CONTEMPORARY DENTAL CARIES MANAGEMENT CONCEPTS IN PAEDIATRIC DENTISTRY: A SURVEY OF AWARENESS AND PRACTICE OF A GROUP OF GULF COOPERATION COUNCIL DENTISTS

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ABSTRACT

Introduction: Debatable clinically relevant child dental caries management concepts exist; restoring a carious primary molar (RCM), the choice of pulpotomy medicament (PM), the "Hall Technique" (HT), and sealing of dental caries (SDC). Our aim was to assess the knowledge and practice of dentists treating children in the Gulf Cooperation Council (GCC) region of the aforementioned contemporary concepts.
Methodology: Paediatric Dentists (PDs) and General Dental Practitioners (GDPs) who treated children completed a questionnaire (N=150) covering: RCM choices; choice of PM; knowledge and practice of HT and acceptance of SDC in primary and permanent teeth. Statistical analysis was conducted using Chi-Square test ($p<0.05$).
Results: For RCM: 76% of those surveyed would remove non-pulpal caries in an asymptomatic lower D and restore with composite (33%), glass ionomer or conventional stainless steel crown (SSC) (17.4%), amalgam (7.4%) and zirconia (0.7%). The remaining 24% would seal caries (HT SSC). For PM: 40.7% chose Ferric Sulphate, followed by Formocresol (36.7%), Mineral Trioxide Aggregate (14%) and Calcium hydroxide (8.7%); For HT: 60.6% had knowledge of HT but 81.5% never used it. For SDC: sealing caries in primary & permanent teeth was rejected by 56.6% & 53.1% respectively. GDPs and PDs choices differed significantly with RCM, HT (knowledge and practice) ($p=0.007$, 0.003 and 0.003 respectively).
Conclusion: Overall the surveyed dentists practicing in the GCC disagreed on RCM, PM with reluctance to accept new concepts like the HT and SDC. PDs choices of RCM differed from GDPs, and their awareness of HT and practice of HT were more favourable.
Keywords: Hall technique, pulpotomy medicaments, dental caries, sealing caries.

1. Introduction

The discipline of paediatric dentistry is an extensive field in a constant state of development and change. Several aspects of its clinical practice, related to the management of the caries, have shown new insights and practices challenging old concepts. With the drive to base both dental education and dental practice on sound platforms of evidence based dentistry and contemporary clinical guidelines, a plethora of new methods/concepts have emerged. This created a scientific debate, albeit a healthy one, that divided the paediatric dentistry community and created opposing schools of thought. Interestingly, the debate had an impact on undergraduate dental education and postgraduate dental practice.[1] In paediatric dentistry, how to restore a carious primary molar (RCM),[2, 3, 4] the choice of appropriate "pulpotomy medication" (PM) in primary teeth,[5] the "Hall technique" (HT),[6] and "sealing dental caries" (SDC) in primary and permanent teeth[7] were four areas where change and debate took place. These

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clinical issues have had direct impact upon clinical treatment of child patients and are of interest, not only to specialists in paediatric dentistry, but general dental practitioners alike. While the debate has been, and still is, ongoing in the dental literature,[8,9] the opinions of those treating children in the dental community in the Gulf Cooperation Council countries (GCC) had not been assessed. What were the opinions of dentists about these changing new concepts? As the United Arab Emirates (UAE) and the State of Kuwait (SoK) are representative nations in the GCC (along with Saudi Arabia, Oman, Qatar and Bahrain) which have dental practitioners from many different backgrounds, the aim of this paper was to survey- by means of a questionnaire- the dental awareness and practice of dentists in GCC countries of the above concepts. It was hypothesised that GCC dentists; a) agreed on treatment options for RCM when faced with a non-pulpally involved carious primary molar in a cooperative child, b) agreed on the PM used in a primary molar pulpotomy, c) were aware of the HT, d) had practiced the HT and e) agreed to the concept of SDC in primary and permanent teeth.

2. Materials and methods

2.1. Design

The study was designed as a cross-sectional survey. Data was collected by the authors and postgraduates (the surveyors) from Hamdan Bin Mohamed College of Dental Medicine (HBMCDM) in Dubai, UAE. The participants were dental professionals (General Dental Practitioners/ Interns [GDPs], and Paediatric Dentists [PDs]) attending paediatric dentistry postgraduate conferences held at various institutions in the UAE and SoK namely HBMCDM in Dubai (UAE) and Ras AlKhaima Dental College, Ras AlKhaima (UAE) and the Kuwait Health Ministry, Kuwait city, (SoK). The aim was to investigate their awareness and practice of RCM, HT, choice of PM and SDC concepts outlined above. The reason behind the choice of events was to capture the views of a cross section of dentists dealing with children from various areas in the GCC.

