reciprocal meter	m ⁻¹
density, mass density	ρ	kilogram per cubic meter	kg/m ³
surface density	ρ_A	kilogram per square meter	kg/m ²
specific volume	<i>v</i>	cubic meter per kilogram	m ³ /kg
current density	<i>j</i>	ampere per square meter	A/m ²
magnetic field strength	<i>H</i>	ampere per meter	A/m
amount concentration, ^(a)	<i>c</i>	mole per cubic meter	mol/m ³
concentration			
mass concentration	ρ, γ	kilogram per cubic meter	kg/m ³
luminance	<i>L_v</i>	candela per square meter	cd/m ²
refractive index ^(b)	<i>n</i>	one	1
relative permeability ^(b)	μ_r	one	1

(a) In the field of clinical chemistry this quantity is also called "substance concentration"

(b) These are dimensionless quantities, or quantities of dimension one, and the symbol "1" for the unit (the number "one") is generally omitted in specifying the values of dimensionless quantities

Table 1c. Coherent derived units in the SI with special names and symbol.

Derived quantity	SI coherent derived unit ^(a)		Expressed in terms of other SI units	Expressed in terms of SI base units
	Name	Symbol		
plane angle	radian ^(b)	rad	1 ^(b)	m/m
solid angle	steradian ^(b)	sr ^(c)	1 ^(b)	m ² /m ²
frequency	hertz ^(d)	Hz		s ⁻¹
force	newton	N		m kg s ⁻²
pressure, stress	pascal	Pa	N/m ²	m ⁻¹ kg s ⁻²
energy, work, amount of heat	joule	J	Nm	
power, radiant flux	watt	W	J/s	m ² kg s ⁻³
electric charge, amount of electricity	coulomb	C		s A
electric potential difference, ^(e) electromotive force	volt	V	W/A	m ² kg s ⁻³ A ⁻¹
capacitance	farad	F	C/V	m ² kg ⁻¹ s ⁴ A ²
electric resistance	ohm	Ω	V/A	m ² kg s ⁻³ A ⁻²
electric conductance	siemens	S	A/V	m ² kg ⁻¹ s ³ A ²
magnetic flux	weber	Wb	Vs	m ² kg s ⁻² A ⁻¹
magnetic flux density	tesla	T	Wb/m ²	kg s ⁻² A ⁻¹
inductance	henry	H	Wb/A	m ² kg s ⁻² A ⁻²
Celsius temperature	degree Celsius ^(f)	°C		K
luminous flux	lumen	lm	cd sr ^(c)	cd
illuminance	lux	lx	lm/m ²	m ⁻² cd
activity referred to a radionuclide ^(g)	becquerel ^(d)	Bq		s ⁻¹
absorbed dose, specific energy (imparted), kerma	gray	Gy	J/kg	m ² s ⁻²
dose equivalent, ambient dose equivalent, directional dose equivalent, personal dose equivalent	sievert ^(h)	Sv	J/kg	m ² s ⁻²
catalytic activity	katal	kat		s ⁻¹ mol

(a) The SI prefixes may be used with any of the special names and symbols, but when this is done the resulting unit will no longer be coherent.

(b) The radian and steradian are special names for the number one that may be used to convey information about the quantity concerned. In practice the symbols rad and sr are used where appropriate, but the symbol for the derived unit one is generally omitted in specifying the values of dimensionless quantities.

(c) In photometry the name steradian and the symbol sr are usually retained in expressions for units

(d) The hertz is used only for periodic phenomena, and the becquerel is used only for stochastic processes in activity referred to a radionuclide.

(e) **Editors' note:** Electric potential difference is also called "voltage" in the United States and in many other countries, as well as "electric tension" or simply "tension" in some countries.

(f) The degree Celsius is the special name for the kelvin used to express Celsius temperatures. The degree Celsius and the kelvin are equal in size, so that the numerical value of a temperature difference or temperature interval is the same when expressed in either degrees Celsius or in kelvins.

(g) Activity referred to a radionuclide is sometimes incorrectly called radioactivity.

(h) See CIPM Recommendation 2 (CI-2002), p. 78, on the use of sievert (PV, 2002, 70, 205).

based on the results. Give reasons for the outcome, explain why significant differences were found or not, compare your data with the outcome of other studies and explain why there are differences, if indicated. If possible give explanations about the possible impact to clinical dentistry of the results and finally, it is helpful if indications about further research based on the results of the present study is given. Having said all of the above, one must be careful in the formulation. It should be very clear which are facts from the study or other studies, which are interpretations of these facts and which are hypotheses one could come up based on the findings.

At the end of the "Discussion" conclusions should be drawn. They must be strictly limited to the facts of the findings in the present study and should be formulated as briefly as possible (e.g. "the in vitro wear volume of the glass ionomer tested was

more than 2x the wear volume of the universal composite". Avoid bringing in wishful thoughts into the conclusions!

At the very end of the text there is space for "Acknowledgements". Here usually the authors should include data on sponsors, agencies, industry that supported the costs of the studies (if supported by a grant, it's # must be mentioned) and thanks to collaborators that helped to accomplish the task.

Finally under "Literature" all the papers, books and reports that were quoted in the text are listed with their proper source either in the sequence of their first appearance in the text or alphabetically, depending on the instructions for authors of the respective journal.

Once the first version of the manuscript is completed, it should go through language editing, if the authors do not have English as a

Table 1d. Examples of SI coherent derived units whose names and symbols include SI coherent derived units with special names and symbols.

Derived quantity	SI coherent derived unit		
	Name	Symbol	Expressed in terms of SI base units
dynamic viscosity	pascal second	Pa s	$m^{-1} kg s^{-1}$
moment of force	newton meter	N m	$m^2 kg s^{-2}$
surface tension	newton per meter	N/m	$kg s^{-2}$
angular velocity	radian per second	rad/s	$m m^{-1} s^{-1} = s^{-1}$
angular acceleration	radian per second squared	rad/s ²	$m m^{-1} s^{-2} = s^{-2}$
heat flux density, irradiance	watt per square meter	W/m ²	$kg s^{-3}$
heat capacity, entropy	joule per kelvin	J/K	$m^2 kg s^{-2} K^{-1}$
specific heat capacity, specific entropy	joule per kilogram kelvin	J/(kg K)	$m^2 s^{-2} k^{-1}$
specific energy	joule per kilogram	J/kg	$m^2 s^{-2}$
thermal conductivity	watt per meter kelvin	W/(m K)	$m kg s^{-3} K^{-1}$
energy density	joule per cubic meter	J/m ³	$m^{-1} kg s^{-2}$
electric field strength	volt per meter	V/m	$m kg s^{-3} A^{-1}$
electric charge density	coulomb per cubic meter	C/m ³	$m^{-3} s A$
surface charge density	coulomb per square meter	C/m ²	$m^{-2} s A$
electric flux density, electric displacement	coulomb per square meter	C/m ²	$m^{-2} s A$
permittivity	farad per meter	F/m	$m^{-3} kg^{-1} s^4 A^2$
permeability	henry per meter	H/m	$m kg s^{-2} A^{-2}$
molar energy	joule per mole	J/mol	$m^2 kg s^{-2} mol^{-1}$
molar entropy, molar heat capacity	joule per mole kelvin	J/(mol K)	$m^2 kg s^{-2} K^{-1} mol^{-1}$
exposure (x and γ rays)	coulomb per kilogram	C/kg	$kg^{-1} s A$
absorbed dose rate	gray per second	Gy/s	$m^2 s^{-3}$
radiant intensity	watt per steradian	W/sr	$m^4 m^{-2} kg s^{-3} = m^2 kg s^{-3}$
radiance	watt per square meter steradian	W/(m ² sr)	$m^2 m^{-2} kg s^{-3} = kg s^{-3}$
catalytic activity concentration	katal per cubic meter	kat/m ³	$m^{-3} s^{-1} mol$

mother tongue. It is important to understand that a dental publication uses some specific professional language. Therefore it is not sufficient to find someone proficient in English, the person proofreading must also be knowledgeable on the dental technical language (dentist or dental technician or dental hygienist). So the best choice would be a dentist with English as a mother tongue or at least a Dentist that has studied/practiced for many years in an English speaking country. A good alternative for such proof reading is to seek the help of professional scientific editorial services (e.g. www.oleng.com.au, contact@savantproofreading.com, <http://oakfortressproofreading.com>). Omitting this last step may be detrimental and may lead to the rejection of the manuscript, since in my personal experience the most frequent complaint of reviewers is about poor language. Before submission every author must read the final version and approve it. This is necessary, because being on the author line, every author takes scientific/intellectual responsibility for the manuscript!

4.2. The review process

The standard mode for submission is the internet. Most editors/publishers provide templates to guide authors through the submission process. Usually the first step is that the editor/publisher checks if the manuscript complies with the formalism. Many are very careful about the question if the content is new and original (high probability to be published) or if the content is new, but basically confirming existing knowledge (high risk of being rejected). Then the decision is

made if it should be sent into the review process. Most Journals use a blind review performed by at least two reviewers. The main purpose of the review process is to improve the paper, therefore if reviewers find detrimental flaws in "Materials & Methods", this is usually a reason for rejection, since the paper cannot be salvaged. On the other hand, if the authors were not able to explain what was really done in "Materials & Methods", then the reviewer does not understand it and recommends rejection as well. Many reviewers do a simple test by computing the number of cells as described in the experimental design and compare it with the total # of samples produced (e.g. 3 materials x 2 shades and 3 treatments = $3 \times 2 \times 3 = 18$ cells; if the author reports that 200 samples were made, then $200/18 = 11,11$ ergo something is wrong, since n can be 11 or 12 only). If the resulting n is not a single number then something is wrong and the paper in the best case goes back to the authors.

Many papers get rejected outright, very few are accepted without modifications/revisions. This means they are sent back to the authors with comments and requests for modifications. This causes frustration at first glance and the authors may get emotional, since they had tried to do the best. But remember the objective of the reviewers is to improve the paper, therefore authors should not object to the reviewer's comments unless really justified and return the manuscript with minimal revisions only. I have personally experienced many cases where the revised paper was sent the second time to the reviewers and came back with the recommendation "reject" and the comment

Table 2. Example how results should be presented: Tensile bond strength of ceramics contaminated with saliva after different cleaning procedures.

	After contamination cleaned with				
	Control	Water spray	H ₃ PO ₄ gel	polishing paste	Cleaner
Ceramic 1	55.9±9.2 ^{ab1}	21±13.6 ^{c1}	40.6±10.7 ^{b1}	29.7±15.2 ^{c1}	54.2±8.8 ^{ab1}
Ceramic 2	52.1±10.9 ^{a1}	15.8±16.1 ^{c1}	26.7±11.8 ^{c2}	21.9±14.2 ^{c1}	46.3±7.9 ^{a1}

ANOVA, Tukey post hoc test $p < 0.01$. superscript letters show same statistical groups in rows, superscript numbers show same statistical groups in columns

Table 3. Comments of reviewers, actions taken by authors and comments of authors for the reviewers.

Line	Comments of Reviewer	Action taken	Comment of Author
		Requested changes were done using the Track changes function in Word, so the reviewer can follow them. Additionally a manuscript was submitted without visible changes for the production of the layout.	
	Well done systematic description and analysis of the problem. Few changes required		thank you
27	The statement "The monopolization of Grant research has shifted research towards "safe" studies" is to general and must be backed with literature	The content was expanded with the following sentences: xxxx and 3 Literature were added to the References list.	Thank you, very valid comment
247	The reviewer disagrees with the following "The peer reviewed system which is basically a good idea has become very ineffective and is more hindering research than improving its quality"	Added the following sentence: Since the acceptance rate has dropped to below 8% (due to financial restraints and growing number of submissions), it means that one granted project yields 12 submissions for the author and requires 12X3 = 36 peer reviews, which binds resources of researchers cannot be effective and efficient.	The Author maintains this view, but has added more explanations to substantiate it.

that authors did not follow the recommendations for improvement. Therefore the recommendation is that the authors compile all comments of the reviewers into a table with one line per comment. Then they should add two more columns. In the first they should address the comments and let the reviewer know what they did or give reasons why they did NOT do any changes. In the other column the changes can be displayed (Tab. 3). This approach may further speed up the review process, since having very good explanations about the changes the editor may decide based on such a table rather than send it for the second time to the reviewers.

5. Conclusions

- research is exciting
- hard work is often boring
- writing follows standard rules -> boring
- with precision, know how, and the right attitude there is a very high chance for success

Acknowledgments

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CV

Jean-François Roulet, DDS, Dr med dent, PhD, is the former chair and current professor of the Department of Restorative Dental Sciences at the University of Florida. Professor Roulet is author/coauthor of more than 180 papers, edited/contributed to 27 textbooks and mentored more than 150 theses. He is a renowned international lecturer with over 800 appearances to date. Dr. Roulet is a member of many professional organizations, has won numerous awards, and holds four patents. He is editor of *Prophylaxe Impuls* and *Stomatology Edu Journal*. His areas of interest include minimally invasive dentistry, dental materials (ie, composites and ceramics), adhesive dentistry, esthetic dentistry, and application concepts in preventive dentistry.

Questions

There are many reasons why people do research. What reason should not exist:

- a. Obtain a title;
- b. Obtain/maintain a position;
- c. Obtain grant money;
- d. "L'art pour l'art".

The "Material and Methods" section contains:

- a. Explanations why the materials were used;
- b. Explanations why the used method was selected;
- c. Reasons for the outcome;
- d. Tables and figures.

What should a mentor not do?

- a. Provide guidelines;
- b. Provide instructions for use;
- c. Provide templates;
- d. Do the work.

What part is not in the structure of a scientific paper:

- a. Introduction;
- b. Material and methods;
- c. Results;
- d. Acknowledgements.

CALCIUM PHOSPHATE NANOPARTICLES REDUCE DENTIN HYPERSENSITIVITY: A RANDOMIZED, PLACEBO-CONTROLLED SPLIT-MOUTH STUDY

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ABSTRACT

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Introduction: Modern strategies for dental remineralization and prevention of dentin hypersensitivity are increasingly based on biomimetic materials. The aim of this study was to assess the clinical efficacy of a calcium-phosphate nanoparticles-based dentin desensitizer (DD, Teethmate Desensitizer, Kuraray Noritake, Japan).

Methodology: 25 patients, requesting treatment after reporting sensitivity of non-carious cervical lesions and dental abrasions were recruited. Inclusion criteria were: response score ≥ 6 on a 10 cm-long visual analog scale (VAS) for 1+ teeth in each of two quadrants. Exclusion criteria were: presence of systemic diseases, ongoing analgesic therapy, pregnancy, presence of carious or pulpal lesions, poorly contoured restorations, enamel cracks, active periodontitis and ongoing use of desensitizing agents. The response was determined to 2 s air blast. VAS scores were collected at $t=0$ (PRE), immediately after treatment with the DD (POST), after 1 week, and after 1, 3 and 6 months. Half of the sites in each patient (split-mouth) were randomly treated with a placebo, and scores collected until after 1 week. The DD was then applied to the placebo sites.

Results: Both DD and placebo significantly decreased VAS scores on POST confronted to PRE ($p < 0.0001$), showing similar efficacy (35% and 28%, respectively). DD application further decreased scores after 1 week (63%) while placebo application did not show significant differences confronted to POST ($p = 0.09$). DD scores maintained throughout the observational period the levels obtained after 1 week.

Conclusion: The tested DD effectively reduced dentin hypersensitivity during 6-month follow-up, after one single application. Biomimetic desensitizers may be an effective solution to dentin hypersensitivity.

Keywords: biomimetic material, dentin hypersensitivity, desensitization, calcium-phosphate nanoparticles.

1. Introduction

A short pain on exposed dentin, which can be elicited by thermal, evaporative, tactile, osmotic or chemical stimuli,¹ characterizes dentinal hypersensitivity. It is now widely acknowledged that dentin hypersensitivity derives from exposed dentin tubules, where stimuli excite pulp cells as proposed by Brannström's hydrodynamic theory.^{2,3} According to that theory, the diameter of the exposed tubules and their density are the factors that mainly influence hypersensitivity,⁴ as already highlighted by Yoshiyama et al.⁵ Finding a way to close the orifices of the tubules could

therefore decrease pain perception. Since this discovery, many therapeutic approaches to dentin hypersensitivity have been employed.^{1,2,4,6} Less recent techniques were based on blocking the nociceptive conduction (mainly using potassium salts), on the superficial blocking of the orifices of the tubules with different compounds (varnishes, dentin bonding systems), or by inducing sclerosis of the tubules (SnF_2 , $\text{SrCl} \cdot 6\text{H}_2\text{O}$, Al-, K-, Fe- oxalate, Fluorides, Na_2FPO_4). Lasers are also employed and have obtained positive results, but the exact mechanism is not fully understood, being likely due to either tubule occlusion or superficial glazing.⁶

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A new possibility is provided by the introduction of biomimetic materials commonly used in dentistry. These materials can mimic a few properties of the tissue they are replacing, and in particular the use of nanotechnologies can help in obtaining synthesis and precipitation of hydroxyapatite at tooth level, opening possibilities for bioactive compounds and biomaterials to remineralize tooth structures, modulate biofilm formation, prevent caries occurrence and treat dentin hypersensitivity.^{7,8,9,10} Among several advantages that these remineralization techniques present, the possibility of closing exposed orifices of dentinal tubules using these materials is promising.

The aim of this study was to assess the clinical efficacy, expressed as pain reduction from hypersensitive tooth areas, of a dentin desensitizer (DD) based on calcium phosphate nanoparticles. The null hypotheses were that (i) no differences are shown between the tested DD and a placebo compound in pain reduction after one week of follow-up, and (ii) no significant differences in the efficacy of the test compounds are found among the evaluated time points.

2. Methods

2.1. Study design and materials

This study evaluated the efficacy of a calcium-phosphate nanoparticles-containing DD (test DD, Teethmate Desensitizer, Kuraray Noritake, Dental Inc. Okayama, Japan) on desensitization of non-cariou cervical lesions and tooth abrasions. The test DD was compared with a placebo during the first 1 week of evaluation in a trial designed as a randomized, double-blind, placebo-controlled, split-mouth study. After that period, only the test DD was evaluated to assess its efficacy for up to 6 months. The composition of the materials used in this study are displayed in Table 1; the powder and liquid were transferred from the original packaging to glass bottles only identified by letters, masking their content to both patient and dental operator (double-blind trial).

The 'Guidelines for the design and conduct of clinical trials on dentin hypersensitivity' were adopted and partly followed during the design and execution of the study.¹¹

The study was conducted in agreement with the principles of the Declaration of Helsinki updated by the World Medical Association in 2013.¹² Before obtaining written, informed consent, all patients

eligible for this trial received extensive verbal and written information regarding possible benefits and risks of the treatment. Patients were informed that one of the compounds tested is a placebo and that, if they felt the treatment did not reduce dentin hypersensitivity, they could feel free to exit the trial anytime and ask for alternative solutions.

2.2. Subject selection

Patients visiting 3 different private practice dental offices in Northern Italy and requesting treatment after reporting sensitivity were screened for eligibility. Non-cariou cervical lesions or dental abrasions might be, or not, present at the hypersensitive sites. The inclusion criterion was a response score of ≥ 6 on a 10 cm long visual analog scale (VAS) that was numbered every centimeter from 0 to 10, for at least one tooth in each of two quadrants situated on the right-side and left-side of the mouth, so that a split-mouth model for test and placebo compounds could be applied.

Exclusion criteria were the presence of systemic diseases, ongoing temporary or permanent analgesic therapy for any reason, pregnancy, presence of carious or pulpal lesions, poorly contoured restorations, presence of enamel cracks on the hypersensitive teeth, active periodontitis and ongoing use of desensitizing agents of any kind. Patients were also excluded if the clinical situation requested other treatments on the screened sites than desensitizing alone.

The response was determined to a 2 s, cold air blast from a dental syringe directed perpendicularly to the tooth surface at approximately 5 mm distance. In the VAS scale, patients were told that 0 indicated a well-being condition with complete absence of any pain, while 10 was the worst pain they experienced or thought could ever exist. VAS scores collection was performed immediately after the air blast, patients being asked to point on the VAS scale to the nearest full centimeter number describing their pain perception.

A total of 25 patients were recruited, and each had the hypersensitive sites assigned to test or placebo treatment according to a randomization list. Neither the patient nor the dentist performing desensitizing treatments knew if the treated area belonged to the test or placebo compound, thus obtaining a double-blind model. The patients' demographics were as follows: 9 males (32-57 years old) and 16 females (25-60 years old).

Table 1. Composition of the tested materials. Placebo was obtained using reagents purchased from Sigma-Aldrich (St. Louis, MO, U.S.A.).

Material	Powder	Liquid
Teethmate Desensitizer	Tetracalcium phosphate, TTCP; dicalcium phosphate anhydrous, DCPA; sodium fluoride; glycerol; polyethylene glycol	Ultrapure water
Placebo	Glycerol monostearate; polyethylene glycol (PEG3350)	HPLC-grade water

2.3. Application method

The targeted area was first cleaned with a cotton pellet. Then, the dentist mixed the powder with the liquid for 15 s to obtain a paste that was immediately applied on the treated areas with a microbrush by gently brushing for 2 min (Fig. 1 to 4). In the same visit, both test and placebo treatments were applied to each patient according to a randomization list. Patients were then asked to rinse their mouth, and within 15 min after the treatment the blinded dentist applied the same air blast stimuli under the same conditions to assess pain scores after treatments (POST). Patients were recalled for hypersensitivity assessment of the treated areas after 1 week. At that time point, after data collection, both dentist and patients were unblinded regarding the test or placebo treatment, and the test treatment was applied to the area that previously received the placebo compound. Patients were then recalled after 1, 3 and 6 months and at each recall the dentist assessed only tooth areas that were treated with test compound since the beginning of the trial.