2.2. Sample selection

The sample was a convenience sample selected during the aforementioned dental activities during 2015. At registration time randomised participants were invited by the surveyors from HBMCDM, to participate in the survey by filling a questionnaire. In both countries a total of 315 attendees were invited to participate. Participants were allowed to complete the questionnaire once only, thus avoiding duplicate entries.

2.3. Ethical matters

All participants were informed of the objectives and confidential nature of the survey and that there would be no negative consequences for declining to participate even if they agreed initially. Hence, they freely consented to participate in the survey. Ethical approval of the work was obtained from the Ethics Committee of HBMCDM (approval ERC/ DCDM 11/14) and approval of the event organisers of the activities in both SoK and UAE.

2.4. Questionnaire

A size A4 sheet questionnaire was designed by the authors and was administered to all participants involved in the study. The questionnaire, was piloted and tested amongst the paediatric dentistry staff and postgraduates of HBMCDM (10 members) (Fig. 1 and Table 1) and was found to be reliable and consistent (Cronbach's alpha= 0.66). They were not included in the final sample. The questionnaire included:

- A section capturing demographic data (age, gender, specialty, country of practice, years in practice and country of qualification);
- Six questions items covered the previously highlighted topics RCM, HT, PM and SDC (Fig. 1 and Table 1).

2.5. Data analysis

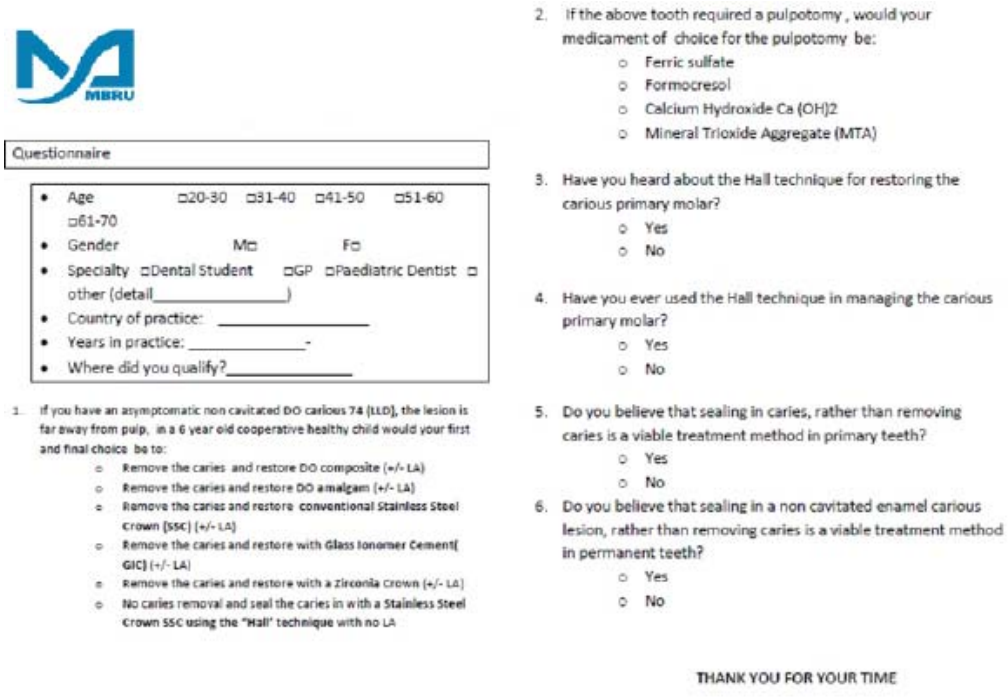
The survey sheets were completed anonymously. The returned questionnaires were collected by the surveyors and incomplete questionnaires were excluded from the study. The data collected was uploaded into a Microsoft Office 2010 Excel© sheet and data analysis was carried out using SPSS© statistical software Statistical Package of Social Science (SPSS Inc.; Chicago, Illinois) version 21 was used for data management and analysis. Descriptive statistics including frequencies, means, median, and standard deviation were performed to give general descriptions of the data. Chi-square test was performed to test the dependency between variables. The level of statistical significance was set at 5%.

3. Results

Out of a total of 315 attendees invited to take part in the survey, 202 verbally expressed willingness to participate and were issued the questionnaire sheets. However only 159 actually participated, completed and returned the questionnaires to the surveyors. Nine surveys with incomplete fields were excluded; therefore, the total number of those surveyed was 150 dentists (a return rate of 74.2%). The demographic breakdown of those surveyed, was as follows: Out of the total number of those surveyed (N=150), the majority of them were GDPs (n=119, 79.3%) while 20.7% (n=31) were PDs. The majority were female dentists (70.7%, n=106) and the rest were males (n= 44, 29.3%).

The mean age was 30.5 (±6.5) years and the range was 23-60.

The dominant age group was between 20-30 years (n= 96, 64%). The countries of practice were UAE (n=79, 52.7%) followed by Kuwait (n=35, 23.4%), the remaining dentists were working out with these two countries but within the GCC [29 from Saudi Arabia (19.3%), 3 from Bahrain (2%), and 2 (1.3%) from each of Qatar and Oman]. The median of years of practice was 4 years and the range was1-30 years. Countries of qualification were various but were regrouped into Arab countries (50.6%,



Questionnaire

- Age □20-30 □31-40 □41-50 □51-60 □61-70
- Gender M□ F□
- Specialty □Dental Student □GP □Paediatric Dentist □ other (detail_____)
- Country of practice: _____
- Years in practice: _____-
- Where did you qualify?_____

1. If you have an asymptomatic non cavitated DO carious 74 (LLD), the lesion is far away from pulp, in a 6 year old cooperative healthy child would your first and final choice be to:
   - Remove the caries and restore DO composite (+/- LA)
   - Remove the caries and restore DO amalgam (+/- LA)
   - Remove the caries and restore conventional Stainless Steel Crown (SSC) (+/- LA)
   - Remove the caries and restore with Glass Ionomer Cement(GIC) (+/- LA)
   - Remove the caries and restore with a Zirconia Crown (+/- LA)
   - No caries removal and seal the caries in with a Stainless Steel Crown SSC using the "Hall" technique with no LA
2. If the above tooth required a pulpotomy , would your medicament of choice for the pulpotomy be:
   - Ferric sulfate
   - Formocresol
   - Calcium Hydroxide Ca (OH)2
   - Mineral Trioxide Aggregate (MTA)
3. Have you heard about the Hall technique for restoring the carious primary molar?
   - Yes
   - No
4. Have you ever used the Hall technique in managing the carious primary molar?
   - Yes
   - No
5. Do you believe that sealing in caries, rather than removing caries is a viable treatment method in primary teeth?
   - Yes
   - No
6. Do you believe that sealing in a non cavitated enamel carious lesion, rather than removing caries is a viable treatment method in permanent teeth?
   - Yes
   - No

THANK YOU FOR YOUR TIME

Figure 1. The Questionnaire: original format.

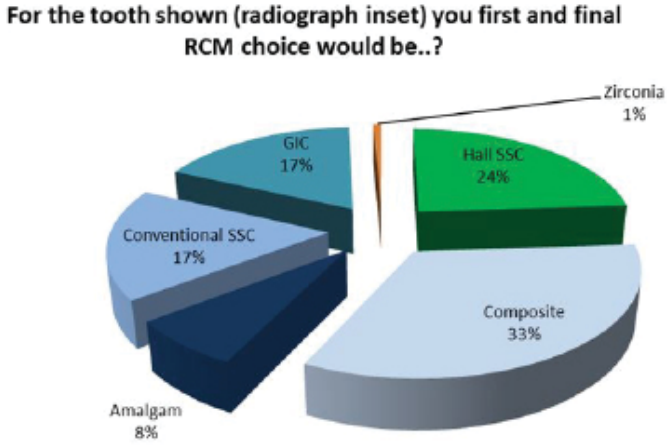


Figure 2. The management choices for treatment of tooth DO caries 74 set (see radiograph inset). SSC: Stainless Steel Crown; GIC: Glass Ionomer Cement.

n=76), East Asia (15.3%, n=23), Western Europe (11.3%, n=17), Eastern Europe (20.6%, n=31) and the United States of America (USA) (2%, n=3). The results of the survey showed the following (Fig. 1 and Table 1).

3.1. Results for the first question (RCM), *which asked about management options for caries in tooth #74 (class II ≤ caries shown in a radiograph) in a cooperative six year old child* (Fig. 2), the majority chose caries removal and restoration (n=114, 76%) compared to the HT (n=36, 24%, Fig 2). Within the group that chose to remove caries and restore, the choices were; composite (n=50, 33.3%), Glass Ionomer Cement (GIC) (n=26, 17.4%), conventional SSC (n=26, 17.4%), amalgam (n=11, 7.4%) and finally zirconia crowns (n=1, 0.7%).