Figure 1. Patient requesting desensitization treatment for vestibular areas of maxillary teeth. No presence of cervical lesions or abrasions could be identified as well as other lesions, yet upper right and upper left canines and premolars scored 7 on VAS after air blast test.



Figure 2. Application of the tested DD on right maxillary teeth (test site), same area depicted in Fig 1.

2.3. Statistical analysis

All statistical analyses were performed using statistical software (JMP 10.0, SAS Institute Inc, Cary, NC, USA). A preliminary check of the normality of distribution and homogeneity of variances was performed using Shapiro-Wilk's and Levene's tests ($p < 0.0001$ and $p = 0.0014$, respectively). Since data did not belong to continuous variable (0-10

ordinal VAS scores), were not normally distributed and homoscedasticity was not respected, non-parametrical ANOVA and non-parametric comparisons for each pair using Wilcoxon method ($p < 0.05$) were used to highlight significant differences between groups.



Figure 3. Dental occlusal erosions bilaterally on palatal side of maxillary frontal and lateral teeth. Air blast test scored 8. Patient was referred to a gastroenterologist physician. He was later diagnosed with gastroesophageal reflux disease (GERD) and given treatment. Patient refused restorative therapies, requesting treatment of pain symptoms only.



Figure 4. Application of the test DD on the same area as in Fig 3.

3. Results

All 25 subjects completed the trial without requesting alternative desensitization treatments or dropping out from the trial. No adverse reactions were reported. The results of the study are displayed in Fig. 5. Both DD and placebo significantly decreased VAS scores comparing POST and PRE ($p < 0.0001$) measurements, thus showing similar efficacy (35% and 28%, respectively). DD application further decreased scores after 1 week (63% in comparison with PRE), while placebo application did not show significant differences when compared to POST ($p = 0.09$). The scores from the areas treated with the DD maintained, throughout the observational period, the levels obtained after 1 week (maximum decrease in scores = 69% after 3 months). At 6 months, a small, non-significant increase in VAS scores was also observed.

4. Discussion

Dentin hypersensitivity is an increasing occurrence, and dental materials or procedures able to reduce the patient's sensitivity are increasingly needed. A variety of therapies are currently available,^{2,4,6} but the most modern and biocompatible approach

seems to be the one aiming at reconstituting a barrier and closing the open orifices of the tubules by using biomimetic materials and techniques.^{13,14,15,16}

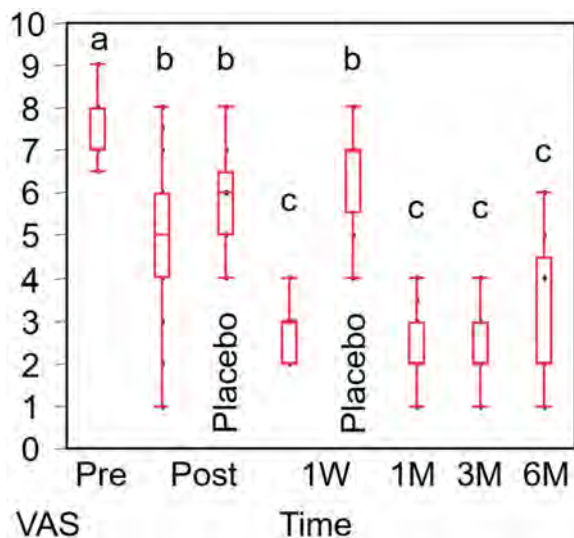


Figure 5. Box plot depicting the main findings of the study. The minimum and maximum values and the 25th, 50th, and 75th percentiles are shown in red. Different superscript letters indicate significant differences between groups ($p < 0.05$) as assessed by Wilcoxon method. The test DD was compared with a placebo for up to 1 week, then its effect on reducing pain perception was monitored for 6 months.

In this study, we assessed the clinical efficacy, expressed as pain reduction from hypersensitive tooth areas, of a biomimetic, hydroxyapatite-forming dentin desensitizer (DD) based on calcium phosphate nanoparticles.

The first null hypothesis could not be fully rejected, since immediately after application there was no significant difference between DD under investigation and placebo, meaning that the reaction to the test DD immediately after application could not be due to its activity, but simply to a placebo effect. After one week, however, there was a highly significant difference between placebo and test DD. In fact, the test DD required 1 week to reach the significantly lowest scores of pain perception, and this level was maintained for up to 6 months. The second null hypothesis could, therefore, be rejected.

The tested DD is a biomimetic desensitizing compound based on the reaction between tetracalcium phosphate and dicalcium phosphate anhydrous in the presence of fluoride ions. Once water is added, the reaction produces hydroxyapatite and small parts of fluorapatite nanoparticles that precipitate as an amorphous layer on the tooth structures. Since nanocrystal deposition on enamel and dentin structures is driven by collagen backbone structures, one may speculate that the presence of these structures inside dentine tubules may help organize deposition of hydroxyapatite and fluorapatite. Thanatvarakorn et al. in 2013¹⁷ provided some data in support of this hypothesis. They showed that the tested DD developed an immediate reduction in dentin permeability and an effective integration of the calcium phosphate rich

layer with dentin surfaces, enhancing mineralization under oral conditions.¹⁷ The data obtained in this study could convey some indirect hints regarding the activity of the compound. It seems clear that the deposition of an amorphous layer of nanocrystals on the hypersensitive tooth surfaces does not lead to a reduction in pain perception greater than placebo effect. It is very likely, however, that hydroxyapatite and fluorapatite deposition inside dentinal tubules takes place at least over a one-week time period after application and is responsible for the significant reduction in pain perception when confronted to the placebo at 1 week or to the initial values. Our results confirm the assumptions of Zhou et al.¹⁰ thus providing a clinical confirmation of their in vitro results. In their study, the effectiveness of the same DD was evaluated in reducing dentin permeability and tubule orifice occlusion. It was found that the two parameters improved depending on the time until maximum values in permeability reduction and tubules occlusion were found after one week.¹⁰ These results are in good correlation with those of the present study, meaning that dentine permeability and occlusion of tubuli orifices (>50%) can be good indicators of reduction in pain perception.

In our study, it was found that the reduction in pain perception due to the test DD did not remain significantly different between the different time points starting from 1 week for up to 6 months. This means that the effects obtained by the tested DD (remineralization, reduction in dentin permeability and tubule occlusion)^{10,17} are long-lasting, however additional studies are needed to ascertain if the test DD may express its activity over extended observation times up to one or several years.

The study was performed under conditions as close as possible with those of similar studies^{14,15} in order to evaluate possible differences yielded from geographical areas or pain perception. The tested DD compound was the same as the one used by Mehta et al. in 2014¹⁴ and similar to the one tested by the same research group one year after.¹⁵ The study design was the same as in Mehta et al., 2015,¹⁵ except for the placebo follow-up that was stopped after 1 week in the present study. The statistical analysis was different in methodology, since in the present study no parametric analysis of data could be applied. One would speculate that, given that the material, the study design and the patient recruitment were very similar among these studies, similar results would be obtained. A first observation can be made comparing the initial pain scores to those after treatment and 1-week follow-up. The initial scores in the present study were higher than those from Mehta et al.,^{14,15} and reduction in pain perception after at least one week of treatment was higher than the results of Mehta et al.,¹⁵ but similar to the results the same Authors obtained one year earlier.¹⁴

Many different explanations for these results may be provided, including the fact that pain remains an extremely subjective perception being influenced by many confounding factors such as the socio-economic-religious environment. This difference shows the importance of performing several studies with different populations from as many different

environments as possible, particularly when testing the clinical behavior of therapies influencing a patient's pain perception. From this point of view, the setting itself where the investigations were carried out may be an additional confounding factor, since in the present study it was constituted by some private dental clinics while Mehta et al. evaluated patients seeking cure at a hospital Dental College.^{14,15} Apart from the aforementioned factors, this distinction may have had an influence on the general health expectations patients had.

An additional difference between our study and that of Mehta et al.¹⁵ is that the latter evaluated Teethmate AP paste, produced by the same manufacturer as the desensitizer tested here. The main difference between the two products is that the paste is a water-free calcium phosphate compound, while the test DD used in this study is a mixture of calcium phosphate powder with water, containing an accelerator that leads upon mixture and application to the reaction producing and precipitating hydroxyapatite nanocrystals.¹⁸ Comparing all findings, the pain reduction obtained by the paste desensitizer was slower and more moderate than that of the DD tested in this study.

According to Holland et al.,¹¹ assessments were made between contralateral teeth, and one side of the mouth served as a control for the other side (split-mouth model). A randomization list was used to assign each side to either test or control treatments. The comparisons were made between an active treatment (test DD) and a placebo that had aspect and composition identical to the active treatment, save for the active principles. In a previous study¹⁵ comparisons were made between a similar DD and distilled water (placebo) for up to 6 months. In a pilot study we performed on 3 patients (data not shown), we saw that differences between placebo and test compounds were noticeable as of 1 week after treatment. It must be noted that all enrolled patients of this study reported discomfort levels in response to air blast ≥ 6 on VAS scale, and the tested treatment aimed to reduce pain perception. Contrary to the study design adopted by Mehta et al.,¹⁵ in the present study it was therefore decided not to prosecute observations on the placebo group for

longer than the minimum amount of time necessary to assess a difference between placebo and test (1 week), since this would provide patients with further, unnecessary discomfort.

Another difference in the study design regarded the assessment of hypersensitivity, since in the present study, contrary to Mehta et al.,^{14,15} it was decided not to use the scrape test. The guidelines on conducting trials on dentin hypersensitivity suggested, as an example of response-based method, the use of cold stimuli, such as timed air blast, or tactile stimuli.¹¹ In the study conducted by Mehta et al, as well as in many other studies, response was evaluated using both air blast and the tactile running of a dental explorer across the cervical area of the assigned teeth, in horizontal and vertical direction at a "relatively mild force". If one considers the microscopical and sub-microscopical structure of enamel and dentine, however, it is clear that the tactile test is invasive and may produce damage to tooth structures at that level. Furthermore, tactile tests, if applied immediately after desensitization, may locally disturb the precipitated layer of nanocrystallites, hampering their further deposition and organization to occlude dentin tubule orifices. For this reason, any contact test was avoided in the present study, and further studies may be performed to assess the influence of tactile stimuli on the behavior of biomimetic hydroxyapatite-forming dentin desensitizers.

5. Conclusion

The results obtained in this study showed that the tested DD effectively reduced patient discomfort caused by dentin hypersensitivity during a 6-month follow-up, up to 69% after 3 months, after one single application. Biomimetic, hydroxyapatite-forming desensitizers may be an effective solution to dentin hypersensitivity.

Disclosure

No conflict of interest exists for any of the Authors of the paper.

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CV

He graduated with top marks in Dentistry and Oral Prosthetic Rehabilitation at the University of Milan, Italy, in 2008. He got his PhD in Nanotechnologies at the University of Trieste, Italy, in 2015. Since 2005 he has been working at the Oral Microbiology Laboratory of the University of Milan, director Prof. Eugenio Brambilla, where he has been a research coordinator as of 2013. He authored 25 publications in peer-reviewed journals. He won the Paffenbarger Award of the Academy of Dental Materials, the Robert Frank Award of the Continental European Division, International Association of Dental Research (CED-IADR) and the Expertise contest of 3M Oral Care. He is a promoter of the Young Researchers Group of CED-IADR. His main research interests include the study of bioactive and biomimetic materials, antimicrobial compounds and their interactions with oral biofilms.

Questions

What is a biomimetic material?

- a. A material that is only made of biological parts taken from natural tissues;
- b. A material able to reproduce some features and properties of a natural tissue;
- c. A material that reacts with the environment in a different way than a natural tissue does;
- d. A material that does not react in any way with the environment or with the host.

Which one cannot be the mechanism of action of a dentin desensitizer?

- a. It can block pain stimuli by blocking nervous transmission, for instance using potassium salts;
- b. It can demineralize dentin surface, thus leaving more tubule orifices open to the oral environment;
- c. It can cause sclerosis of the tubuli, thus reducing their lumen until the tubule is closed;
- d. It can cause deposition of crystals inside tubuli, thus closing their orifices.

Which of these factors must be exclusion factors for subject recruitment when conducting a trial on dentin sensitivity?

- a. Subjects already using a desensitizing toothpaste;
- b. Subjects permanently using analgesic therapies;
- c. Subjects younger than 30;
- d. Subjects presenting carious lesions.

If a test treatment shows a positive effect confronted to the baseline, but the effect is non-significantly different from that of a placebo, what conclusions can be drawn?

- a. The test compound is performing better than the placebo;
- b. The test compound is not safely applicable to human subjects;
- c. The test compound does not perform better than the placebo;
- d. The placebo effect is not visible in the test.

A RADIOGRAPHIC STUDY TO DETERMINE THE POSSIBLE EXISTENCE OF A "SAFE ZONE" AGAINST ENDODONTIC PERIAPICAL EXTRUSION IN THE LOWER PREMOLAR

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ABSTRACT

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Introduction: Studies have shown that the most common position of the mental foramen in several Asian populations was in line with the apex of the second premolar. Therefore, we seek to determine the average distance of the mental foramen to the apex of the second premolar by using the crown length of the second premolar as a ruler. We hope to define a "safe zone" in this region.

Methodology: Measurements were made from the apex of the second premolar to the mental foramen of ninety seven dental radiographs fulfilling the criteria set.

Results: Non-detection of mental foramina happened significantly more often in female subjects than male (Pearson Chi-square; $p=0.01$). Of the mental foramina that were visible, 96% were found to be located within one-crown distance from the apex. More mental foramina (37.1%; 56 sites) were located at the apex than any other locations. This is followed by finding the mental foramina located at ¼-crown distance from the apex (26.5%; 40 sites). The visibility of the mental foramen was found to be significantly limited in females and in patients aged 50 and above (Pearson Chi-square; $p<0.05$).

Conclusion: These findings suggest that there is no safe zone against accidental extrusion of endodontic files and materials in the second premolar region.

Keywords: endodontology, complication, inferior alveolar nerve, mental nerve, mental foramen.

1. Introduction

The mental foramen is located close to the mandibular premolars, especially the second premolar.¹ A morphometric study by Philips et al.² reported the mental foramen to be located on average at a distance of 2.18 mm mesially and 2.4 mm inferiorly from the plain radiographic apex of the second premolar. More precisely, the mental foramina could be located anywhere 3.8 mm mesially 2.7 mm distally, 3.4 mm above or 3.5 mm below the apex of the second premolar. Various cadaveric studies reported the apices of the second premolars to be between 0 and 4.7 mm away from the mental foramen.^{3,4} Using a newer technology of cone beam computed tomography (CBCT), Bürklein et al.⁵ also reported similar findings, with an average distance of 4.2 mm. However, 3.2% of the mental foramen was directly in contact with the second premolar.

Because of this close proximity, various events affecting the second premolar, such as odontogenic infection and orthodontic, endodontic, periodontal or surgical misadventure, may result in the neurosensory disturbance to the area innervated by the mental nerve that exits the mental foramen.^{1,6} A retrospective study found an incidence of 0.96% of

mental paraesthesia related to root canal treatment of mandibular premolar teeth. However, all these incidents were related to periapical infection or pathology, instead of being a complication of the root canal treatment itself as the authors excluded 2 (0.24%) cases of severe overfill and iatrogenic root perforation with mechanical instrumentation into the mental nerve.³

Eliminating infection in the pulp and dentin, followed by adequate intra-canal preparation and proper sealing constitute the basic principles of root canal treatment. Ideally, mechanical preparation and filling should be limited within the root canal as overinstrumentation or the extrusion of chemical fillings beyond the apical foramen to the adjacent nerve can give rise to NSD such as paraesthesia or anaesthesia.^{7,8} Paresthesia related to overinstrumentation usually resolves within several days.⁹ In addition, minor material extrusions are generally well tolerated by the periradicular tissues as long as they do not spread to the adjacent nerve.¹⁰ However, long-term NSD has been reported in cases where the nerve fibre is lacerated due to overinstrumentation or in contact with toxic overfilled endodontic materials.^{8,11}

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As the close proximity of the apices of the mandibular premolar to the mental foramen acts as an important contributory factor for NSD when overinstrumentation or overfilling of endodontic materials happen, it is the aim of this study to determine the distance of the mental foramen to the second mandibular premolar tooth. We chose to concentrate on the second premolar only as an earlier study has shown that most of the terminal end of the inferior alveolar nerve is located in line with the apex of the second premolar.¹² In this pilot study, also conducted on a selected Malay population, we seek to determine the average distance of the mental foramen from the apex of the second premolar by using the crown height of the second premolar as a ruler. The identification of this distance, will hopefully enable us to come up with a so called "safe zone" to ensure that root canal treatment in the lower premolar region can be performed with minimum complications in case files or endodontic filling materials are accidentally extruded beyond the apices of these premolars.

2. Methodology

2.1. Materials

One hundred twenty panoramic radiographs of Malay patients of 4 different age-groups, taken between 2003 and 2005 were obtained from the records stored by the Dental Faculty of the University of Malaya, Kuala Lumpur, Malaysia. The age-groups were categorised as 20-29 years-old, 30-39 years-old, 40-49 years-old and 50 years and above.

All panoramic radiographs were taken using Siemen Orthophos® (Sirona, Bensheim, Germany) or Planmeca® (Planmeca, Helsinki, Germany) machines. The magnification factors reported by the manufacturers were 1.2 and 1.25, respectively. The radiographs were chosen according to the following criteria:

1. High quality with respect to geometric accuracy and contrast of the image.
2. Radiographs in which the lower teeth (between 36 and 46) were missing, had deep caries, root canal treatment or various restorations were excluded because of possible associated periapical radiolucency.
3. Radiographs must be free from any radiolucent or radiopaque lesion in the lower arch. There should be no evidence of jaw fracture around the mental foramen region.
4. Radiographs with supernumeraries and unerupted teeth were excluded because the impacted/ unerupted teeth might obscure the appearance of mental foramen.
5. Films should be devoid of any radiographic exposure or processing artefacts.
6. Radiographs where the lower canine was missing were excluded because of the possibility of mesial premolar drift.
7. Radiographs in which the upper premolars were missing were excluded because of the possibility of overeruption of the lower premolars.

2.2. Methods

The dental panoramic radiographs were placed on

a radiograph view-box. A transparent tracing paper was placed over the radiograph and fixed properly to ensure it remain static in relation to the film. An imaginary line was drawn to outline the second premolar. A line was drawn to join the mesial and distal points of the cement-enamel junction (CEJ). Another line was drawn at the tip of the crown, parallel to the line joining the CEJs. A line vertical to both these lines was then drawn. It represents the crown height of the second premolar. A pair of caliper was used to transfer this distance to a metal ruler to obtain an exact measurement. This measurement was then divided by 4 (calculated to the nearest millimeter) to give the height of a quarter-crown. The distance from the mental foramen to the apex was measured using the second premolar crown height as a ruler (Fig. 1) and was categorised as below:

- I. located at apex
- II. within ¼-crown-distance
- III. within ½-crown-distance
- IV. within ¾-crown-distance
- V. within 1-crown-distance
- VI. within 1½-crown-distance
- VII. within 2-crown-distance
- VIII. Could not be identified

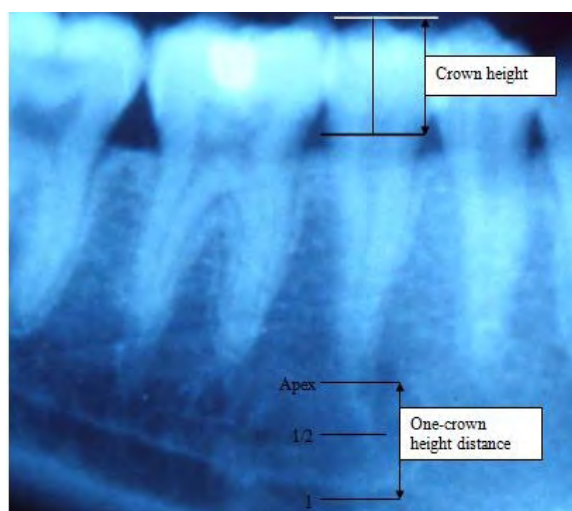


Figure 1. An illustration showing the method used to determine the distance of the mental foramen to the apex of the second premolar using the crown height as a ruler (Note: In this dental panoramic radiograph, the mental foramen is located at the apex of the second premolar).

3. Results

There were a total of 97 radiographs with bilateral sites that fulfilled the criteria and were examined. Thirty-one of the subjects fell into those aged between 20-29 years, 24 subjects were between 30-39 years old, 22 between 40-49 years old and the final 20 were aged 50 years and above. The number of subjects (hence radiographs) that fulfilled the criteria set became less with the age increase as there was a high number of subjects who become fully edentulous or partially edentulous beginning from the first premolar.

The mental foramen was visible in 77.8% (151) of the sites reviewed. It was slightly more pronounced on

Table 1. Distribution for location of mental foramina according to age-groups.

Location	20-29 years [site/percentage]	30-39 years [site/percentage]	40-49 years [site/percentage]	≥ 50 years [site/percentage]
Apex	23 (37.1%)	17 (35.4%)	9 (20.4%)	7 (17.5%)
¼-crown	14 (22.6%)	11 (22.9%)	11 (25%)	4 (10%)
½-crown	4 (6.4%)	5 (10.4%)	3 (6.8%)	0 (0%)
¾-crown	4 (6.4%)	2 (4.2%)	11 (25%)	2 (5%)
1-crown	6 (9.7%)	7 (14.6%)	2 (4.5%)	3 (7.5%)
1½-crown	0 (0%)	2 (4.2%)	1 (2.3%)	3 (7.5%)
2-crown	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Not visible	11 (17.8%)	4(8.3%)	7 (16.0%)	21 (52.5%)

the left (80.5%; 78 sites) than the right side (75.3%; 73 sites) of the mandible. Out of the mental foramina that were visible, 96% were found to be located within a one-crown distance from the apex. More mental foramina (37.1%; 56 sites) were located at the apex than at any other locations. This is followed by finding the mental foramina located within a ¼-crown distance from the apex (26.5%; 40 sites).

Table 1 shows the overall distribution of mental foramen according to various age groups. The mental foramina were visible in the majority of panoramic radiographs of subjects under the age of 50 years (20-29 years: 82.3%; 30-39 years: 91.7%; 40-49 years: 84.1%). However, they did not become visible in more than half (52.5%) of panoramic radiographs of subjects aged 50 and above. This finding is statistically significant (Pearson Chi-square; $p < 0.001$)

Age-wise, all mental foramina were noted to be located within a one-crown distance from the apex in panoramic radiographs of subjects aged 20-29 years. However, between 84.2% and 95.4% of them were located within a one-crown distance for the remaining 3 age groups.

Figure 2 shows the distribution of the mental foramina according to the gender of the subjects. The majority of the foramina were located within a one-crown distance from the apex, irrespective of gender (female 95.4%; male 96.5%). The apex of the second premolar was the most common location for finding mental foramen in both genders (female 40.9%; male 34.1%). However, there were gender differences for other locations, with the ¼-crown distance being the second most common for female but ¼- and ¾-crown distance for the male. When the mental foramina were not observed, more of

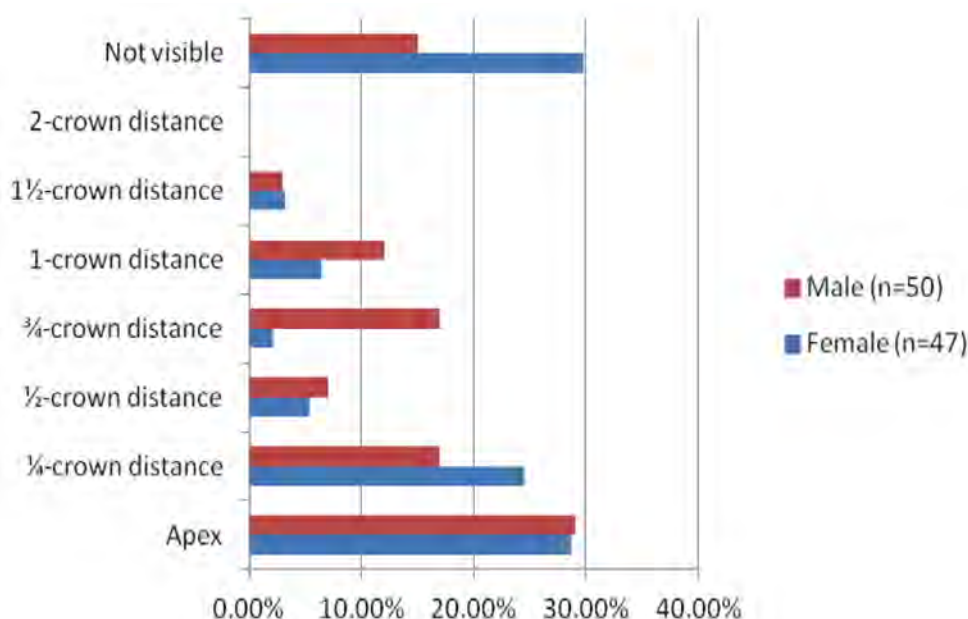


Figure 2. Distribution of the mental foramina according to the gender of the subjects.

this happened in panoramic radiographs of female subjects (28 sites) than male (15 sites). This difference was statistically significant (Pearson Chi-square; $p=0.01$)

4. Discussion

Neurosensory disturbance (NSD) after root canal treatment is an outcome of a rare accident at the apical region of the mandibular posterior teeth. Numerous reports have been published describing the occurrence of NSD during and after endodontic treatment of the mandibular premolars^{7,8,13,14} with the possible mechanisms attributed to 3 factors, namely mechanical, chemical, and thermal damage. Mechanical damage results from compression that occurs during overinstrumentation or by the filling material forced into the mandibular canal.¹⁵ Chemical damage, on the other hand, happens where there is an extrusion of cytotoxic products used during root canal preparation (irrigation and/or root canal medication) or obturation while thermal damage is related to a lack of control in thermocompaction filling techniques.^{9,16}

The close proximity of the apices of the mandibular premolar and molar teeth to the mental foramen and mandibular canal facilitate NSD to happen when overinstrumentation or overfilling of endodontic materials happened.^{1,15} In the molar/premolar region, the inferior alveolar nerve describes a curve that brings the second premolar as well as the second molar root apices in closest proximity to the nerve.⁴ Not many researchers have looked into the distance of the premolar teeth to the terminal end of the inferior alveolar nerve, namely the mental nerve and its foramen.^{2,3,4,5} Worse all of these studies were undertaken on Caucasian subjects. We, therefore, feel it is timely to study this relationship in Asia due to the fact that endodontic extrusions with complication are still being reported every now and then. We hoped to define a "safe zone" apical to the mandibular second premolar, if one indeed exists.

Bürklein et al.⁵ recently undertook such a study using data generated from cone beam computed tomography. However, CBCT is not as widely used in our centre, and we instead have a huge archive of data stored in panoramic radiographs. Hence we decided to study the premolar-mental foramen relationship in panoramic radiographs as this is still relevant clinically. However, as measurement done on panoramic radiographs is generally considered distorted, it was decided that the crown height was used as a comparative ruler because of two reasons: a) the inability to accurately measure the length/distance as these images were in hard copies, as opposed to the newer machine with a measuring software, and

b) for clinical application sake, whereby it was felt that dentists/endodontists may want to have a mental map of the "safe zone" around the premolar region, which can easily be related to the crown-height of the tooth concerned. This may become important when only a periapical radiograph is taken for endodontic purpose.

It is well accepted that dental panoramic radiographs have some disadvantages, namely, variable

magnification from 10% to 30%, image distortion and invisibility in the facio-lingual dimension. Therefore, measuring directly on different radiographs taken using different machines with different distortion would result in a compromised finding. However, by calculating a ratio based on the crown height as a tool of measurement, it is hoped that this will ensure that we are always consistent in relating distance between the mental foramen and the apex of the second premolar. This ratio can be used to provide a mental picture of the distance available based on the average crown height of a mandibular second premolar of 8.2 mm, with a crown to root ratio of 1:1.8.¹⁷

Translating the finding that 96% of mental foramina were found to be located within one-crown distance from the apex, this can easily suggest that a majority of the mental foramina were located within a 8.2 mm perimeter from the apices of the second premolar. Worse, almost two-thirds (63.6%) of the mental foramina were located either at the apex or within a quarter crown-height distance from the apex, translating to a 'safe zone' between 0 to 2 mm only! Nevertheless, the distance recorded in this study is still larger than that reported by Phillips et al.² where the centre of the mental foramen was located on an average distance of 2.18 mm mesially and 2.4 mm inferiorly from the radiographic apex of the second premolar. Our finding, together with that reported by Phillips et al.² earlier, suggests that there is no really "safe zone" against accidental extrusion of endodontic files and materials in the second premolar region.

Two secondary findings that are statistically significant are the fact that more mental foramina were not noticeable in female patients and in patients aged more than 50 years old. The latter finding has been reported in an earlier publication.¹⁸ The effect of gender on non-visibility of mental foramen has not been reported, and could be related to the difficulty to distinguish it from trabeculae pattern in these patients, in addition to poor radiograph quality (over dark radiographs).¹⁹ As osteoporosis affects female subjects more than males, it is possible that is a potential contributing factor although this suggestion remains a hypothesis due to the fact that we did not actively seek to determine if these subjects were indeed having bone metabolism disorder.

5. Conclusion

More mental foramina were significantly not visible in panoramic radiographs of female subjects than male. Of mental foramina that were visible, 96% were found to be located within one-crown distance from the apex. Almost two-thirds (63.6%) of the mental foramina were located either at the apex or within a quarter crown-height distance from the apex. The visibility of the mental foramen was found to be significantly limited in patients aged 50 and above. These findings suggest that there is no "safe zone" for accidental extrusion of endodontic files and materials in the second premolar region.

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Professor Dr Wei Cheong Ngeow graduated from the Faculty of Dentistry of the University of Malaya in 1992 and went into private practice before being offered a tutorship at his alma matter. In 1996, he obtained his Fellowship in Dental Surgery from the Royal Colleges of Surgeons in Ireland and England, respectively. Back in Malaysia he was a pioneer lecturer at the newly established Universiti Kebangsaan Malaysia. He returned to private practice in 1999 but in 2000 returned to the University of Malaya He obtained an MDSc (2008) and a PhD from the University of Sheffield (2010). He has published over 160 articles, letters, comments and reports in local and international journals, and was the Editor of the Malaysian Dental Journal (2005-2007) and Editor of the MDA Newsletter (2015). His research interests are craniofacial anthropometry, variations of the mandibular nerve, recovery of peripheral nerves after microsurgical repair.

Questions

1. Which tooth is usually closely related to the mental foramen?

- a. First premolar;
- b. Second premolar;
- c. First molar;
- d. Second molar.

2. Which of the following statements is not the main principle of endodontic treatment?

- a. Eliminating pain;
- b. Eliminating infection in pulp and dentine;
- c. Achieving adequate intracanal preparation;
- d. Achieving proper seal.

3. The following is not a factor that contributes to the occurrence of neurosensory disturbance during endodontic treatment of the mandibular premolars:

- a. Mechanical;
- b. Chemical;
- c. Thermal;
- d. Psychological.

4. When translating the finding that 96% of mental foramina were found to be located within one-crown distance from the apex, how far are the majority of the mental foramina located within from the apices of the second premolar?

- a. 6 mm;
- b. 7 mm;
- c. 8 mm;
- d. 9 mm.

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ORAL MANIFESTATIONS IN IRON DEFICIENCY ANEMIA: CASE REPORTS

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ABSTRACT

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The aim of this work is to reveal the clinical, radiological, immunological, cytological, microbiological and histopathological manifestations of oral pathology taking the form of sideropenia, correlations and interdependence.

Summary: During a four-years period a study was conducted on patients with different clinical forms of iron deficiency anemia (IDA) and the prevalence of oral diseases in those patients was highlighted. This paper discusses 24 case results and presents two clinical cases, patients with iron deficiency anemia (by: metrorrhagia, deficiency, gingiva bleeding, colon cancer) and oral symptoms associated. The results are meaningful and applicable to the whole group studied. Sampling was done according to the directions of interest in the study regarding: sex, age, the type of anemia, dental and periodontal lesions.

Key learning points: The originality of the study lies in the association of specific examination of the oral cavity with the investigations used in other medical specialties, which led to the creation of a more accurate diagnosis and the establishment of a connection (sometimes specific issues) between oral diseases and systemic disease, represented in this study by various forms of sideropenia.

Keywords: oral medicine, iron deficiency anemia, sideropenia, dental and periodontal manifestations.

1. Introduction

Anemia represents a world wide health problem which affects both developing and developed countries. It affects all groups of age. Globally 24.8% of the population reveal anemia, in Europe the percentage being 22.9%. Approximately half of the cases with anemia are due to iron deficiency.^{1,2} Anemia may be classified clinically, morphologically, erythro-kinetic and etio-pathogenic.

The clinical classification is associated with decreased levels of hemoglobin and/or a decreased packed red cell volume (hematocrit).^{3,4} Iron deficiency is also characterized by a reduced value of the mean corpuscular volume (MCV) and the mean corpuscular hemoglobin concentration (MCHC), caused by lack of iron.¹

Grading:

- Mild anemia: Hb 11-9 g/dl, Hct 39-30%;
- Moderate anemia: Hb 9-7 g/dl, Hct 30-22%;
- Severe anemia: Hb 7-3 g/dl, Hct 22-10%.¹⁴

The purpose of this paper developed on patients with IDA, in collaboration with the "Prof. Dr. C.T. Nicolau" National Institute of Transfusion Hematology, is to identify and describe oral manifestation that occurred and also to establish immunoserological values, histopathological, microbiological and cytological aspects associated.

2. Methodology

Clinical examination determined intraoral assessment of mucosa, periodontium and caries lesions. Detection of caries involved both clinical (visual and tactile) and radiographic examination. Evaluation of the periodontium consisted of clinical assessment of attachment levels, bone topography (radiographs evaluation) and tooth mobility; inflammatory status of the tissue, tissue color, texture, contours, edema and sulcular exudates was also noted.

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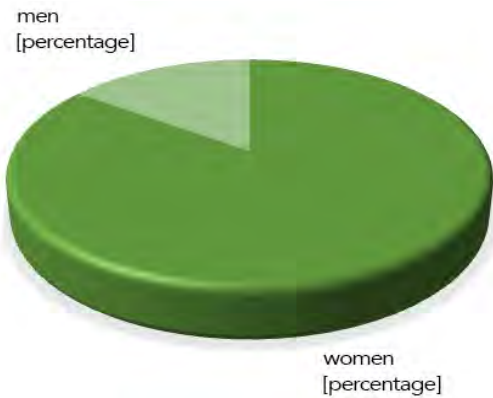


Figure 1. Sex prevalence of IDA.



Figure 2. Oral manifestations among patients diagnosed with iron deficiency was 77,55%.

Biological samples were taken from gingival sulcus or periodontal pockets. After the MGG (May-Grünwald-Giemsa) staining cytologic microscopic aspects were observed. The samples obtained were also cultivated on specific medium and bacterial growth characteristics were observed. Cell staining is a necessary and useful technique to visualize morphology and structure of cells. Serology was used to establish Complement and Immunoglobulin levels. Gingival biopsy was performed, fixation and sectioning of the tissues. A solution of paraformaldehyde was used to fix tissues. IHC is an excellent detection technique and has the advantage of being able to show exactly where a given protein is located within the tissue examined, in our cases gingival chorion and epithelium. The markers used were: CD1a, CD20, CD3, CD4, CD5 corion, CD7 corion, MPO, CD138, S100, SMA, ki67, p63, p53, AE1-AE3, CD31 and CD34.

This prevalence study was carried on a number of 40 patients with various degrees of iron deficiency anemia - 34 females and 6 males (Fig. 1), between 16 and 82 years of age and revealed, 24 patients with dental and periodontal lesions, gingiva inflammation in 7 patients and lack of symptoms on 9 of the cases (Fig. 2).

The main factors involved in developing caries are: dental structures, the plaque and diet influenced by the immune system, saliva, timing and topical

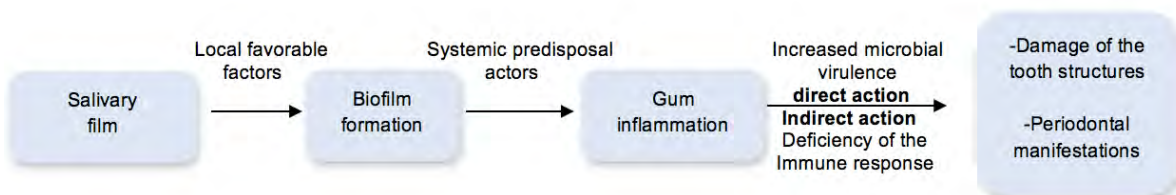


Figure 3. Ethological factors influencing the development of caries process and periodontal diseases.

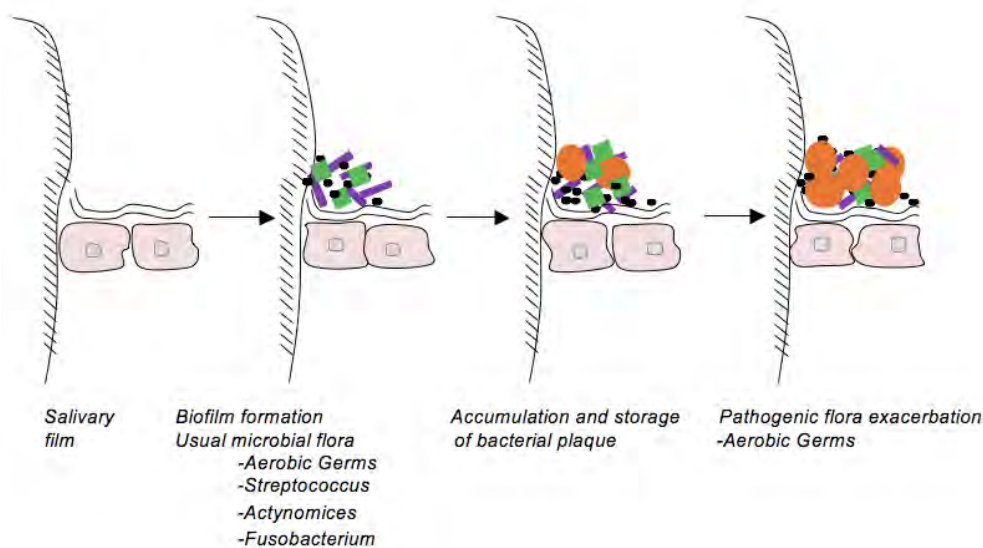


Figure 4. Emergence of salivary biofilm with the development of common microbial flora and exacerbation of the pathogen flora under the action of systemic predisposing factors.



a. **Figure 5.** Chronic marginal periodontitis, active approximal and cervical caries lesions: a. facial aspect; b. lingual aspect.

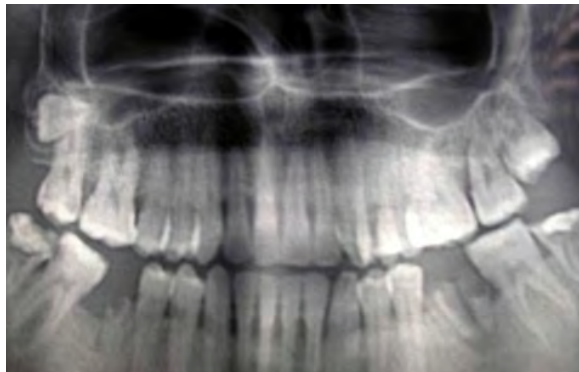


Figure 6. Panoramic image.

fluoride. In addition, there are general factors such as: education, socio-economic status, behavior, health attitude, income. When one of the risk factors increases, it produces an imbalance, leading to caries (Fig. 3).^{5,6,7}

The most complex and accessible microbial ecosystem of the human body lies in the oral cavity, there are about 700 species of known bacteria, at least 30 species of fungi (especially *Candida*) and several species of protozoa (associated with food bacteria) and some intracellular viruses.^{8,9,10,11}

In a healthy oral cavity, what is normally found is between 20-50 bacterial species, the number going up to 200-400, in case of disease. These

microorganisms are always found in communities and vary with the cavity environment.^{12,13,14} The dental surfaces and the mucosa are the areas of microbial colonization. The constant production of saliva and the intermittent food feeding with sugars and amino acids generate nutrients for microbial growth.¹⁵

The increased number of microorganisms, their development on a favorable ground and the association with the inflammatory response of the host are responsible for caries development under the plaque (Fig. 4).^{16,17}

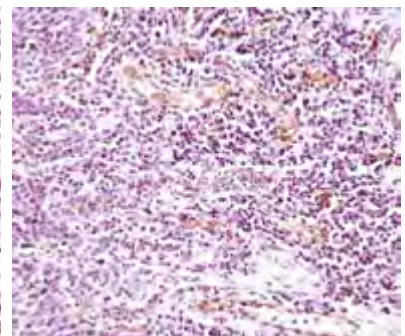
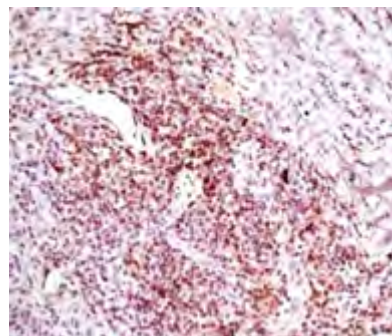
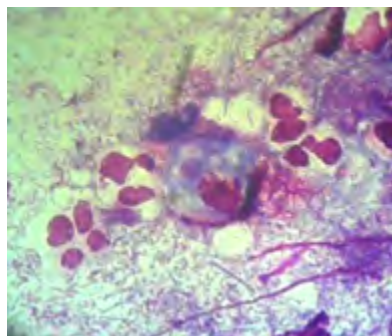
Immunity is the ensemble of humoral and cellular, specific and nonspecific factors, which protect the human body against infectious diseases, parasites aggressions and malignant proliferation. The presence of microorganisms and their products initiating and producing caries causes an immunity response based on specific and nonspecific factors.^{18,19,20}

A systemic disease can influence the effectiveness of the immunity response which can lead to an intense microbial activity consequently with dental or periodontal manifestations.

3. Cases reports

3.1. Case no. 1: M.Ş., f, age 25

3.1.1. Oral diagnosis - active approximal caries: mesial on 12 and 22; cervical caries



a. **Figure 7.** Laboratory aspects: a. inflammatory infiltrate, macrophages, frequent cocci, bacilli, candida filaments; b. abundant inflammatory infiltrate in the corion (IHC-CD3); c. mild vascular hyperplasia (IHC-CD34).