While GDPs and PDs followed the same pattern (i.e., favour caries removal and restore rather than seal), cross tabulating the RCM choices in the above scenario and the specialty revealed statistically significant differences between their individual restorative choices (p=0.007) (Fig. 3). Most PDs (n=20, 64.5%) chose SSCs (either conventional SSC or HT SSC) compared to GDPs (n=42, 35.3%). GDPs first choice was to use composite (n=42, 35.3 %), while PDs first choice was conventional SSCs

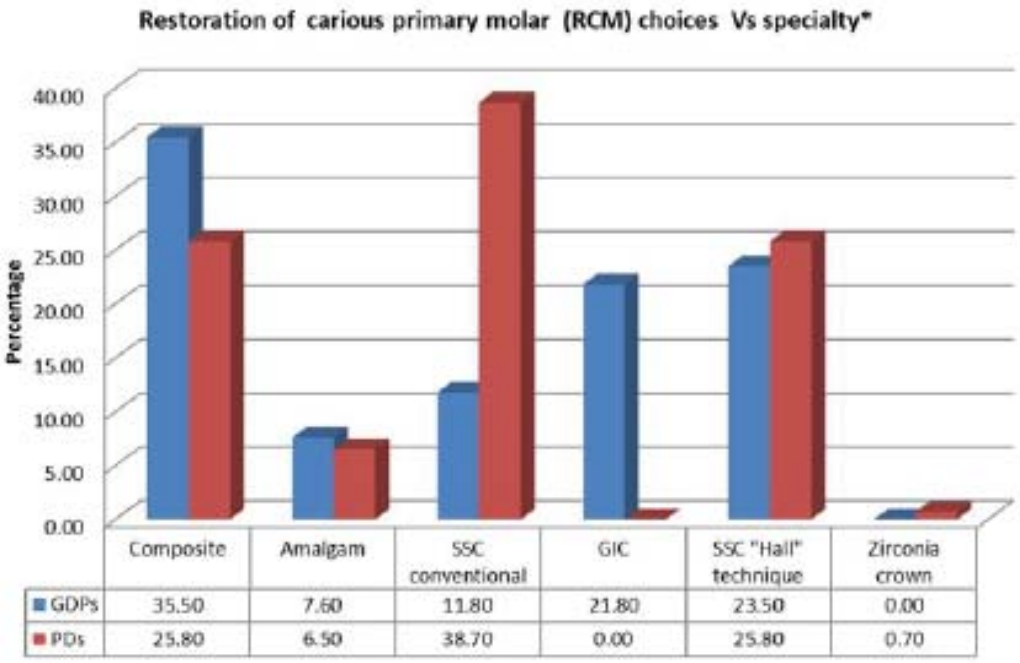


Figure 3. First choice of management of 74 (see radiograph inset) according to specialty. * denotes statistical significance (p >0.05). SSC: Stainless Steel Crown; GIC: Glass Ionomer Cement.

(n=12, 38.7%). Significantly so, 21.8% of GDPs (n=26) would choose GIC while all none of the PDs (n=0) chose GIC. In addition, a small proportion of GDPs (n=11, 7.4%) and PDs (n=2, 6.5%) chose amalgam, whilst none of the GDPs (n=0) and 0.7% of PDs (n=1) suggested zirconia crowns as a final restoration.

3.2. Results for the second question (PM), *the medicament of choice in a pulpotomy* (Fig 4); overall, those surveyed chose the following: Ferric Sulphate (FS) (n=61, 40.7%), followed by Formocresol (FC) (n=55, 36.7%), Mineral Trioxide Aggregate (MTA) (n=21, 14%) then Calcium Hydroxide (CH) (n=13, 8.7%). Cross tabulating the PM choice and specialty (Fig 5) revealed no statistically significant difference between PM choices of PDs and GDPs (p=0.281). The majority of GDPs chose FS (n=48, 40.3%), followed by FC (n=42, 35.3%), MTA (n=16, 13.4%) and finally CH (n=13, 10.9%). While 41.9% of PDs (n=13) chose FS and an equal proportion chose FC too, followed by MTA (n=5, 16.1%). No PD chose CH as a PM medicament (n=0, 0%).

3.3. Results for the third and fourth questions (HT), *t awareness and practice of the Hall Technique.* The majority of those surveyed (n=91, 60.6%) had heard about the HT while those who had not heard about it were 39.4% (n=59). However an overall majority (n=122, 81.4%) had not used the HT clinically, compared to 18.6% (n=28) who had (Fig. 6).