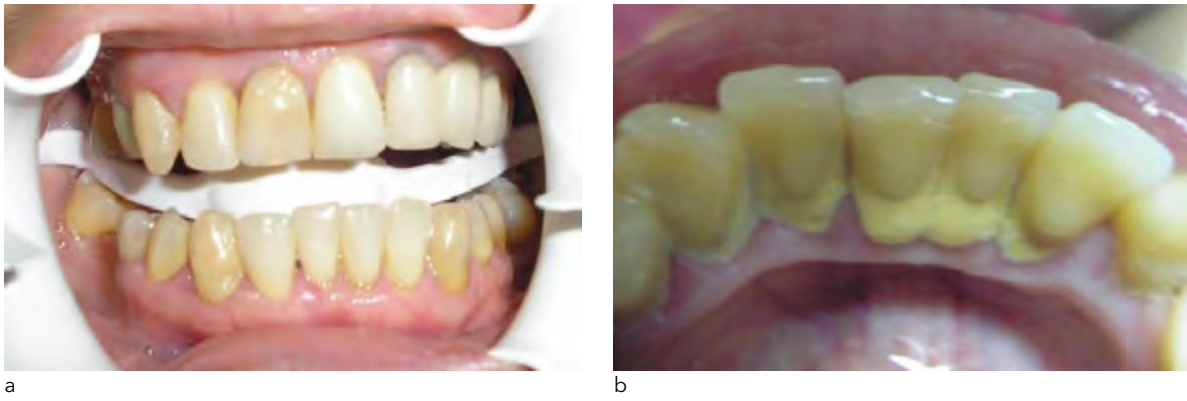


Figure 8. Chronic periodontitis, active cervical lesions: a. facial aspect; b. lingual aspect.

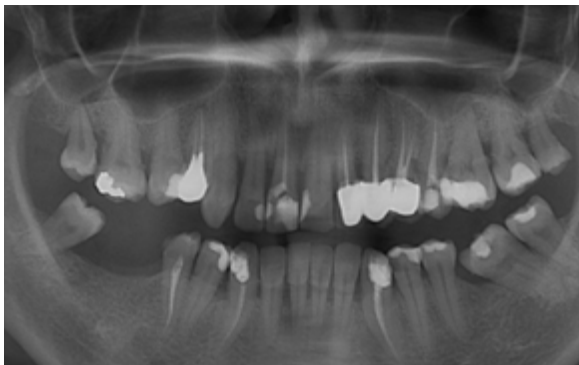


Figure 9. Radiograph aspect - horizontal bone atrophy with localized vertical resorption.

lesions distal on 43 and 44, facial on 45; chronic marginal periodontitis. The exam of the marginal periodontium revealed: calculus index 34.48 percent; gingival inflammation index 11.20 percent; periodontal inflammation index 6.03 percent; periodontal pockets with dimensions between 3-4 mm; gingiva color changed, from light red to brick red, with a bordure periphery area (lisere) and ulceration areas; bleedings at slight touch; the periodontal chart revealed slight gingiva recession at the level of the front inferior incisors, periodontal pockets in 11. 12. 15. 27. 33. 42. 43. 44. 45 and slight dental mobility (first degree) at the inferior incisors (Fig. 5-a; b).

3.1.2. Hematologic diagnosis - iron deficiency anemia due to metrorrhagia: HGB 10.47 g/dL; HCT 33.75 %; RBC 3.61 $10^6/\mu\text{L}$; MCV 79 fL; Fe 23 $\mu\text{g/dL}$.

Complementary exams: radiological, cytological, immunohistochemical, microbiological, immunoserological.

3.1.3. Serology - slight modification: CRP 3.0 g/dL; IgA 3.63 g/L; IgG 11.84 g/L; IgM 1.82 g/L; C3 1.2 g/L; C4 0.4 g/L.

3.1.4. Radiological - generalized horizontal minimal bone loss; radiotransparency with different site: cervical on 43, 44, 45; approximately on 47 and 48; vertical bone resorption on 13 (Fig. 6).

3.1.5. Cytologic appearance: microbial loaded epithelial cells were observed interspersed in a background of inflammatory cells: macrophages, granulocytes, lymphocytes with microbial elements: cocci, diplococci, *Treponema denticola*, fusobacterium, yeasts (Fig. 7-a).

The histopathologic examination revealed fragments of squamous mucosa with prominent acanthosis with irregularly elongated epithelial cristae and abundant inflammatory lymphoplasmacytic infiltrate in lamina propria. Moderate edema within the lamina propria and moderate epithelial spongiosis were noted; focally, erosive and ulcerative areas were present (Fig. 7-b; c).

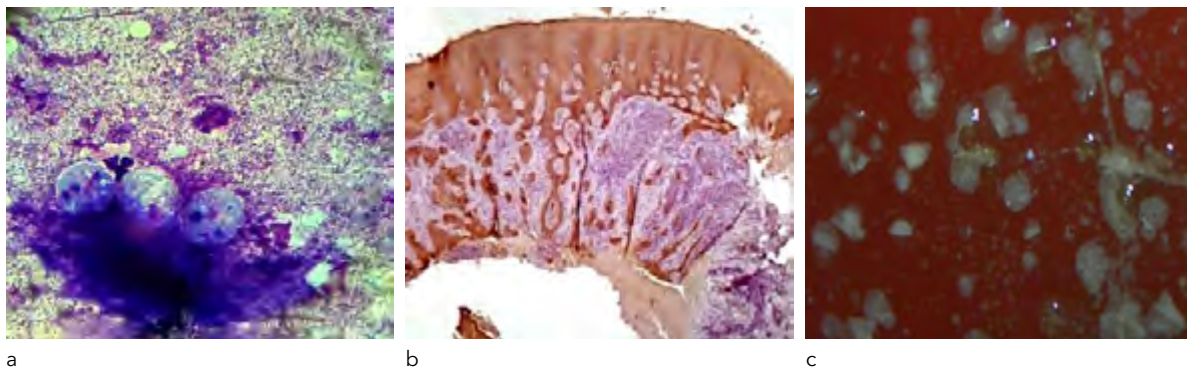


Figure 10. Laboratory aspects: a. inflammatory lymphoplasmocytic infiltrate with macrophages loaded with germs; b. acanthotic squamous epithelium with important elongation of the interpapillary cristae and abundant chronic infiltrate in corion; islands of odontogenic epithelium in corion; c. aerobic macroscopic aspect.

3.2 Case no. 3: S. M., f, age 41

3.2.1. Oral diagnosis - on teeth diagram: active cervical lesions on 13.31.41 and 43; arrested brown lesions on 37 and 48; on periodontal chart: chronic periodontitis with calculus index of 25.89%; gingival inflammation index of 10.71%; periodontal inflammation index of 7.14%; generalized gingiva retraction, with Stillman's clefts on 16.26; seropurulent exudate when exercising pressure on the sides of the periodontal pockets at 13.12.23.37.43.44; bleedings on gingival pressure level of the inferior front incisor; moderate dental mobility (second degree) (Fig. 8-a; b).

3.2.2. Hematologic diagnosis - iron deficiency anemia: HGB 10.8 g/dL; HCT 38 %; RBC 4.79 $10^9/\mu\text{L}$; MCV 73.1 fL; Fe 21 $\mu\text{g/dL}$.

Complementary exams: radiological, cytological, immunohistochemical, microbiological, immunoserological.

3.2.3. Serology - increase of the IgM: CRP 5.5 g/dL; IgA 1.93 g/L; IgG 12.4 g/L; IgM 2.40 g/L; C3 1 g/L; C4 0.2 g/L.

3.2.4. Radiological - general horizontal bone minimal loss; proximal demineralization on 34 and recurrent caries lesion under restoration on 37 (Fig. 9).

3.2.5. Cytology - microbial loaded macrophages, mixed cellular component (epithelial and conjunctive), cocci, bacilli, candida filaments (Fig. 10-a).

3.2.6. Histopathologic appearance: squamous mucosa with hyperkeratosis with parakeratosis, acanthosis, diffuse spongiosis; mild lymphoplasmocytic inflammatory infiltrate, mild hyperemia and important interstitial edema within the corion; minute remnants of odontogenic epithelium are identifiable within the corion (Fig. 10-b).

3.2.7. Microbiological - on a rich macrophages inflammatory infiltrate ground, intercellular cocci and bacilli phagocytosis, the presence of some large, creamy, half-transparent colonies belonging to Gram-negative bacteria, considered as *Klebsiella* was noticed (Fig. 10-c). Also, smaller colonies, also with mucoid aspect, that could be considered by their aspect, as belonging to the germs of *Pseudomonas* sp. Colony culture anaerobically developed revealed a very abundant growth, non differentiated regarding the aspect of the colonies; the colonies were in confluence, creating a creamy aspect and above them some other types of colonies developed with different forms and aspects, difficult to identify.

4. Results**4.1. Oral aspects**

The study noticed the following by clinical examination, periodontal chart and radiographs on patients: active caries lesions; arrested brown lesions; defective restoration; cervical lesions; fissures; tooth fractures; matte white active cervical

lesion; secondary caries; plaque and calculus; general marginal gingivitis; chronic periodontitis; aggressive periodontitis with localized and general bone loss. Gathering this information, a graphic image of the oral manifestations distribution in associated systemic disease (IDA in these cases) was obtained (Fig. 11).

4.2. Immunohistochemical analysis

On the patients included in the studied lot gingival biopsy was performed. The harvest was made from the affected periodontal structure. The iron deficiency anemia from metrorrhagia (13 cases) is characterized by: 5 cases with lack of T helper cells and PMNs, 3 cases with absence of T helper cells, 1 case with absence of PMN, frequent Langerhans cells, T and B lymphocytes in 4 cases. The following was noticed with respect to IDA (11 cases): the absence of T helper cells in 2 cases, the absence of PMNs in 3 cases and in 4 cases the absence of both T helper cells and PMNs. In 2 cases frequent Langerhans cells, melanocytes and B-lymphocytes were noticed (Table 1).

The 24 patients with dental and periodontal manifestations showed: the absence of T helper cells and PMNs in 9 cases; PMNs absence in 4 cases and in 5 cases the absence of T helper cells (which implies the lack of bacterial component in 13 cases, as well a decrease of the cellular immune line in 14 cases); frequent Langerhans cells, T and B lymphocytes in 6 cases (Fig. 12).

4.3. Serology

Generally, in the case of anemia there are no patent systematic changes of immunoglobulin and/or Complement, and, when present, there is an associated cause (Table 2).

This study showed:

- high levels of IgM (associated to dental and periodontal manifestations) in 2 cases;
- decreased IgG level in 2 cases (possibly due to hypogammaglobulinemia);
- low values of C3 (due to chronic periodontics infections) in 6 cases;
- decreased C4 in 2 cases (SLE, macrophages iron storage) (Fig. 13).

4.4. Microbiology

Samples were taken from gingival sulcus or periodontal pockets. After the Gram staining, bacterial cultures were obtained. Bacterial investigations were limited, due to the given conditions of their metabolic cultivation and activity testing. A series of observations started from lesion peculiarities of some of the cases. The investigation was limited only to morphology and characteristics of the cultivation of the growth of the respective bacteria, in aerobic and anaerobic environment. A rich bacterial polymorphism was found, which could not be significantly correlated with the lesion aspects encountered. Among the isolated major groups, the following can be mentioned: Gram positive cocci from *Micrococcus*

sp. and Staphylococcus sp. genres (nonhemolytic); Klebsiella Gram negative bacillus (colonies with characteristics: big, mucoid); spiral shape bacteria and morphological aspects specific for yeasts, labeled as Candida. It should have been surely necessary to expand the bacterial investigations with molecular biology tests. There are studies about the preponderance of some bacteria from the genres of: Actynomices sp.; Fusobacterium nucleatum; Bacteroides sp.; Prevotella intermedia, Aggregatibacter actinomycetemcomitans; Porphyromonas gingivalis; Tannerella forsythia; Treponema denticola; Prevotella intermedia; Fusobacterium nucleatum; Eikenella corrodens; Eubacterium nodatum; Peptostreptococci; Selenomonas noxia; Capnocytophaga; Klebsiella, more frequently met in caries and periodontal pathology.¹³ From the group of aerobic and anaerobic bacteria cultures were developed, whose cultivation rate suggested the presence of certain bacterial groups. Seven of the cases indicated the presence of homogeneous cultures, especially of positive gram cocci, which can be associated with the aggressiveness of ecological dominance, selected under the action of local pressure factors and even constitutional general factors (anemia determines growth in monocultures). The frequent cultures were the associated ones, associations of at least 2 bacterial groups, which could have been distinguished through their morphological characteristics. In one single case, the presence of Candida was identified, frequently mentioned in oral conditioned pathology, associated with small, round scattered colonies, with homogeneous shape and dimensions, which suggests a bacterial presence. The presence of a polymorph microbial flora correlated with the dental and periodontal affections was also found.

4.5. Cytology

Gathering samples at the level of gingival sulcus and periodontal pockets from the studied patients revealed:

- The morphology of exfoliating cells in the inflammatory process (hyperplasia, parakeratosis, hyperkeratosis and acanthosis), epithelial cells microbial filled, with a various flora: cocci, bacilli, candida filaments, fusobacterium species;
- The presence of inflammatory infiltrate of several types of cells (neutrophils, monocytes, lymphocytes, leukocytes, macrophages) histiocytic proliferation; morphologic and erythrokinetic characteristics of the cellular factors of the immunity system were correlated with the type of anemia (acquired or genetic);
- Microbial polymorph flora characteristic to the acute or chronic degree of dental and periodontal manifestations (coccus Gram positive, bacillus Gram negatives, fusobacterium spp., candida filaments).

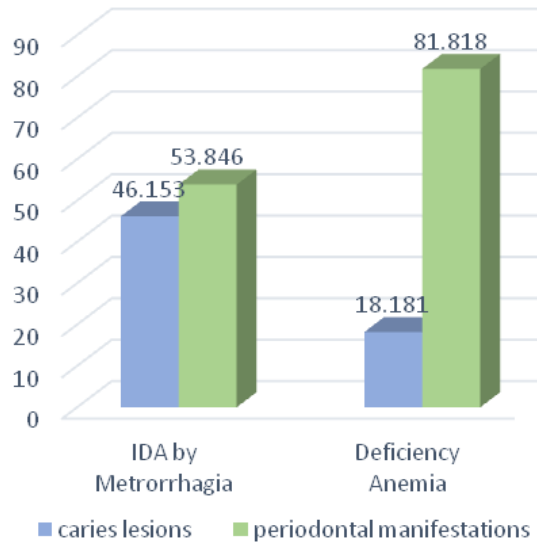


Figure 11. Distribution of dental and periodontal manifestations in types of anemia.

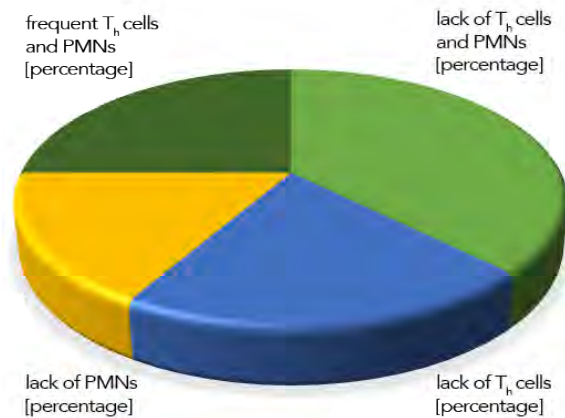


Figure 12. Graphic representation of cases with low cellular defense.

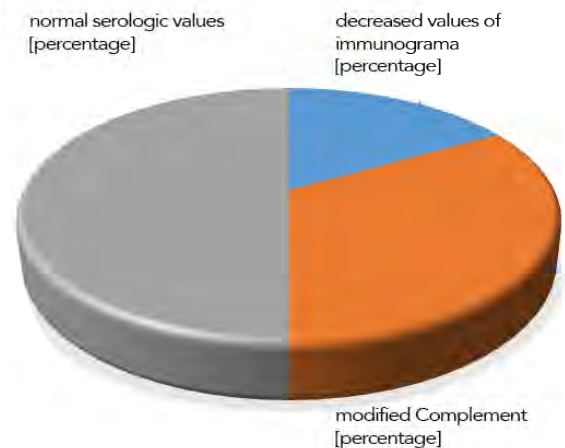


Figure 13. Immunogram graphic representation.

Table 1. Specific markers values on patients with IDA and oral manifestations

No.	Name	Sex	Age	Hematologic diagnosis	Etiology of anemia	Oral diagnosis
1	L.A.	F	25	IDA	Chronic gastrointestinal blood loss	Chronic gingivitis Numerous stained class 5 caries lesions
2	E.R.	F	35	IDA Colon cancer	Chronic gastrointestinal blood loss	Chronic gingivitis Cervical lesions consistent with brown arrested lesions
3	G.I.	F	32	IDA	Metrorrhagia	Chronic gingivitis Cavitated active cervical lesions
4	P.D.	F	35	IDA	Metrorrhagia	Chronic gingivitis Matte, white, active cervical lesions
5	I.F.	F	29	IDA	Metrorrhagia	Generalized marginal gingivitis Multiple adjacent defects that fit the description of abfraction lesions
6	M.Ş.	F	39	IDA	Metrorrhagia	Chronic marginal periodontitis Active approximal and cervical caries lesions
7	N.V.	F	35	IDA	Metrorrhagia	Chronic marginal periodontitis Multiple active caries lesions
8	Ş.G.	F	30	IDA Thrombocytopenia	Metrorrhagia	Chronic marginal periodontitis Extensive active caries
9	Ş.A.	F	25	IDA	Metrorrhagia	Chronic marginal periodontitis Active recurrent caries lesions
10	C.A.	F	30	IDA	Metrorrhagia	Chronic marginal periodontitis Smooth surface caries lesions presenting microfractures in the surface
11	C.V.	F	27	IDA	Metrorrhagia	Chronic gingivitis active root-surface caries lesions
12	T.A.	F	34	IDA Systemic lupus erythematosus	Metrorrhagia Chronic inflammation	Chronic periodontitis Inactive or arrested caries lesions
13	T.C.	F	28	IDA	Metrorrhagia	Chronic periodontitis Cavitated active cervical lesions
14	B.L.	F	21	IDA	Deficiency	Aggressive periodontitis Extensive active cervical caries
15	B.R.	M	22	IDA	Deficiency	Chronic gingivitis Matte, white, active cervical lesions
16	V.M.	F	26	IDA	Deficiency	Chronic gingivitis, Arrested lesions and active localized caries
17	G.C.	F	25	IDA	Deficiency	Chronic periodontitis Arrested caries lesions
18	M.R.	F	23	IDA	Deficiency	Chronic periodontitis Arrested non-cavitated lesions
19	I.B.	F	20	IDA	Deficiency	Aggressive periodontitis, Extensive active root-surface caries lesions
20	R.A.	M	29	IDA	Deficiency	Chronic periodontitis Non-cavitated lesions and fissures
21	S.A.	F	43	IDA	Deficiency	Chronic periodontitis, Active caries lesions with small and large cavities
22	R.M.	F	31	IDA	Deficiency	Chronic periodontitis generalized Cavitated lesions
23	I.M.	F	24	IDA	Deficiency	Chronic periodontitis Active discolored lesions
24	S.M.	F	41	IDA	Deficiency	Chronic periodontitis Active cervical lesions

SMA	S100	S100	CD20	Plasmatic cells	CD4	MPO chorion	MPO epith	CD3 chorion	CD3 epith	CD5 chorion	CD5 epith	CD7 chorion	CD7 epith
gran tissue	2	2	1	1	1	1	1	2	1	2	1	1	1
-	1	1	1	1	1	1	1	2	1	2	1	1	1
-	1	1	-	-	0	0	0	0	1	1	1	1	1
-	1	1	2	1	0	1	0	2	1	1	1	1	1
gran tissue	1	1	-	-	0	0	0	0	0	0	1	-	-
gran tissue	1	1	1	2	0	2	1	1	1	2	1	1	1
gran tissue	1	1	1	1	1	0	0	2	1	2	1	1	1
-	1	1	1	2	0	1	1	2	1	2	1	1	1
-	2	2	1	1	0	1	1	1	1	1	1	1	1
-	2	2	-	-	0	1	0	1	1	2	1	1	1
gran tissue	1	1	-	-	1	1	0	2	1	1	1	1	1
-	1	1	1	1	1	1	2	2	2	2	1	1	1
gran tissue	1	1	-	-	1	2	2	2	1	2	1	1	1
gran tissue	2	2	1	2	0	2	1	1	1	1	1	1	1
-	2	2	-	-	0	0	0	2	1	2	1	1	1
-	1	1	2	1	1	-	-	-	-	-	-	-	-
gran tissue	1	1	1	1	0	2	1	1	1	1	1	1	1
-	1	1	2	1	1	1	0	1	1	1	1	1	1
-	2	2	2	1	1	1	0	2	1	1	1	1	1
-	2	2	1	1	0	1	0	2	1	2	1	1	1
-	2	2	-	-	1	0	0	2	1	1	1	1	1
-	1	1	-	-	1	1	0	2	1	1	1	1	1
gran tissue	1	1	1	1	1	1	2	1	1	1	1	1	1
-	1	1	1	1	0	1	0	2	1	2	-	-	-

Table 2. Serological values on patients with IDA and oral manifestations.

No.	Name	Sex	Age	Hematologic diagnosis	Etiology of anemia	Oral diagnosis
1	L.A.	F	25	IDA	Chronic gastrointestinal blood loss	Chronic gingivitis Numerous stained class 5 caries lesions
2	E.R.	F	35	IDA Colon cancer	Chronic gastrointestinal blood loss	Chronic gingivitis Cervical lesions consistent with brown arrested lesions
3	G.I.	F	32	IDA	Metrorrhagia	Chronic gingivitis Cavitated active cervical lesions
4	P.D.	F	35	IDA	Metrorrhagia	Chronic gingivitis Matte, white, active cervical lesions
5	I.F.	F	29	IDA	Metrorrhagia	Generalized marginal gingivitis Multiple adjacent defects that fit the description of abfraction lesions
6	M.Ş.	F	39	IDA	Metrorrhagia	Chronic marginal periodontitis Active approximal and cervical caries lesions
7	N.V.	F	35	IDA	Metrorrhagia	Chronic marginal periodontitis Multiple active caries lesions
8	Ş.G.	F	30	IDA Thrombocytopenia	Metrorrhagia	Chronic marginal periodontitis Extensive active caries
9	Ş.A.	F	25	IDA	Metrorrhagia	Chronic marginal periodontitis Active recurrent caries lesions
10	C.A.	F	30	IDA	Metrorrhagia	Chronic marginal periodontitis Smooth surface caries lesions presenting microfractures in the surface
11	C.V.	F	27	IDA	Metrorrhagia	Chronic gingivitis active root-surface caries lesions
12	T.A.	F	34	IDA, Systemic lupus erythematosus	Metrorrhagia Chronic inflammation	Chronic periodontitis Inactive or arrested caries lesions
13	T.C.	F	28	IDA	Metrorrhagia	Chronic periodontitis Cavitated active cervical lesions
14	B.L.	F	21	IDA	Deficiency	Aggressive periodontitis Extensive active cervical caries
15	B.R.	M	22	IDA	Deficiency	Chronic gingivitis Matte, white, active cervical lesions
16	V.M.	F	26	IDA	Deficiency	Chronic gingivitis Arrested lesions and active localized caries
17	G.C.	F	25	IDA	Deficiency	Chronic periodontitis Arrested caries lesions
18	M.R.	F	23	IDA	Deficiency	Chronic periodontitis Arrested non-cavitated lesions
19	I.B.	F	20	IDA	Deficiency	Aggressive periodontitis Extensive active root-surface caries lesions
20	R.A.	M	29	IDA	Deficiency	Chronic periodontitis Non-cavitated lesions and fissures
21	S.A.	F	43	IDA	Deficiency	Chronic periodontitis Active caries lesions with small and large cavities
22	R.M.	F	31	IDA	Deficiency	Chronic periodontitis generalized Cavitated lesions
23	I.M.	F	24	IDA	Deficiency	Chronic periodontitis Active discolored lesions
24	S.M.	F	41	IDA	Deficiency	Chronic periodontitis Active cervical lesions

Serum immunoglobulins			Complement		
IgA	IgG	IgM	C3	C4	CRP
325	1401	102	100	14,3	++
133	876	70	60	20	++
158	1450	234	110	30	++
228	1010	65	123	23,2	++
192	1500	142	140	20	-
363	484	182	120	40	++
166	1100	124	100	60	++
205	1100	150	130	30	++
255	1030	496	110	20	++
372	1060	124	80	30	++
332	1250	120	70	30	++
77	1540	108	126	14,3	-
274	1160	123	110	30	-
184	1002	100	110	50	++
185	1210	90	110	20	-
78	1220	129	100	20	++
144	983	182	110	40	++
156	1410	176	100	30	++
136	68	154	160	40	++
271	1210	122	90	30	++
158	1340	168	70	30	-
164	1200	122	90	30	-
216	1230	139	110	20	++
193	1240	240	100	20	++

5. Conclusions

- The microbial macroscopic determinations showed species of: Streptococcus mutans, Lactobacillus, Porphyromonas gingivalis, Tannerella forsythia etc. correlated with the degree of impairment of the oral structures;
- The evolution of the caries and other oral manifestations can be slow or rapid depending on the patient’s background, the microbial component and the systemic factors (anemia in this case), which can change the general state;
- A reduced or abundant inflammatory polymorphous infiltrate was also revealed, depending on the degree of the inflammation and tissue destruction (neutrophils, macrophages, histiocytes, lymphocytes, plasma cells) and also related to the epithelial alterations (hyperplasia, acanthosis, parakeratosis);
- The immunohistochemical exam showed a chronic inflammatory process consisting of numerous T cells (pan T markers CD3 and CD5 positive) retaining CD7 expression and belonging mostly to T helper phenotype (CD4+). inflammatory infiltrate includes also B-lymphocytes (expressing CD20), neutrophils, Langerhans cells (expressing CD1a and S100); it also revealed a moderate vascular hyperplasia with significant angiogenesis (revealed with CD34 marker);
- The immunoserological exam demonstrated modifications of the Immunogram values and of the Complement system; these findings are not characteristic for the systemic affection, but for infections;
- The results lead to a better understanding of the determining factors of oral pathology (in clinical types of anemia); further studies involving larger groups of subjects are necessary in order to definitely establish a causal relation between these entities.

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What means the acronym IDA?

- a. Immune disorder activity;
- b. Iron deficiency anemia;
- c. Increased data analyses;
- d. Iron disease autoimmune.

Anemia is associated with:

- a. Decreased levels of hemoglobin (Hb);
- b. Increased values of hematocrit (Hct);
- c. High levels of hemoglobin (Hb);
- d. Developing countries only.

Oral manifestations can appear due to:

- a. A healthy diet;
- b. An imbalance immune system;
- c. Lack of risk factors;
- d. Normal dental structures.

Increased number of microorganisms in the oral cavity, the inflammatory reaction of the host and immunity response based on specific and nonspecific factors in the previous clinical cases are revealed by:

- a. Normal microbial macroscopic aspects;
- b. Epithelial cells with no trace of cocci, bacilli, candida filaments and fusobacterium species;
- c. Lack of inflammatory infiltrated;
- d. Immunohistochemical exam that showed a chronic inflammatory process.



THE MICROBIAL PROFILES OF DENTAL UNIT WATERLINES IN A DENTAL SCHOOL CLINIC

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ABSTRACT

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Background: The microbiological quality of water delivered in dental units is of considerable importance since patients and the dental staff are regularly exposed to aerosol and splatter generated from dental equipments. Dental-Unit Waterlines (DUWLs) structure favors biofilm formation and subsequent bacterial colonization. Concerns have recently been raised with regard to potential risk of infection from contaminated DUWLs especially in immunocompromised patients.

Objectives: The study aimed to evaluate the microbial contamination of DUWLs at RAK College of Dental Sciences (RAKCODS) and whether it meets the Centre of Disease Control's (CDC) recommendations for water used in non-surgical procedures (≤ 500 CFU/ml of heterotrophic bacteria).

Materials and Methods: Ninety water samples were collected from the Main Water Source (MWS), Distilled Water Source (DWS) and 12 random functioning dental units at RAKCODS receiving water either directly through water pipes or from distilled water bottles attached to the units. Bacterial enumeration and molecular identification were performed.

Results: The MWS had the lowest bacterial count (499 CFU/ml). The bottled units contained significantly higher numbers of CFU (2632 ± 1231.783) compared to non-bottled units (1484.75 ± 1395.093), $p < 0.02$. *Ralstonia spp.* was the most common bacteria present in the MWS and DWS (in 96% of the samples). Other bacteria were *Sphingomonas paucimobilis* 88.8% and *Leifsonia spp.* 73.5%.

Conclusion: There is a need for regular water monitoring at dental clinics, in addition to regular maintenance and disinfection programs to ensure quality water delivery that meets the CDC guidelines for non-surgical water.

Keywords: Maintaining dental unit waterlines, microbial contamination, biofilm formation, non-surgical water.

1. Introduction

In the dental office, infection control in terms of self-protection, instrument sterilization and surface disinfection is given great importance due to its huge impact on the patient's health. The microbiological quality of water running in the Dental-Unit Water Lines (DUWLs) however is mostly overlooked.

Contaminated water in DUWLs causes a health threat to both patients and dental staff who are regularly exposed to aerosol and splatter.¹ The patients with the highest risk of infection from contaminated water are immunocompromised patients, elderly patients and patients with recent surgeries and open wounds.

Bacteria responsible for DUWL contamination can originate from municipal water piped into the dental chair unit or from patients' oral cavities

through a process known as back-siphonage. Back-siphonage is the process of aspirating oral fluids as a result of the temporary negative pressure produced when the drill stops rotating while still in the patient's mouth^{2,3} due to lack of anti-retraction valves.⁴ In certain conducted studies, it has been observed that about 1 mL of oral fluids is retracted in old as well as some new dental equipments.³ This process increases the risk of cross infection as oral fluids are retracted from one patient's oral cavity, grown within the DUWL, and spread through aerosol or splatter to other patients or healthcare personnel.

Dental unit water systems' narrow lumens and small bores, in conjunction with the long periods of stagnant water favor the formation of biofilms which adhere to the inner surfaces of the lines and serve as a haven for pathogens protecting

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the bacteria both from being washed away by the water flow and from many types of antimicrobial water treatments.⁴ Although the microorganisms found in biofilms are predominantly harmless, gram-negative water bacteria, opportunistic pathogens such as *Pseudomonas aeruginosa*, *Legionella pneumophila*, and non-tuberculous mycobacteria may also be found.⁵

The opportunistic pathogens of *Pseudomonas* spp. were found, in a number of cases, to be the predominant species isolated from DUWL.^{2,6} In a study conducted by Dr. Barbeau et al. (1998), it was stated that pathogens like *Pseudomonas aeruginosa*, *Legionella pneumophila* and nontuberculous mycobacteria do not merely survive in DUWL, but also proliferate over time with enhancing resistance by the inhabited biofilm as they wait for a susceptible host.⁷ This kind of contamination is especially dangerous, and crucial enough not to be overlooked or taken lightly, particularly when treatment of immunocompromised patients is considered, such as cases of cystic fibrosis or AIDS.^{8,9,10}

In 1995, the American Dental Association (ADA) Board of Trustees and ADA council on Scientific Affairs adopted a statement on DUWLs. The statement recommended improving the dental unit design so that by the year 2000, water delivered to patients during non-surgical dental procedures would contain no more than 200 colony forming units (CFU)/ml of aerobic mesophilic heterotrophic bacteria.^{1,11,12} This was equivalent to the standard for dialysate fluid.

In 2003, the Center for Disease Control's (CDC) guidelines for infection control in dental health care settings stated that coolant/irrigant water used in non-surgical dental procedures should meet the Environmental Protection Agency (EPA) regulatory standards for drinking water which is less than or equal to 500 CFU/ml of heterotrophic bacteria.^{1,13}

RAK College of Dental Sciences (RAKCODS), UAE moved into a new building in 2011. The main water supply to the college is through the Municipality network. The water is collected in ground reservoir then pumped to the roof tank. From the latter, water is delivered through water pipes network to the whole building including the dental units (Fig. 1). The majority of dental units (90%) receive water directly through the water pipes. A limited number (10%) of dental units receive distilled water via bottles attached to the units, which are filled frequently from the water distilling machine as required (Fig. 1).

As part of the sanitary measures taken by the administration, the main water (Municipality water) is regularly examined for microbial load and other chemical ingredients to ensure that it meets the recommended standard by the local authority. However, the performed water analysis never included samples from the dental units. Before water is pumped to the roof tank a small device "Solenoid-Driven Metering Pump" is fixed

with the main pipe, which ejects dosed chemicals into the water stream (Fig. 1). These non-toxic chemicals are commercially available under the name "MembraClean Plus Disinfectants", which presumably have antimicrobial action, including bacteria, fungus and algae, and prevent scale or biofilm formation. The supplier of the chemicals never discloses the actual chemical composition. Nevertheless, the product is approved by the local authority for drugs and chemicals control, UAE. Further search for the chemicals details was tried but to no avail.

The main aim of this study was to evaluate the microbial contamination of DUWLs in RAKCODS by determining composition as well as concentration of microflora and whether it meets the Centre of Disease Control's (CDC) recommendations for water used in non-surgical procedures. The research highlights on the importance of regular water monitoring as well as antimicrobial water treatments to assure quality water delivered.

2. Materials and Methods

2.1. Sample collection

The study material included water samples from the main water source, distilled water source and 12 functioning dental units at RAKCODS randomly. The main age of the dental units is 3 years of service. From each collecting point, 3 samples were collected at interval over a period of 6 weeks. Three water samples were collected from the Main Water Source (MWS) before entering RAKCODS water pipe-lines, 3 water samples from the Distilled Water Source (DWS) (water distilling machine) and 3 samples were collected from each point of the dental units; including Distilled Water Bottles (DWB) and dental units' Water Line Tubes (WLT) connecting the Hand pieces and Ultrasonic scaler tips (H/S). Care was taken to collect the samples in aseptic condition to avoid any external microbial contamination. Most of the samples were collected between 10.30 am and 12.30 pm using sterile air-tight containers. All dental units included in the study were operating at the time of sample collection. Approximately, 15 ml of water was collected from each collecting point in pre-labelled, air-tight sterile containers. The containers were labeled according to the point of water collection and reference number of the dental unit. The water outlet, like hand pieces, scaler tips, water line tubes were flushed for few seconds before taking the sample. In total 90 samples were collected successfully. The water samples were then transferred to the microbiology department, RAK Medical and Health Sciences University (RAKMHSU) within 3 hours from collection time for microbial analysis.

2.2. Laboratory procedures

- Pour plate technique for bacterial enumeration (Standard Plate Count):

In the RAKCOMS microbiology lab, pour plate technique for bacterial enumeration was performed as follows:

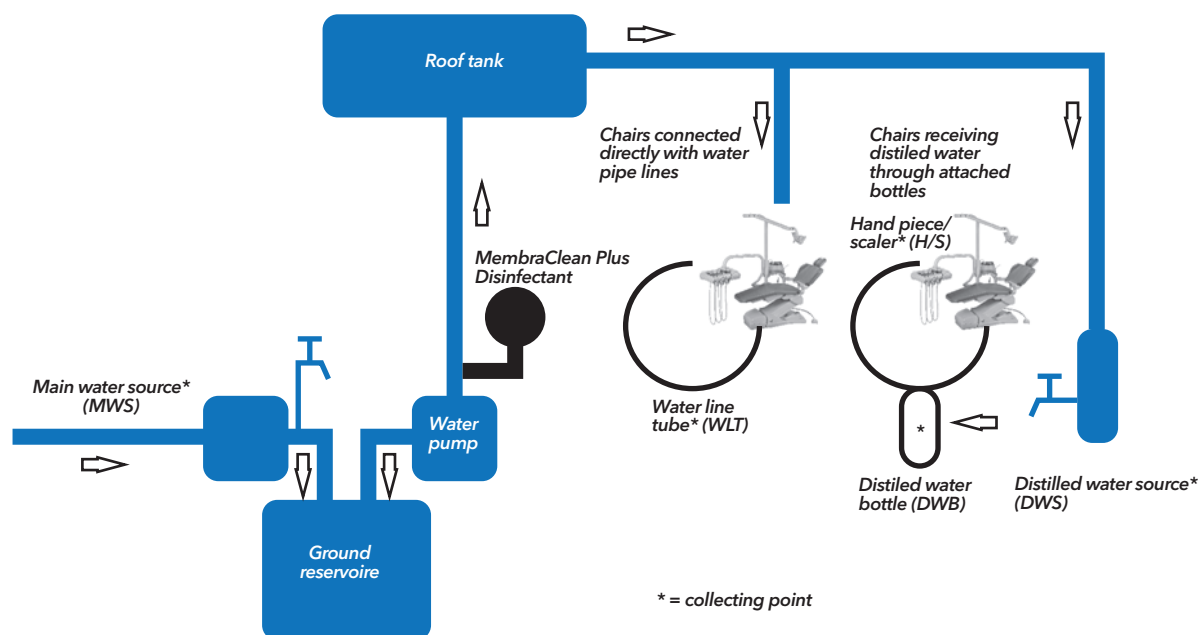


Figure 1. The diagram of the RAKCODS Dental Units' water supply system and the points of samples collection.

Plate Count Agar (HiMedia, India) was prepared according to standard procedure and then cooled at 44-46°C. Serial dilutions were prepared from the water samples in addition to undiluted sample (1:1, 1:10, 1:100). One ml of each sample or dilution was transferred to the properly labeled sterile Petri dish. Approximately 15ml of the cooled agar medium was then poured into each Petri dish. The sample and agar were then mixed by rotating the plate several times. After the media has solidified, the plates were inverted and incubated at 35°C for 48-72 hours. After incubation, the count of colonies, mean and standard deviation were calculated.

• Molecular identification of bacteria:

Pure cultures of the isolated bacteria were sent for molecular identification in AccuVis Bio laboratories in Abu Dhabi University Campus, Abu Dhabi, UAE. **Bacterial 16S rRNA gene sequencing** was performed according to the following protocol: Bacterial DNA isolation AccuVis Bio's Bacterial Genomic DNA Isolation Kit (AV1003). PCR

amplification uses PCR Primers (Universal), forward: 27F - 5'- AGAGTTTGATCMTGGC TCAG - 3'; Reverse: 1492 R - 5'- TACGGYTACCTTGTTACGACTT - 3'. DNA sequencing using BigDye® Terminator v1.1 Cycle Sequencing Kit, Sequencing reaction for Forward (518F) and Reverse (800R), Data analysis - Sequencing Analysis Software v5.2. Bioinformatics tools used Fasta format conversion of both sequences - NCBI, Pairwise sequence alignment - LALIGN software, trimming of final sequence, NCBI blast search, Similar sequence identification, identification of bacteria.

3. Results

Table 1 shows the total count of bacteria (CFU/ml) in water samples collected from the Main Water Source, the Distilled Water Source and 12 dental units of RAKCODS, counted according to ADA guidelines (Table 1).

Based on the ADA guidelines, which state that water used in dental treatment should contain a bacterial level of ≤200 CFU/ml, the majority of samples collected in our study showed CFU above the standard.

Table 1. Bacterial count in the water samples taken from different collecting points

Site of collection	Total number of collected samples	Number (%) of samples with 0-200 CFU*/ml	Number (%) of samples with >200 CFU/m	Mean number of CFU/ml±SD
Main Water Source	3	0 (0%)	3 (100%)	499±345
Distilled Water Source	3	0 (0%)	3 (100%)	1538±1165
Distilled Water Bottle	12	0 (0%)	12 (100%)	2397±1403
Water Line Tube	36	5 (14%)	31 (86%)	1867±1434
Handpiece/Ultrasonic Scaler	36	2 (6%)	34 (94%)	2000±1535

*CFU: colony forming units

Table 2. The bacterial distribution of the water samples according to the collecting points and isolated bacteria

Source/site of sample collection	Total number of collected samples	Number (%) of samples in which the following bacteria were isolated				
		<i>Ralstonia</i> spp.	<i>Sphingomonas paucimobilis</i>	<i>Leifsonia</i> spp.	<i>Brevundimonas aurantiaca</i>	<i>Pseudomonas aeruginosa</i>
Main Water Source	3	1 (33.3%)	2 (66.7%)	3 (100%)	0 (0%)	0 (0%)
Distilled Water Source	3	3 (100%)	3 (100%)	2 (66.7%)	1 (33.3%)	0 (0%)
Distilled Water Bottle	12	12 (100%)	10 (83.3%)	10 (83.3%)	6 (50%)	3 (25%)
Handpiece/Ultrasonic Scaler	36	35 (97%)	33 (91.7%)	24 (66.7%)	14 (38.9%)	3 (8.3%)
Water Line Tube	36	36 (100%)	32 (88.8%)	27 (75%)	13 (36.1%)	3 (8.3%)
Total	90	87 (96%)	80 (88.8%)	66 (73.5%)	34 (37.8%)	9 (10%)

The CDC recommended that non-surgical dental water should have a heterotrophic plate count (HPC) of ≤ 500 CFU/ml. The only samples that fulfilled this criterion were the Main Water Source samples (499 CFU/ml) which is equal to the levels of HPC in drinkable water.

Since the dental units' water supply systems were of two types as shown in Fig. 1, it was found that the bottled units contained significantly higher numbers of CFU (2632 ± 1231.783) compared to the non-bottled units (1484.75 ± 1395.093), $p < 0.02$.

RAKCODS had a prescheduled plan to replace all of the distilled water bottled dental units with new units receiving direct water connection. The units were installed on time (September 2015) and were allowed to work for 4 months. Random water samples from 7 of the newly installed dental units. Two samples from each water outlets (water/air syringe and hand piece tubes) were collected in the same manner as described earlier and the bacterial colonies per ml were counted. The average CFU/ml of these samples were compared with the average counts of water line tubes of the previous bottled units. The newly installed dental unit counts showed remarkable reduction in the number of CFU/ml (720 , $SD \pm 969$).

Table 2 shows the isolated bacteria and number of water samples contaminated with each type of bacteria out of the total number of samples collected from the Main Water Source, the Distilled Water Source and the 12 dental units (Table 2).

Ralstonia spp. was the most common bacteria in the MWS, DWS and dental units' WLT, as it was found in 96% of the collected samples. The other common isolated bacteria were *Sphingomonas paucimobilis* 88.8%, *Leifsonia* spp.(73.5%), *Brevundimonas aurantiaca* (37.8%) and *Pseudomonas aeruginosa* (10%).

4. Discussion

The majority of the collected samples in this study showed CFU above the standards for drinking water or water used for dental procedures according to the CDC guidelines. The only samples that fulfilled this criterion were the MWS samples with an HPC of (499 CFU/ml), which is equal to the levels of HPC in

drinkable water. The fact that MWS samples contained significantly lower CFU/ml of bacteria compared to the DWB, WLT or H/S clearly indicates that the dental water pipelines provide good environment for bacteria to thrive.

When bottled dental units were replaced with new dental units, the average CFU/ml was reduced dramatically. This result substantiates the assumption that the DWB was the main source of contamination.

In the examined water samples from the dental units, bacteria of the *Pseudomonadaceae* family were the most common. These obligate aerobic, motile, gram negative bacilli are widely spread and have the ability to survive and grow almost in any environment. Their presence is associated with the main water supply and failure of disinfection methods to eradicate them totally or even reduce their counts. The isolated bacteria tend to categorize as non-fermenting gram-negative bacilli (NFGNB) which are a group of organisms that either do not utilize glucose as a source of energy or utilize it oxidatively.¹⁴

Pseudomonas aeruginosa, species of *Pseudomonas* genus can be recovered from the oral cavity of 4% of healthy individuals⁴ and this indicates the possibility of these microorganisms getting aspirated into the DUWLs through a defective check valve and colonized in the waterlines. This is a drawback due to the fact that water after having passed through DUWL, flows through hand pieces during treatment and forms aerosol and splatter therefore increasing the chances of cross infection especially in immunocompromised patients.

Following is a list of bacteria tested for in our study, in the order of their prevalence:

4.1. *Ralstonia* spp.

Ralstonia spp. was the most common type of bacteria present in the MWS, DWS and dental units' WLT. It was found in 96% of the collected samples. This finding is in accordance with many of the previous studies.^{15,16,17} This bacterium is known to be isolated from water regardless of its source. It could be isolated from municipal drinking water, bottled water, dental waterline tubes, hospital water supplies, standard purified water, laboratory-based high-purity water systems and industrial ultra-pure/high purity water.¹⁸

Ralstonia (named after the American bacteriologist E. Ralston) is a genus of Proteobacteria, previously included in the genus *Pseudomonas* and contains 13 species (*R. basillensis*, *R. campinensis*, *R. eutropha*, *R. gilardii*, *R. insidiosa*, *R. mannitolilytica*, *R. metallidurans*, *R. paucula*, *R. pickettii*, *R. respiraculi*, *R. solanacearum*, *R. syzygii*, *R. taiwanensis*). Most of these bacteria are environmental bacteria with no clinical significance. However some of the species like *Ralstonia pickettii* can cause bacteraemia and serious infections e.g. sepsis contaminating injection solutions and aqueous chlorhexidine solutions.¹⁹ These bacteria were also documented to be related to infection in cystic fibrosis patients.¹⁹ *R. paucula* and *R. gilardii* have only been isolated from human clinical samples including cerebrospinal fluid, bone marrow, wounds, and the respiratory tract.²¹ Previous studies stated that the majority of the *Ralstonia* isolates showed susceptibility to most of the tested antibiotics.¹⁸

4.2. *Sphingomonas paucimobilis*

The second most common contaminant of the MWS, DWS and dental units' WLT was an aerobic bacterium found in soil and water known as *Sphingomonas paucimobilis*. Although it rarely causes infection it has been reported as a causative agent of healthcare-associated infection especially in immunocompromised patients. In the current study it was found in 88.8% of the collected samples. These findings are similar to previous studies.^{22,23}

Sphingomonas paucimobilis was reported to cause outbreaks of bacteremia among immunocompromised patients in hematology and oncology units due to bacterial contamination of hospital water systems.²⁴ It is now emerging as an opportunistic pathogen that is frequently reported in clinical settings.²⁵ It can be isolated from hospital environments such as distilled water, nebulizers, and multiple equipments used in medical care. It has been associated with a few cases of continuous ambulatory peritoneal dialysis and is notorious for its resistance to the commonly used antibiotics.²⁶ Some reports stated that *S. paucimobilis* can cause infections in healthy as well as immunocompromised individuals where infection caused by *S. paucimobilis* can lead to septic shock.²⁷ Although this organism is a gram negative bacteria it lacks the lipopolysaccharide components in the outer membrane of the cell wall which is associated with endotoxin activity.²⁸

A recent study showed that *S. paucimobilis* isolates from cancer patients were fairly sensitive strains, with resistance observed only against ceftazidime and aztreonam.¹⁴ This organism tends to show unpredictable antibiotic sensitivity attributed to the antibiotics' therapeutic failure.²⁶

4.3. *Leifsonia*

The third most common contaminant *Leifsonia* was found in 73.5% of the samples collected from the MWS, DWS and dental unit's WLT. It is an aquatic bacterium typically found in environmental water habitats and is a usual finding in dental water lines as shown in previous studies.^{29,30,31}

This bacterium is catalase and oxidase positive. *L. aquatica* was once classified as a species of the Corynebacterium genus. However, because of the chemotaxonomic and genetic differences from

corynebacteria, it has been reclassified.³² Infection due to *L. aquatica* is rare, and is commonly catheter associated in immunocompromised patients. Serious infections in healthy people however, have also been reported.³³

4.4. *Brevundimonas aurantiaca* and *Pseudomonas aeruginosa*

Out of the 90 samples 34 (37.8%) showed the presence of *Brevundimonas aurantiaca*. This bacteria was present in water from all sources except the MWS. The highest contamination rate was in DWB (50%).

The pattern of contamination was the same with *Pseudomonas aeruginosa*, which was not present in MWS and DWS, but present in 25% of the samples taken from DWB, 8.3% of H/S water samples and 8.3% of samples taken from WLT. The total number of samples positive for *Pseudomonas aeruginosa* was 9 (10%).

Brevundimonas (Pseudomonas) aurantiaca is a gram-negative soil bacterium which can synthesize antimicrobial compounds that have the same structure of compounds produced by other members of pseudomonades. These include phenazines, proteins, phloroglucinols and Mycolytin (an antifungal biopesticide).³⁴ These bacteria showed remarkable intrapopulation phenotypic variability observed during their germination. This is an important survival strategy under unfavorable environmental conditions.³⁵

Pseudomonas aeruginosa is a gram-negative bacteria that is citrate, catalase and oxidase positive. It has the ability to grow in plumbing fixtures and survive in distilled water.³⁶

Pseudomonas aeruginosa in samples taken from DWB, WLT or H/S need not infer an oral source of the bacteria. In this study, *Pseudomonas aeruginosa* was present in 8.3% of H/S water samples which represent the point of contact to the oral cavity. This, compared to the 25% of DWB samples suggests that back-flow of the concerned bacteria from the oral cavity is unlikely. Therefore, we can only assume but not confirm the presence of fairly effective mechanisms that prevent sucking back fluids from patients' oral cavities, and subsequent multiplication in our university's dental clinic units. This eliminates a potential source of cross infections.

Our investigation showed that there were no bacteria of *Streptococcus* and *Staphylococcus* genera. Nevertheless, the presence of these microorganisms in distilled water reservoir of dental units has been reported.³⁷

5. Conclusion

The bacterial concentration in majority of the collected water was relatively higher than the standard counts. The study revealed that the bottled units contained significantly higher numbers of CFU and had more chances of contamination with serious bacteria. The bacterial flora in the water samples comprised of bacteria characteristic for water supply systems and opportunistic pathogens, with no bacteria of the oral cavity flora. Nevertheless, microbial counts of water samples collected from dental units after replacement of all bottled dental units (causing the major contamination) demonstrated substantial reduction in the counts. In addition, this study's determination

of contamination sources and evaluation of microbial load in RAKCODS could contribute to the development of quality control methods in the future.

Acknowledgments

The current study has been approved by the Research and Ethics Committee of Ras Alkhaimah Medical and Health Sciences University, 2015 (RAKMHSU-REC-3-2015-UG-D).

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Questions

Presence of which of the following bacteria in a water sample suggests an oral source?

- a. Staphylococcus;
- b. Leifsonia;
- c. *Pseudomonas aeruginosa*;
- d. A and C.

The most commonly present bacteria in the main water source, distilled water source and dental units' water line tubes was:

- a. *Leifsonia*;
- b. *Sphingomonas paucimobilis*;
- c. *Ralstonia* spp.;
- d. A, B and C above.

Samples from which of the following sources met the CDC recommendations for non-surgical dental water which have a heterotrophic count of ≤500 CFU/ml?

- a. Main Water Source samples;
- b. Distilled water source;
- c. Both A and B;
- d. None of the samples.

Which of the following statements is CORRECT?

- a. Non-bottled units contained significantly higher numbers of CFU compared to bottled units;
- b. Bottled units contained significantly higher numbers of CFU compared to non-bottled units;
- c. The difference in bacterial count between bottled and non-bottled units was not statistically significant;
- d. None of the statements is correct.

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ETHICS INSTRUCTION AT CALIFORNIA DENTAL SCHOOLSLola K. Giusti^{1a*}, Bruce Peltier^{1b}, Lynn G. Beck Brallier^{2c}, Tobias E. Rodriguez^{3d}¹Department of Dental Practice, Arthur A Dugoni School of Dentistry, University of the Pacific
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Purpose/ Objectives: This essay is a report of qualitative research conducted in 2015 to determine the methods that California dental schools use to educate undergraduate dental students in professional ethics. Its purpose was to describe Dental Ethics curricula in the State of California and describe diverse undergraduate programs, foster communication and collaboration between schools, and facilitate dialogue.**Methods:** Faculty members identified as Dental Ethics Course Directors at four schools were contacted by phone to inform them of the research project and invite participation. Subjects then responded to an emailed survey questionnaire.**Results:** Results were collated and analyzed.**Conclusions:** Effective ethics instruction is an essential component of modern dental education, and results show that each of the four schools uses a variety of methods to accomplish the task.**Keywords:** dental education, dental ethics, professionalism education, Codes of Ethics, principle-based ethics.**1. Introduction**

Dental students come to their schools with diverse foundations in ethics and ethical behavior. Most are influenced by their culture, families, educational backgrounds, life circumstances, and socioeconomic levels.

This study describes the ways in which four California dental schools teach their students to recognize ethical dilemmas in practice, analyze various courses of action in responding to them, and prepare for ethical practice after graduation.

1.1. The Current SituationDental faculty are charged with teaching ethics to young professionals who may not incorporate consistent ethical concepts into their daily interactions with faculty, staff and patients. Academic and life stressors affect dental students during their first year especially, and throughout dental school.^{1,2} Dental students may not perceive the value of ethics courses, and they (as well as administrators) may believe that the subject is dry and boring.^{3,4} Nonetheless, students have proven to be very concerned about ethical conundrums faced in their practice with patients. In a study bySharp et al, foremost in the concerns of fourth year students were the lack of resources on the part of their patients.⁵ Students perceive such disparities as ethical issues. Indeed "students struggle with a sense of obligation to treat patients fairly and equally and are troubled when they are unable to do so." Other concerns reported by these students involved conflict between clinicians in treatment plans; practices or policies inconsistent with the standard of care; and identifying the appropriate surrogate decision maker, among others.Seminal research in this area was conducted by Lantz, Bebeau and Zarkowski, and published in the *Journal of Dental Education* in October of 2011.¹² The researchers queried faculty in Dental Ethics courses at all fifty-six (at the time) dental schools with respect to the instructional methods and assessments used in these programs. In recommending future research in this area, the authors offered the following suggestion: "First, we conclude that dental schools should use measures to assess the learning outcomes of their ethics instruction. These outcome assessments not only provide a way to ensure that schools are achieving***Corresponding author:**

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desired learning outcomes, but also a mechanism for documenting the ethical competence of graduates and setting goals and charting progress toward improving learning outcomes." This study seeks to continue inquiry into the various ways Dental Ethics are taught in California schools. The researchers asked leaders at four California schools questions regarding the individuals involved in teaching dental ethics in the predoctoral curricula. One of the first questions of interest is, "Who should teach ethics?" and by extension, "Whose ethics should be taught?" Should the subject be taught by a dentist, a psychologist, or a trained ethicist? Additionally, should the subject matter be presented in conjunction with discussions of clinical-technical topics? The next questions follow naturally: "How, when, and where should the subject be taught?" and, of course "How can we know if our curricula are effective? Do students behave differently as a result of our Ethics Education curricula?"

This study is part of a small but growing body of research that has sought to understand both the processes and structures (as well as the impact) of ethical education in medical, dental, and other professional schools.

The need for ethics education during dental school has been clearly established. Accreditation standards for Dental Ethics and Professionalism have been written and implemented. The Commission on Dental Accreditation (CODA)⁶ has set the following guidelines for predoctoral dental education: **2-20. Graduates must be competent in the application of the principles of ethical decision making and professional responsibility.**

1.2. Intent

Graduates should know how to draw on a range of resources, among which are professional codes, regulatory law, and ethical theories. These resources should pertain to the academic environment, patient care, practice management, and research. They should guide judgment and action for issues that are complex, novel, ethically arguable, divisive, or of public concern.

The structures and processes to provide this education continue to be of interest to dental educators. Faculty teach and reinforce these concepts at three levels: legal (arguably the minimum standard), risk management, and ethical, or aspirational. At the legal level there is content dedicated to regulatory practices, codes, and other subjects such as standard of care, and these are often taught in free-standing Dental Law courses. Students are taught risk management throughout the curriculum in topics related to communication, documentation, and the use of technology, among other curricular themes. Teaching and reinforcing ethical-moral principles and the higher aspirations of the dental profession provide ongoing challenges to educators.

Understanding the legal principles reinforced during dental education can be done retrospectively. By analyzing the sorts of problems encountered by dentists in practice educators might work "backwards" to create course content.

Foundational exploration of this critical subject in dentistry was published in a two-part white paper by Professor Muriel Bebeau at the University of Minnesota. The purpose of this publication was described as follows:⁸

"The goal is to help participants identify and address personal shortcomings that led to disciplinary action, while simultaneously satisfying the board's need to feel that they have fulfilled their responsibility to the public."

Seminal work undertaken by Bebeau in Part Two of that analysis focused on the areas of ethical sensitivity, moral reasoning, and role concept, among others.⁹ It "examines the effectiveness of the specially-designed ethics courses for the 38 referred professionals who completed one or more of the assessments following instruction and summarizes their perceptions of the value of the process." The use of cases as well as reflections and self-assessments enabled dentists to "change their minds about prior beliefs and to engage their colleagues in addressing issues of professionalism."

Subsequent inquiry into the "essential role of medical ethics education in achieving professionalism: The Romanell Report" underscored the importance of ethics in improving patient care outcomes.¹⁰ The authors analyzed ethics instruction, and assessments and interventions used in the field of medicine. They seem to share the concerns expressed by Bebeau and others who teach dental ethics. Among their conclusions are the following:

"However, our report also identifies many challenges facing medical ethics educators. First, there is no consensus about specific educational objectives for medical ethics and professionalism. Second, several pedagogical methods have been shown to offer some benefit to learners, but the supporting data are rarely robust, and educational approaches vary greatly between programs and institutions. Third, increasing pressure to demonstrate effectiveness raises particular challenges for faculty teaching medical ethics and professionalism because these educational efforts do not always produce short-term, quantitatively measurable improvements. Finally, the "hidden curriculum" can undermine learners' professional development, creating a need for attention to the learning environment and for widespread faculty development that would require significant resources and expertise."

A recent study at the University of Iowa College of Dentistry proposed a model of the desired characteristics of a dental school graduate, including ethical and professional values. The proposed schema outlined three key values: (1) dedication to care of patients, (2) empathy/honesty/integrity, and (3) self-respect and respect for the others. These values were identified as central among the desired characteristics of a graduate from the institution.¹¹

Another question involves the impact of teaching and learning in this content area: Do students change their thinking as a result of ethics

instruction? A preliminary study carried out at the University of Istanbul indicates an affirmative conclusion.¹³ Case scenarios were presented to fourth year students (n=37) who were presented with a four topics approach to clinical ethics (medical indication, patient preferences, quality of life, and contextual features), and asked to solve the case using their knowledge of ethics, which they had gathered from a lecture in their third year. Thereafter students received a three-hour lecture on the four topics approach, used for clinical ethical case analysis. After completion of the lecture, the same case scenario was presented to the students again. There was significant development in the students' performance after the course. The authors provide evidence that ethical decision-making can indeed be taught and learned within the framework of a dental school course.

This topic was also investigated by faculty in the fields of business and accounting. Two studies published in the *Journal of Business Ethics* in 2015 demonstrate interest in the impact of ethics education upon student behavior. The first study, published by Martinov-Bennie and Mladenovic (2015), analyzed how accounting students develop ethical sensitivity and ethical judgment. Their findings indicate that the existence of a framework alone does not appear to increase ethical sensitivity, but that an integrated ethics component using case studies can increase ethical sensitivity. Ethical judgment was similarly affected by the integrated education program. The second study, done at West Chester University of Pennsylvania with undergraduate business students, researched the roles of gender, personal ethical perspectives, and moral judgment in business ethics instruction.¹⁴ The findings demonstrated there was variability connected to the type of ethical dilemma, and some effect linked to gender, but no main effect of each factor. The authors discussed their conclusions by stating (page 600), "Finally, we would like to reiterate a concern of other researchers that the way in which students respond to ethical dilemmas in the classroom may not be indicative of how they will react to ethical challenges in the real world."

For example, the analysis of whether or not the ethics curricula are effective has been vigorously debated by Bertolami and Jenson.^{15,16} Spirited analysis of academic dishonesty promoted national discussion. In responding to Bertolami's assertion that students continue to cheat in spite of the existence of dental ethics courses, Jenson maintained that (page 227):

"...dental ethics courses, as they are now taught, are essential and valuable. Could they be better? Absolutely. Could they actually provide students with the moral courage needed to make the right choices when they already know right from wrong? This is an open question and one that deserves some empirical research."

The authors of this paper assert that ongoing efforts to assess and improve ethics instruction in dental education are essential. The dental schools that participated in this research respond to the charge of educating ethical practitioners through

the practices described below.

2. Methods

The Institutional Review Board approval was obtained for the unfunded project, with expedited review. Faculty members identified as Dental Ethics Course Directors at four California schools were contacted by phone to enlist their participation in a qualitative study. After completion of the Informed Consent processes, faculty members from four of the schools completed an electronic survey (see Appendix 1) and respondents attached relevant course documents. The survey instrument was developed as a cooperative effort between a student in a Master's program and faculty members at the University of the Pacific Benerd School of Education and the Academy for Academic Leadership. Participation by the schools was entirely voluntary. The participants responded to approximately ten questions via electronic survey and attached relevant course documents. Responses were collected and analyzed qualitatively, with telephone follow-up in those cases where data collection required it (clarification of responses by the principal investigator).

The work was undertaken as a pilot study to promote collaboration and communication about best practices in dental ethics instruction at California dental schools.

3. Findings/Results

All the schools utilized a lecture format to deliver content in Dental Ethics courses. Small group exercises were also used by these institutions. Among the schools a variety of approaches to learning activities are employed: group projects, flipped classrooms (a teaching method that delivers course content outside the classroom) with prep assignment, daily reflections, online materials, an American College of Dentists video course (with completion certificate required), panel discussions and American Society of Dental Ethics projects and readings. Students receive lectures on the CDA Code of Ethics and the Dental Practice Act. Other methods used for student engagement were lunch and learn, and course electives focusing on professionalism and ethics. Content was delivered at a variety of times across doctoral programs, with courses specifically designated as "Dental Ethics" or "Dental Ethics and Jurisprudence" at two of the schools. One school seeks to "demonstrate the highest quality of care, governed by ethical principles, integrity, honesty and compassion." It performs assessments in this domain "through solving ethical dilemmas in group discussions and applying principles in a clinical setting." It extends ethical discussions from the classroom to the clinical setting via efforts to "demonstrate collaboration with clients and with other health professionals to develop a plan of care to achieve patients' positive health outcomes." Another institution has designed courses in ethics specifically for orthodontic residents as well as international dental students. Faculty mentioned

that ethics was mentioned in the classroom and clinical scenarios across all years of their programs. For example, a Systems Based Healthcare course presented opportunities for dental students in their third year of training to interface with other healthcare providers in a venue where “topics include team building, conflict resolution, sexuality and healthcare law, healthcare delivery and reimbursement, quality improvement, economic and cultural considerations in healthcare decisions, and public and personal perspectives of what constitutes conflict of interest.” Other areas in which learning sessions take place are lectures on topics such as “Ethical Issues in Research” nested within a “Critical Thinking and Lifelong Learning” class. Malpractice and misconduct issues are specifically discussed at all of the institutions. Small group case discussions with written summaries are used, and oral summaries are given “as called upon in large group discussion.” One school invites a guest lecturer from the California Dental Board to speak to its students. Another presents students with a panel discussion of California Dental Association member dentists who have struggled with alcohol and drug addiction issues in conjunction with disciplinary actions by the Board. In addition, an attorney experienced in legal ethics regularly attends small group seminars, helping to promote discussion in topics ranging from informed consent, documentation, and contracts to challenging clinical scenarios faced by students in their patient care.

Competence assessments in dental ethics are met in a number of ways. Course directors employ multiple choice exams, written exams, reflection papers on ethical issues in clinic, case analysis, and a video project. Students also use a live theater presentation at one of the schools to demonstrate their understanding. Other methods of assessment include periodic quizzes, dentaethics.org modules and discussions of classroom activities.

Because of the attempts of faculty across disciplines to include ethics instruction in their courses it can be difficult to estimate the number of hours devoted to the subject in total. However, available estimates range from twenty to over forty hours of dedicated clock hours to formal ethics instruction at the schools surveyed.

The professional backgrounds of the course directors and faculty members charged with teaching the subject are varied. The group of faculty at the schools includes a variety of individuals: a hygienist with an Ed.D., experienced general dentists, psychologists, a general dentist with a Master’s degree in ethics, a dentist self-taught in ethics, Associate Deans from Academic Programs, Student Affairs, Clinical Dental Sciences, and the Student Clinic Director. Some of the faculty members have formal ethics training and some do not. Several of the faculty members belong to the American Society of Dental Ethics, while others are not members.

Collaboration with other departments or schools at the respective institutions occurs in a number of ways to deliver course content. While one of the

programs is in the midst of revision with its second and third year courses, all faculty reflect the spirit of collaboration in their curricula, with a range from “not much, some in the past,” to guided collaborations with Schools of Medicine and Nursing. Another institution anticipates classroom collaboration with students from its dental hygiene program. Faculty also derive inspiration from ASDA through its materials and methods, and course notes at meetings of the American College of Dentists. Course directors also employ online coursework for their own education in Ethics.

In response to a query concerning ethical issues faced by students, a number of topics surfaced. One instructor felt that the “challenges are largely the same as the ones we faced years ago. The big difference is that technology magnifies the opportunities.” Others mentioned that the competition for grades and patient needs vs. clinical requirements factor into the challenges students manage during their education. “The majority of students are aware of what is right to do, but a few make bad decisions when faced with a challenge that threatens their grades or ability to graduate on time.” One faculty member dedicated a book chapter to precisely this subject. Another stated that “there have been several JDE (Journal of Dental Education) articles on this topic that accurately identify ethical challenges in predoctoral dental clinic.” At one institution students are asked to reflect upon the notion that clinic requirements serve as a proxy for money during their training, on the premise that financial issues will arise after graduation. In terms of ethical challenges faced by students, another faculty member stated that *“patient needs vs. clinical requirements is the big one.”*

Faculty members also face challenges in teaching their courses. Two themes emerged from the research: 1) Eliciting participation from mainstream faculty members, and 2) intrinsic lack of student interest in the subject. “We need more time and resources (trained faculty) to do smaller group case based learning, especially...after students have had clinical experience.”

Another mentioned that instructors are challenged by “carving out sufficient time to deliver content in a very dense curriculum” and “keeping students engaged by balancing the philosophy with real life situations.” Faculty members make a concerted effort to actively engage students in their assignments and classroom activities.

“Making it interesting and relevant, including enough clinical information for relevance without taking the focus off ethics. We focus on Ethical Moments common ethical dilemmas and introduce an ethical theoretical framework on how to reason through a situation.”

“Students are really busy and seem focused on “clinical” courses; hard to get them to do the readings. There has been consistent support from administration and the number of hours has never been cut or threatened.”

4. Conclusions

This study looked into the methods used by four California dental schools to implement their ethics curricula. While there appears to be unanimous concern that students are able to recognize moral dilemmas in clinical practice, the schools employ a variety of measures to prepare their students for ethical practice. Institutions across the board take this charge seriously, and dedicate time, curricular content, and

resources to the endeavor. Future research will be necessary to understand the best practices to carry out this important educational component of training undergraduate dental students.

Acknowledgments

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Appendix 1. Ethics Survey Questions

1. In what courses are Dental Ethics taught at your institution? When and how is competency in dental ethics assessed in your curriculum?
2. What is the professional background of the course director and those that teach ethics?
3. Please describe, in as much detail as possible, the course content. Feel free to attach course syllabi to this email if you wish. Please include learning objectives, themes, assessments, etc.
4. Are you aware of how other schools or departments collaborate with other dental schools in creating or delivering course content in Dental Ethics?
5. How are students assessed in your Ethics course(s)? Check all that apply.
 - a. quiz
 - b. multiple choice exam
 - c. observation
 - d. video
 - e. paper
 - f. case analysis
6. What ethical challenges are students at your institution faced with? How aware are your students of ethical challenges?
7. What are the challenges you face in teaching your course(s)?
8. May I contact you in the future to follow up on these questions? What is your preferred email address/ phone #?

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**CV**

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Questions

In the article, the question “Who should teach ethics?” has a couple of possibilities: “should the subject be taught by....”. Which possibility is not correct?

- a. A dentist;
- b. A psychologist;
- c. A trained ethicist;
- d. A hygienist.

Graduates should know how to draw on a range of resources, among which are professional codes, regulatory law, and ethical theories. These resources should not pertain to:

- a. Academic environment;
- b. Patient care;
- c. Practice management;
- d. Study.

Among the key ethical and professional values for a dental school graduate should not be:

- a. Dedication to care of patients;
- b. Empathy/honesty/ integrity;
- c. Respect for self and others;
- d. Self-interest.

All of the dental schools in the study utilized a common format to deliver content in Dental Ethics courses, like:

- a. Lecture;
- b. Small group exercises;
- c. Panel discussions;
- d. Readings.



PRACTISING SPORTS AMONG DENTISTS IN BULGARIAPeter Georgiev Bojinov^{1a}, Krassimira Borissova Yaneva-Ribagina^{1b*}, Yulian Emilov Borisov^{2c}¹Department of Dental Public Health, Faculty of Dental Medicine, Medical University - Sofia, Sofia, Bulgaria²DSK Bank PLC, Sofia, Bulgaria^aPhD, Assistant Professor^bPhD, Professor, Head of Department, Vice-Dean of Academic Affairs^cSociologist, Market Research AnalystReceived: May 04, 2016
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Cite this article:Bojinov PG, Yaneva-Ribagina KB, Borisov YE. Sport activity among dentists in Bulgaria. *Stoma Edu J.* 2017;4(2):140-145.**ABSTRACT**

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Introduction: Musculoskeletal disorders (MSD) are one of the main occupational risk factors for dentists. They are associated with factors such as gender, age, length of service, lifestyle, working ergonomic conditions, sport activity etc.**The aim** of this study is to determine the spread of practicing sports among dentists in Bulgaria and the impact of some factors (gender, length of service, weekly and daily workload, and health self-assessment) on it.**Methodology:** The study was conducted by an anonymous survey of 1300 dentists in Bulgaria. The response rate of the survey was 53.84% - 700 questionnaire forms were returned back. The results are processed using statistical analyses - descriptive, graphical, alternative and χ^2 .**Results:** The results of our study reveal that a tiny fraction of dentists practiced some sport regularly (12,63%), the most active being those having 11-20 years length of service, while males are a bit more active than females. Practicing sports increases with the increase of the weekly and daily workload and drops with the decrease in own health self-assessment. With the increase of pain, caused by Work Related Musculoskeletal Disorders (WRMSD), practicing sports goes down, the most active remaining those presenting the most recent episodes of pain (for weeks) - 85.7% and moderate intensity.**Conclusion:** A very small number of dentists practice sports regularly (12.63%). The most active is the group of 11-20 years length of service, men being a bit more active than women. Practicing sports drops down with the decrease in health self-assessment. Practicing sports decreases with the pain intensity increase, the most active being those presenting the most recent episodes of pain (for weeks) - 85.7% and moderate intensity.**Keywords:** musculoskeletal disorders (MSD), sport activity, health self-assessment, daily and weekly workload.**1. Introduction**

The importance of practising sports for the general health of each individual is beyond doubt. Even back in the ancient world Aristotle noted „Nothing exhausts and destroys the human body more than continued physical inactivity“. The continued state of good general health is a guarantee and prerequisite for a long professional career.

Data from the study of M.D. DeCarvalho et al. among Brazilian dental students showed that 52% practised sports regularly - bodybuilding (20.3%) and walking/jogging/running (16.7%).¹

Pursuant to a study conducted in Nepal by B.P Shrestha et al. about prevalence of WRMSD among dentists, only 16.7% asked for medical care, while 36,8% self-treated themselves with medicines, while 30.9% had regular physical exercises as back pain prevention.²

Another study by S. Sunnel et al. from British Columbia reported that 88% of dental hygienists and 61% of the dentists tested different therapies and approaches for relieving the WRMSD symptoms. The strategies, providing for continued relief were: physical exercises (13%); changing their work habits/postures (6%); fewer work days (6%).³

A study by Basset dating back to 1983 among 465 Canadian dentists established that 50% exercised as prevention of WRMSD and felt its effects.⁴

A study conducted in Poland by J. Szymanska in 2002 revealed that 64.6% of the dentists undertook some treatment because of MSD. The most popular methods were: physical exercises for the back - 41.55%; morning stretch exercising - 39.27%; flexor-extensor exercises for the backbone - 36.99%; swimming - 35.62%; abdominal muscles

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exercises - 35.16%; shoulder area exercises - 31.05%; relaxing practices - 17.81%; jogging - 10.05%; fitness - 7.76%.⁵

A study conducted in Yemen among dentists with musculoskeletal disorders identified that only 16.7% asked for medical care. As to the physical exercises in case of back pains 30.9% reported that they practice regularly, 51.5% didn't have any exercising, while 17.6% did not give an answer.⁶

The study by P. Dajpratham found out that key methods of pain management were traditional massages (51.9%), drug therapy (28.5%), physiotherapy (15.8%), acupuncture (7.6%) and alternative medicine (4.4%).⁷

The cross-sectional study among 1808 healthcare workers in Belo Horizonte, Minas Gerais State, Brazil showed the high prevalence of WRMSD (49.9%) and their association with many factors, including practising sports less than twice a week.⁸ A questionnaire survey about musculoskeletal discomfort, completed by 329 employees in the Public Dental Services of Hordaland proved that practising sports was negatively associated with discomfort in the lower back.⁹

The aim of this study is to establish the spread of practicing sports among dentists in Bulgaria and the impact of some factors, such as gender, length of service, weekly and daily workload, health self-assessment on it.

2. Methodology

2.1. Study objectives include:

1. Outlining the spread of practicing sports among dentists in Bulgaria.
2. Determining the dependence of practicing sports on some socio-demographic factors (age and gender) and factors, characterizing the dentists' activity (weekly, daily workload), intensity of MSD pain as well as health self-assessment.

2.2. Study material and methods

The information needed for the purposes of the study was gathered by distributing and collecting filled in questionnaires between October 2012-April 2013. We developed the survey questionnaire specifically for this study. The survey was conducted with the support of the Bulgarian Dental Association (BDA) and the regional bodies in Sofia, Pleven, Shumen, Varna, and Vratza. A total of 1300 questionnaires were prepared and disseminated, out of which we got back 700 (return rate - 53.84%). They comprised 27 close questions (fixed answers) on paper, each having a unique entry code.

The age groups covered by the study are almost equally represented, except for the 66+ age group: 25-35 age group - 163 participants (23.35%), 36-45 - 171 individuals (24.50%), the 46-55 age group is the most numerous - 196 individuals (28.08%), 56-65 age group - 139 (19.91%), and the least represented age group of 66+ - only 29 (4.15%) i.e. all age groups were included. The relative share of dentists having +20-years length of service is distinctly high (54.33%). It suggests more representative data on the impact of dental-

specific factors, causing MSD. The major share of dentists, participating in the study, is as follows: general practitioners (58.03%), followed by the group, practicing mostly conservative dentistry (12.49%) and prosthetic dentistry (10.29%). Comparatively lower is the share of those practicing specific narrow specialties such as: oral surgery (7.40%), pediatric dentistry (6.47%), periodontology (3.12%) and the smallest share is that of orthodontics (2.20%).

3. Results

3.1. Dependency between gender, length of service and practicing sports

Just a small fraction of 12.63% (88 individuals) responded to exercise regularly. The bulk group exercises occasionally (not regularly) - 52.80% (368), while another large group does not exercise at all - 34.57% (Fig. 1).

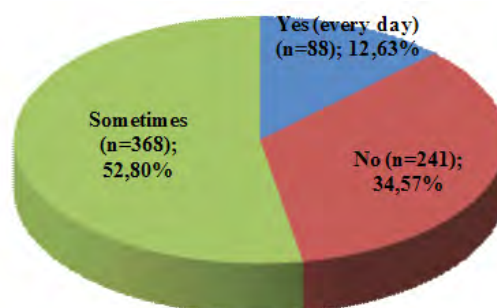


Figure 1. Practicing sports among dentists.

We explored the relationship between gender and practicing sports (Fig.2).

Most of the respondents reported to go practising, but not on daily basis.

Generally practicing sports among males is higher compared to females. 14.69% of the male respondents exercised every day, while 57.96% - occasionally.

11.46% of all female respondents practiced on a daily basis, and 50.34% - occasionally.

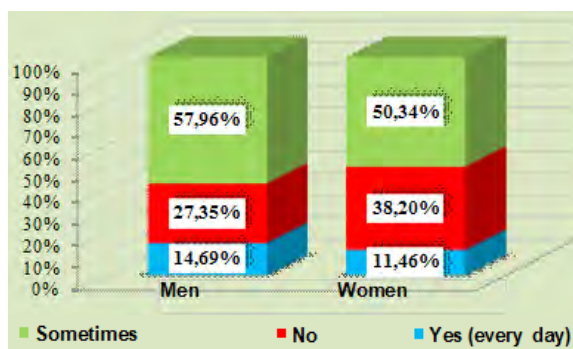


Figure 2. Gender relevant practicing sports breakdown.

The results indicate statistically significant dependency between practicing sports and gender. We also focused on length of service impact on practicing sports (Table 1).

Table 1. Dependency between length of service and practicing sports among dentists. N=689 $p < 0,05$

Dentists' practicing sports	Length of service			
	Up to 10 years	11-20 years	21-30 years	over 31 years
	n %	n %	n %	n %
yes (on daily basis)	26 (16,25%)	24 (15,58%)	28 (13,53%)	7(4,16%)
No	39 (24,38%)	34 (22,08%)	75 (36,23%)	89(52,97%)
Occasionally	95 (59,37%)	96 (62,34%)	104 (50,24%)	72(42,87%)
Total	160(100,0%)	154 (100,0%)	207 (100,0%)	168 (100,0%)

The results indicate a statistically significant dependency between length of service and practicing sports by the respondents. With the increase of length of service the relative share of those actively exercising drops. The highest level of practicing sports is reported among the age group 36-45 having 11-20 years length of service (77.92%) (Fig. 3).

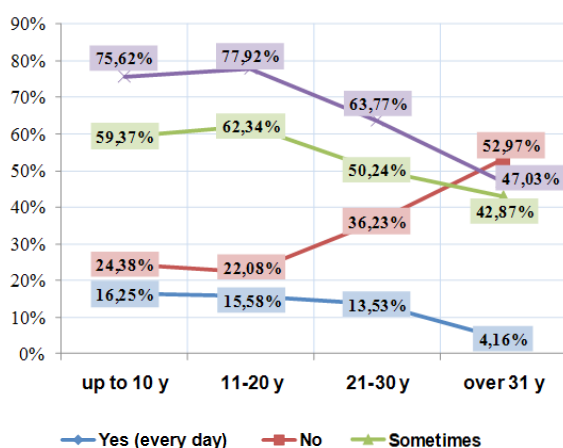


Figure 3. Practicing sports trend based on length of service

3.2. Dependency between weekly, daily workload and practicing sports

We also focused on the dentists weekly and daily workload related to practicing sports (Tables 2, 3). Among the respondents having up to a 3-day weekly workload practicing sports goes up to 54.84%, while for those with a 5-day workload the figure is 65.16%, while for those with a +5-day weekly workload group this figure is 68.42%. In all the three groups of daily and hourly workload practicing sports exceeds 50%. In case of a daily workload of less than 4 hours this activity is 55.74%, 4-8 hours of workload reports 66.35%, while this figure for those having over 8 hours of workload the figure goes to 66.70%.

The results indicate a lack of a statistically significant dependency between weekly and daily workload and practicing sports by the dentists.

3.3. Dependency between health self-assessment and practicing sports

The relationship between health self-assessment and practicing sports is also of interest (Table 4, Fig. 4). In case of poorer health self-assessment practicing sports decreases. 78.44%

Table 2. Dependency between the dentists weekly workload (in workdays) and practicing sports. N=695 $p > 0,05$

Dentists' practicing sports	Dentists weekly workload (in days)		
	Up to 3	Up to 5	Over 5
	n %	n %	n %
yes (on daily basis)	4 (12,90%)	56 (10,55%)	28(21,05%)
No	14 (45,16%)	185 (34,84%)	42(31,58%)
Occasionally	13 (41,94%)	290 (54,61%)	63(47,37%)
Total	31 (100,0%)	531 (100,0%)	133 (100,0%)

Table 3. Dependency between the dentists daily workload (in hours) and practicing sports. N=695 $p > 0,05$

Dentists' practicing sports	Dentists' daily workload (hours)		
	Less than 4	4-8	over 8
	n %	n %	n %
yes (on daily basis)	7(11,48%)	66(12,55%)	14(13,0%)
No	27(44,26%)	177(33,65%)	36(33,3%)
Occasionally	27(44,26%)	283(53,80%)	58(53,7%)
Total	61(100,0%)	526(100,0%)	108(100,0%)

of respondents, self-assessing their health as “excellent” practice sports regularly and occasionally, as 54.03% of these self-assessing their health as “satisfactory” practice sports. 66.8% of respondents, self-assessing their health as “very good” and “good” practice sports. This makes us assume that practicing sports by the dentists depends on their good health self-assessment. The results indicate a statistically significant dependency between health self-assessment and practicing sports by the dentists.

3.4. Dependency between practicing sports and muscle-skeletal pain

We also explored the association between practicing sports and the presence of MSD-pain (Table 5.) The largest groups, having provided answers to both questions, covers 310 respondents (from a total of 692), who experience pain due to MSD but also practice sports “occasionally”.

The data in Table 5 reveal that out of about 2/3 (567) of the surveyed dentists, reporting the presence of MSD provoked pain, 11.29% practice sports on daily basis, and 54.67% - occasionally (a total of 65.96%).

It gives us grounds to assume that the presence of pain motivates dentists to engage in practicing sports.

The results indicate a lack of a statistically significant dependency between the presence of MSD type pain and practicing sports by the dentists.

To support this statement we focused on the dependency between practicing sports and the pain intensity self-assessment (Table 6). Our data reveal that those who most actively practice some sport are those experiencing moderate (64.06%) and mild pain intensity (34.37%). In the group exercising “occasionally” once again the most active are those experiencing moderate (69.25%)

Table 4. Dependency between health self-assessment and practicing sports by dentists. N=693 p<0,05

Dentists' practicing sports	Health status self-assessment				
	Excellent	Very good	Good	Satisfactory	Poor
	n %	n %	n %	n %	n %
yes (on daily basis)	16 (31,38%)	47 (21,08%)	17 (6,00%)	5 (4,03%)	0(0,0%)
No	11 (21,56%)	55 (24,67%)	113 (39,93%)	57 (45,97%)	5(41,67%)
Occasionally	24 (47,06%)	121 (54,25%)	153 (54,07%)	62 (50,00%)	7(58,33%)
Total	51(100,0%)	223 (100,0%)	283 (100,0%)	124 (100,0%)	12 (100,0%)

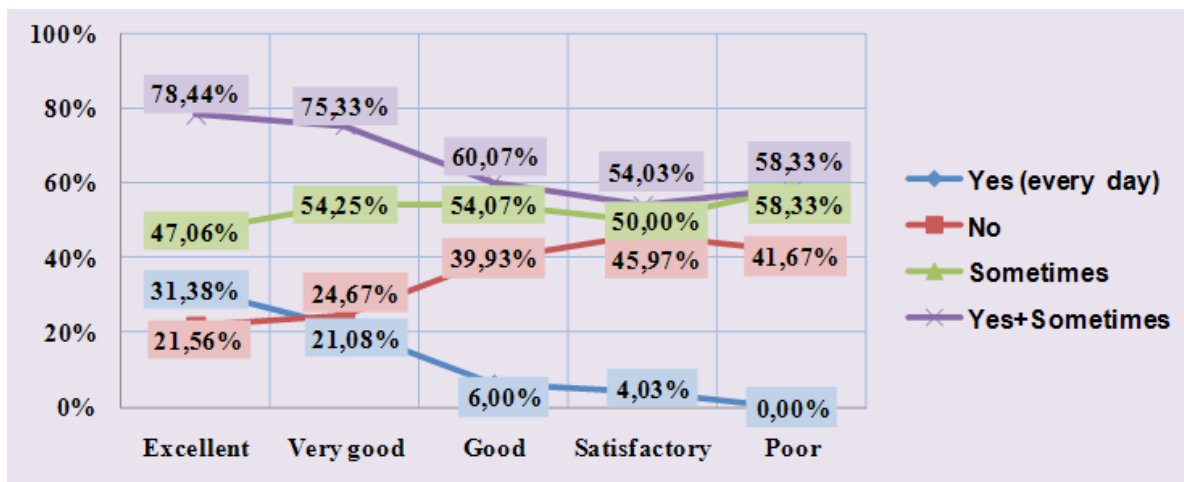


Figure 4. Trends in practicing sports referenced to dentistv health self-assessment

Table 5. Dependency between practicing sports and the presence of MSD type of pain. N=692 p>0,05

Dentists' practicing sports	Presence of MSD type of pain	
	Yes	No
	n %	n %
yes (on daily basis)	64 (11,29%)	22 (17,60%)
No	193 (34,04%)	46 (36,80%)
Occasionally	310 (54,67%)	57 (45,60%)
Total	567 (100,0%)	125 (100,0%)

Table 6. Dependency between practicing sports and the dentists' pain intensity self-assessment. N=567

Dentists' practicing sports \ Pain Intensity	Mild	Moderate	Severe	Unbearable	Total
	n %	n %	n %	n %	n %
Yes (on daily basis)	22 (34,37%)	41 (64,06%)	3 (4,69%)	1 (1,56%)	64(100%)
No	35 (18,04%)	133 (68,56%)	33 (17,01%)	3 (1,55%)	194(100%)
Occasionally	73 (23,62%)	214 (69,25%)	37 (11,97%)	1 (0,32%)	309(100%)

Note: Sum total of all percentages may exceed 100, as some of the respondents have marked more than one response; the total number is based of the number of respondents.

Table 7. Dependency between the dentists' practicing sports and the duration of MSD provoked pain. N=562 $p>0,05$

Dentists' practicing sports \ Pain Intensity	Mild	Moderate	Severe	Unbearable	Total
	n %	n %	n %	n %	n %
Yes (on daily basis)	22 (34,37%)	41 (64,06%)	3 (4,69%)	1 (1,56%)	64(100%)
No	35 (18,04%)	133 (68,56%)	33 (17,01%)	3 (1,55%)	194(100%)
Occasionally	73 (23,62%)	214 (69,25%)	37 (11,97%)	1 (0,32%)	309(100%)

and mild pain (23.62%).

Gradually, with the increase of the pain intensity practicing sports is reduced, which means that probably strong pain is a barrier to sporting or namely due to reduced sports practicing the pains intensify.

Our data show no statistically significant dependence between practicing sports and the pain duration period (Table 7).

What is interesting in our findings is that the most active dentists prove to be those experiencing more recent pain (for weeks - 85,72%). Practicing sports is lower in the groups experiencing the MSD type of pain for months and years (respectively 68.25% and 63.07%). It indicates that despite the lack of statistical significance, it is likely that continued chronic pain is a hindrance to practicing sports by the dentists.

4. Discussion

Our study revealed that a small percentage of dentists practiced sports regularly (12.6%). The more active were the younger dentists (length of service group 11–20 years), men being more active than women. Practicing sports dropped with the decrease in health self-assessment. Officially published data are similar to our findings. The study by J. Szymanska⁵ conducted in Poland also indicated a low level of practicing sports- fitness 7.76% and jogging - 10.05%. A significantly higher level of practicing sports was observed however among the dental medicine students in Brazil per data reported by M. DeCarvalho¹, showing that

50.2% practiced sports regularly (20.3% body building and 16.7% jogging). Our data also show more active practicing of sports among younger dentists - with 11-20 years of length of service. We think that pain due to MSD serves as a motivation to go sporting, yet with the pain intensity increase practicing sports is reduced, most active being those experiencing recent pain (for weeks - 85.72%). Practicing sports influenced positively the health of dentists, decreasing the pain of the lower back.⁹ Physical activities less than twice a week were associated with the higher prevalence of MSD.⁸

5. Conclusions

1. A very small fraction of the respondent dentists practice sports regularly (12.63%).
2. The most active is the group of 11-20 years length of service, men being a bit more active than women.
3. Practicing sports drops down with the decrease in health self-assessment.
4. Despite the lack of statistical significance, the results showed that practicing sports decreased with the pain intensity increase, the most active being those with most recent pain (for weeks) - 85.7% and moderate intensity.

Acknowledgments

The authors declare no conflict of interest related to this study. There are no conflicts of interest and no financial interests to be disclosed.

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CV

Dr Peter Georgiev Bojinov was born on June 20, 1976 in Sofia. He graduated from the Faculty of Dental Medicine, Medical University - Sofia, Bulgaria in 2000.

In 2002 he became an Assistant at the Department of "Social Medicine and Dental Public Health" in the Sofia Faculty of Dental Medicine. In 2005 he obtained a new specialty, namely "Social Medicine and organization of dental health", and in 2007, another specialty, namely "General Dentistry". In 2011 he was promoted Assistant Professor.

In 2014 he defended his doctoral thesis on the topic: "Musculoskeletal disorders among dentists, associated with dental practice" and was awarded his PhD degree.

Questions

Work related musculoskeletal disorders among dentists are associated with:

- a. Microorganisms in the mouth of patients;
- b. Sport activity of dentist;
- c. Mercury, monomers of dental plastics and other chemical risk factors of dental practice;
- d. Marital status of dentists.

Underlain the correct answer:

- a. Men are more active than women with sport activities;
- b. Older dentists are more active with sport activities than younger;
- c. There is no statistical significance between sport activity and length of service;
- d. There is statistical dependency between sport activity and daily and weekly workload.

In our study the regular sport activity among dentists is:

- a. 100%;
- b. 12.6%;
- c. 77.9%;
- d. 50%.

The sport activity increases with:

- a. Increase of pain intensity;
- b. Age;
- c. Decrease of pain intensity;
- d. Decrease of health self-assessment.

Professional tooth whitening by low voltage radiofrequency for mouth rejuvenation

"You'll find that life is still worthwhile, if you just smile."

Charlie Chaplin

Recent studies show that people who have whiter teeth are more self-confident and stand a greater chance of success. The Hollywood smile flashed by movie stars contributes to a better state of mind and opens their path to success.

A bright smile makes us look younger, and dental bleaching, the most popular and least invasive treatment of dental cosmetics, has become a treatment increasingly demanded by a large number of people. Dental bleaching is a simple procedure which may be a stand-alone procedure or it may be performed in combination with other techniques. Dental bleaching, whether performed at home or in the dentist's office, aims to get a whiter smile.

The dental market offers a wide range of whitening products and techniques ranging from toothpaste, mouthwash, gels and strips to professional whitening, each with advantages and disadvantages. Out of the whitening products that are used at home, bleaching strips and gels provide faster results than toothpaste or whitening mouthwash, but if not properly used, they can damage the teeth.

Therefore, it is best to resort to professional whitening and see a dentist.

Recently, at IDS, BrightTonix Medical (Yokneam Illit, Israel) introduced the new Y10 low voltage radiofrequency system, which provides safe, painless and fast bleaching in just 30 minutes without any

home-based training or treatment.

This new system ensures safer and more reliable treatment, providing faster teeth whitening. The RF current catalyses the whitening ingredients in the toothpaste by loading the molecules that are applied in the RF field. The loaded modules change their shape into unstable molecules. Stains on the dental enamel contain a chromophore that is mainly a protein. Loaded molecules will covalently create chemical bonds with the chromophore due to the opposite polarity.

The Y10 BrightTonix teeth whitening system allows dental professionals to provide professional results for the first time in only 30 minutes through a quick and simple procedure for both the practitioner and the patient.

The Y10 system has the following advantages:

- effective and painless whitening procedure;
- portable design which makes it ideal to move around dental practice;
- the peppermint flavour in the Y10 toothpaste and the RF current lead to a mouth refreshing sensation;
- provides for remarkable improvement of several shades in accordance with the common shading grading;
- the unique combination between the RF current and the unique Y10 toothpaste ingredients magnifies and accelerates the gums rejuvenation processes;
- the working technique is simple and clean;
- ergonomic, disposable mouthpiece;
- control device easy to operate.

The Y10 system is a unique, safe and effective alternative to the hydrogen peroxide bleaching treatments currently used in dental clinics as it does not have the side effects associated with dental sensitivity and pain in the gums.



The Y10 system for teeth whitening by BrightTonix Medical (Yokneam Illit, Israel) <https://www.btonix.com>

Florin - Eugen Constantinescu

DMD, PhD Student

Editorial Director, Product News

DOI: 10.25241/stomaeduj.2017.4(2).prodnews.1

Introducing a novel design!

Breath mentor appliance in the oral cavity
to prevent snoring, sleep apnea



You can have refreshing morning and lively life
just wearing it without any surgery or drug

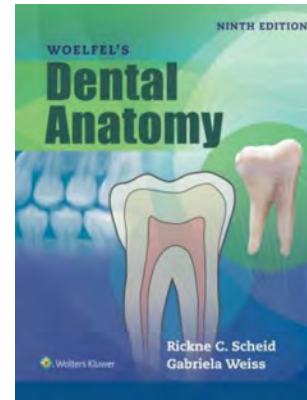
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Website www.breathmentor.com



Woelfel's Dental Anatomy

Authors: Rickne C Scheid / Gabriela Weiss
 Publisher: Lippincott Williams & Wilkins
 Language: English
 ISSN: 978-1-4963-2022-3
 Edition: 9/e
 Publish Year: 2017
 Pages: 528
 Price: \$94.99



A classic book on dental anatomy at its 9th edition, Woelfel's Dental Anatomy written by Rickne C. Scheid and Gabriela Weiss, is a study guide for dental students, dental hygiene students, dental assistants, and dental laboratory technicians.

This new edition has over 120 new color illustrations and interactive exercises. Many chapters were updated to include the most current terminology.

The book is divided into three parts: the first part, Comparative Tooth Anatomy, the second part, Application of Tooth Anatomy in Dental Practice, and the third part, Anatomical Structures of the Oral Cavity.

Each chapter includes a topic list, learning objectives, new terms, glossary, pronunciations, review question with answers, learning exercises, summary tables, original illustrations and drawings, appendix and research data.

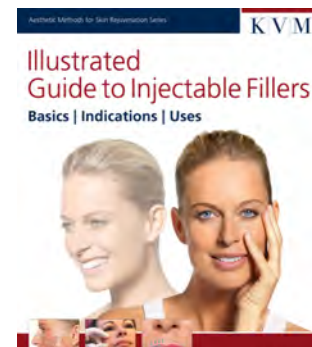
Using clear explanations this text helps you to understand how teeth are related to one another and to the bones, muscles, nerves, and vessels associated with the teeth and face.

Woelfel's Dental Anatomy remains a classical book on the US national board exam and worldwide as a teaching manual and a better useful reference in the dental office.

DOI: 10.25241/stomaeduj.2017.4(2).bookreview.1

Illustrated Guide to Injectable Fillers Basics, Indications, Uses

Authors: Gerhard Sattler / Uliana Gout
 Publisher: Quintessence Publishing
 Language: English
 ISBN: 978-1-85097-251-8
 Edition: 2/e
 Publish Year: 2016
 Pages: 280, illustrated
 Price: 149.00 €



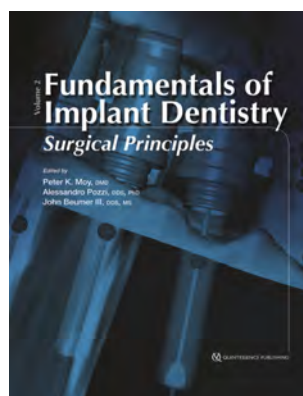
Drs. Gerhard Sattler and Uliana Gout's book entitled Illustrated Guide to Injectable Fillers. Basics, Indications, Uses is a new title in the "Aesthetic Methods for Skin Rejuvenation Series". The authors make a detailed presentation of the variety of injection techniques and the most recent scientific findings required for the use of hyaluronic acid fillers in facial aesthetics. The book is divided in eight fully illustrated chapters and online video sequences via the QR codes. This guide book describes the structure and function of the skin, facial anatomy and the mechanism of facial aging, types of injectable fillers, photographic documentation, examination and treatment planning, treatment setting, regional application, case studies and aids for the practitioner. The authors provide a holistic treatment approach to rejuvenation and harmonization of the face. The combination of written text, graphic illustrations, videos and clinical photography makes this book an excellent one, easy to understand and helps the reader learn the required skills and apply them directly. Because of the patients' desire for non surgical rejuvenation treatment this book should be in the personal library of each practitioner in the field of facial aesthetics.

DOI: 10.25241/stomaeduj.2017.4(2).bookreview.2

The Books Review is drafted in the reviewer's sole wording and illustrates his opinions.

Fundamentals of Implant Dentistry Volume II: Surgical Principles

Authors: Peter K. Moy / Alessandro Pozzi / John Beumer III
Publisher: Quintessence Publishing
Language: English
ISBN: 978-0-86715-584-6
Edition: 1/e
Publish Year: 2017
Pages: 448, illustrated
Price: 168.00 €



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Books Review

The second volume of the book entitled “Fundamentals of Implant Dentistry” tackles the importance of an interdisciplinary approach and demonstrates how the surgeon plays a leading role during treatment planning and surgical management.

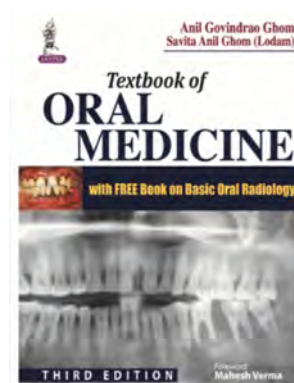
The book has 13 chapters. The first four chapters speak about the basic principles of oral implantology, from the patient’s medical history to the evolution of modern dental implant and the interdisciplinary workup. The next seven chapters illustrate the basic surgical procedure used in implant dentistry, tilted and zygomatic implant, hard and soft tissue grafting, reconstruction of major defects with implants and surgical consideration of the esthetic zone and various loading protocols. The last two chapters tackle complication and follow up. The success rate of dental implants is influenced by the patient’s adequate home care.

This book teaches the clinicians providing implant treatment the importance of a good surgical and prosthetic techniques and maintenance and follow up. The authors present new concept techniques and materials introduced to the field in oral implantology to provide the practitioner with success in his daily activity.

DOI: 10.25241/stomaeduj.2017.4(2).bookreview.3

Textbook of Oral Medicine

Author: Anil Govindrao Ghom / Savita Anil Ghom (Lodam)
Publisher: Jaypee Brothers Medical Publishers (P) Ltd
Language: English
ISSN: 9789351523031
Edition: 3/e
Publish Year: 2014
Pages: 1144
Price: £100.00



The third edition of textbook of Oral Medicine aims to provide education research and service for healthcare professionals. This last edition of the book includes lot of changes and at the end of each chapter there are multiple choice questions for revision.

The book is divided into five sections and has of a total 52 chapters. The first three sections talk about oral diseases, providing analysis of their etiology, diagnosis, histopathology, treatment and prognosis. The last two sections cover topics such as drugs used in dentistry, forensic dentistry, halitosis, controversial diseases, syndromes of oral cavity and geriatrics.

Each chapter of this textbook contains numerous clinical images, illustrations, tables and is presented in a better organization manner. The aim of this textbook is to prepare dental practitioners to better serve each patient and to understand the basic sciences related to dentistry. This new updated edition is very useful for undergraduate and postgraduate students and young dentists.

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DOI: 10.25241/stomaeduj.2017.4(2).bookreview.4

The Books Review is drafted in the reviewer's sole wording and illustrates his opinions.

1. Submitting the Article

The journal publishes articles written in English. All articles will be accompanied by the signed copyright form which can be returned by e-mail, fax (as scanned documents). All the responsibility for the originality of the material sent belongs to the author(s) alone. Each article will be evaluated by the peer-review committee composed of two independent peer-reviewers, in a blinded fashion, according to the peer-review protocol. All articles will be sent to the editor-in-chief at the following e-mail address: stomatology.edu@gmail.com. The articles will also be sent at the e-mail address of the co-editors-in-chief from your area (Americas, Europe, Asia-Pacific).

2. Articles sent for publishing

Stomatology Edu Journal (Stoma Edu J) publishes:

- original articles;
- reviews;
- case reports;
- consensus declaration coming from an association or from a group of specialists;
- letters to the editor.

All articles must be up to 3,000 and 4,500 words for meta-analysis (the word count is for the manuscript text only). Letters to the editor must not exceed 400 words of text and 5 references. Letters may have no more than 3 authors. Letters to the editor can be related to an article already published in the journal or it can represent original scientific contributions or events news/presentations etc. of interest for the reader.

If, following the peer-review process, the article requires only minor changes (language changes etc.) then the manuscript is accepted for publication in its revised form without further input from the author. In case the changes are considered more important (scientific errors or an incorrect use of the language that can affect the quality of the scientific message) the author will be contacted by a member of the editorial committee and it will only be published after he approves the changes considered necessary by the peer reviewers. In some cases, based on the written approval of the author(s), the peer-reviewers and the chief-editor or the publisher the article may be published alongside the comments of the reviewer(s).

3. Authors

Each author must be able to prove his active participation in the study by contributing to the concept, protocol, data gathering or analysis, their interpretation or by critically revising the manuscript. Any other persons who have contributed to the paper, like study participants or colleagues, will be mentioned in the "Contribution" section.

4. Permissions and Ethics

For citations, tables, figures etc. which are not original, these must be accompanied by the written permission for their use and the full reference must be provided. Photographs of identifiable persons must be sent alongside the written permission of the person(s) and all regions that may allow the identification of the subject must be covered.

The author must have obtained, for all studies including human subjects, the permission of the subjects to be part of the study whilst keeping their anonymity. By sending the article, the author declares that he obtained this permission from all his subjects. All studies must respect the Helsinki Declaration (1975).

For human and animal studies, the authors must have obtained the approval of the ethics committee from the University/Institute/etc. where the study was done.

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The article must be written in conformity with the general recommendations of the International Committee of Medical Journal Editors. <http://www.icmje.org/icmje-recommendations.pdf>

The Stomatology Edu Journal (Stoma Edu J) uses double-blind review, which means that both the reviewer and author name(s) are not allowed to be revealed to one another for a manuscript under review. The identities of the authors are concealed from the reviewers, and vice versa.

To facilitate this, please include the following separately:

Title page (with author details): This should include the title, authors' names and affiliations, and a complete address for the corresponding author including an e-mail address.

Blinded manuscript (no author details): The main body of the paper (including the references, figures, tables and any Acknowledgements) should not include any identifying information, such as the authors' names or affiliations.

The articles must be sent either as a Microsoft Word 2000 document (*.doc) or as a Microsoft Word 2003 document (*.docx).

The article will be written using Times New Roman font, size 12 for the characters with one and half (1 1/2) spaces between paragraphs. The manuscript must be sent in its final form. The pages will be numbered with the manuscript containing the following sections: title, authors, abstract, keywords, the text of article, contributions, acknowledgments, references, the figures and the tables legend.

Please also check the Author's Guidelines for the Abstract.

A. The title of the manuscript will have a maximum of 100 characters without spaces, written in title case, centered capitals, and in 12 point bold Times New Roman font at the top of page. Abbreviations should be avoided within the title.

B. The author(s) will send their full name(s) and surname(s), the highest academic position, their full titles and their affiliations. All names are listed together and separated by commas. Provide exact and correct author names as these will be indexed in official archives. Affiliations should be keyed to the author's name with superscript numbers and be listed as follows: Laboratory, Department, Institute, Organization, City, State abbreviation (USA, Canada, Australia), and Country (without detailed address information such as city zip codes or street names).

The correspondent author will send his/her full name and surname, the highest academic position, his/her full title, his/her affiliation, his/her institution address, his/her telephone, fax and e-mail. The authors will send this information in the same format as that in the published articles.

C. The Structured Abstract

The abstract can have a maximum of 250 words. After the abstract, the author(s) must mention a maximum of 5 keywords. Keywords must be selected from **Medline Mesh**.

The abstract for Original Scientific Articles should be no more than 250 words using the following structure: Introduction; Methodology; Results; Conclusion.

The abstract for Review Articles should be no more than 250 words with the authors covering all the following information regarding the subject presented under the following subheadings: Background, Objective, Data Sources, Study Selection, Data Extraction, Data Synthesis.

The abstract for Case Reports should be no more than 250 words using the following structure: Aim, Summary and Key learning points: provide up to 5 short statements of the report.

The abstract for Clinical Articles should be no more than 250 words using the following structure: Aim, Methodology, Results and Conclusions. Abbreviations are not accepted in the title or the abstract.

D. The Article Text

Headings and Sub-headings

Except for special names (e.g. GABAergic), capitalize only the first letter of headings and subheadings. Headings and subheadings need to be defined in Times New Roman, 12, bold. You may insert up to 5 heading levels into your manuscript (not more than for example: 3.2.2.1.2 **Heading title**).

For original articles:

Introduction - a presentation of the most important aspects in the studied domain without doing a review of the literature. The purpose of this part is to present and backup the hypothesis on which the study was based.

Material and Methods - this section will include all required information so that the reader can verify the validity of the study including, but not limited to, subjects, measurements, statistics and ethics. The methods used should be discussed (why the methods have been chosen, which the limitations/advantages). A paragraph about the statistical analysis is required as well.

Results - the results of the study will be presented in a descending order of importance. An interpretation of the results will not be done in this section.

Discussion - the authors will present the way the results backup the original hypothesis, as well as the way in which the results are backed up or contradicted by the published literature. A paragraph must be dedicated to presenting the limitations of the study.

Conclusion - The conclusion presents the implications of this latest work. In addition, authors may consider discussing future plans or recommendations for future research etc.

For all other types of articles we recommend the use of a clear structure based on sections and sub-sections.

E. Acknowledgments

Acknowledge persons who have made substantive contributions to the study. Specify grant or other financial support, citing the name of the supporting organization and grant number.

F. References

- The references will be written using the Vancouver style

(<https://www.imperial.ac.uk/media/imperial-college/administration-and-support-services/library/public/vancouver.pdf>).

- The references will be numbered, in the order they appear in the text as such: " (1).

- All sources found in the text must be present in the bibliography and all the papers mentioned in the bibliography must appear in the text. For references with more than 6 authors, list the first 3 authors followed by "et al."

- Full-page ranges should be given in expanded form (e.g., 426-429, not 426-9).

- If non-English-language titles are translated into English, bracketed indication of the original language should follow the title.

- All journals will be abbreviated and italicized names of journals according to the style in PubMed; refer to the National Library of Medicine (NLM) Journals Database (<http://www.ncbi.nlm.nih.gov/nlmcatalog/journals>) if needed. Journal names will be abbreviated according to the [List of Title Word Abbreviations](#)

- Information obtained from sources which are not published yet, but accepted for publishing will include at the end of the reference the mention "in print" between round parentheses.

- If the cited results have not been published yet the mention will be "personal communication" written in the text of article between round parentheses.

- Only references read by the authors of the article will be cited.

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