Cross tabulating awareness and practice of the HT with specialty revealed different results between GDPs and PDs (Fig. 7), which were statistically significant for both categories (both *p values*=0.003). In both the GDP and PD groups, the majority had heard about the HT (54.6% and 83.8% respectively) and the majority had not practiced the HT (86.5% and 61% respectively). The proportion of PDs whom had heard about the HT (n=26, 83.8%) was statistically significantly higher (p=0.003) than GDPs whom had heard of the HT (n=65, 54.6% of GDPs). There was a larger proportion of GDPs (n=103, 86.5%) who had not used the HT compared to PDs (n=19, 61.2%). Moreover, the proportion of PDs whom had practiced the HT (n=12, 38.8%) was statistically significantly higher (p=0.003) than GDPs whom had practiced the HT (n=16, 13.5%).

3.4. Results for questions 5 and 6 *related to sealing dental caries (SDC) in primary and permanent teeth.* The majority of those surveyed did not believe that sealing in caries in primary and permanent teeth was a viable option (Fig. 8). When asked if sealing in, rather than removing, caries in primary teeth was a viable option the majority disagreed (n=85, 56.6%) while 43.7% agreed (n=65). Moreover, when asked if sealing in a carious non-cavitated enamel lesion in permanent teeth was a viable option, the majority of those surveyed disagreed (n=80, 53.3%) as opposed to those who agreed (n=70, 46.6%). When cross tabulating the specialty and the concept of SDC in primary and permanent teeth, no statistically significant differences (p=0.517, p= 0.182 for both dentitions respectively) between GDPs and PDs were found (Fig. 9). GDPs opinions regarding SDC in primary teeth were divided; against (n=71, 59.6%) and

Table 1. This table shows the overall and specific responses to the questions tabled in this study (N=150). GDP: General Dental Practitioner, PD: Paediatric Dentist.

Question	Total N= 150 (%)		GDPs (n=119)(%)		PDs (n=31) (%)		Pearson's Chi Square test
Question 1 (RCM: Restoring Carious Molar) When you have an asymptomatic non cavitated DO carious 74 (LLD), and the lesion is far away from pulp, in a 6 -year old cooperative healthy child, what would you first and final choice to be?							
No caries removal and seal the caries in with a stainless crown SSC using "Hall" technique with no LA	36 (24)		28 (23.5)		8 (25.8)		0.007*
Caries removal and restoration of which would:	114 (76)		91 (76.5)		23 (74.2)		
-Remove the caries and restore with composite (+/-LA)	50 (33.3)		42 (35.3)		8 (25.8)		
-Remove the caries and restore with amalgam (+/-LA)	11 (7.4)		9 (7.6)		2 (6.5)		
-Remove the caries and restore with conventional stainless steel crown (SSC) (+/-LA)	26 (17.4)		14 (11.8)		12 (38.7)		
-Remove the caries and restore with glass ionomer cement (GIC)(+/-)	26 (17.4)		26 (21.8)		0 (0)		
-Remove the caries and restore with a Zirconia Crown (+/-LA)	1 (0.7)		0 (0)		1 (3.3)		
Question 2: (PM: Pulpotomy Medicament Choice) If the above tooth caries in tooth 74 reached the pulp and required a pulpotomy what would your medicament of choice for the pulpotomy be?	**N = 150 (%)**						
-Ferric sulphate FS	61 (40.7)		48 (40.3)		13(41.9)		0.281
-Formocresol (FC)	55 (36.7)		42 (35.3)		13(41.9)		
-Calcium Hydroxide (CH	13 (8.7)		13 (10.9)		0 (0)		
-Mineral Trioxide Aggregate (MTA)	21 (14)		16 (13.4)		5 (16.1)		
Question 3 & 4 (HT: Hall Technique)	**Yes**	**No**	**Yes**	**No**	**Yes**	**No**	
Have you ever heard about the Hall technique in managing the carious primary molar?	91(60.6)	59 (39.4)	65 (54.6)	54 (45.4)	26(83.8)	5(16.2)	0.003*
Have you ever used the Hall technique in managing the carious primary molar?	28 (18.6)	122 (81.4)	16 (13.5)	103 (86.5)	12(38.8)	19(61.2)	
Question 5 & 6 (SDC: Sealing Dental Caries)	**Yes**	**No**	**Yes**	**No**	**Yes**	**No**	
Do you believe that sealing in caries, rather than removing caries is a viable treatment method in primary teeth	65(43.4)	85 (56.6)	48 (40.4)	71 (59.6)	17 (54.8)	14(45.2)	0.517
Do you believe that sealing in a non cavitated enamel carious lesion, rather than removing caries is a viable treatment method in permanent teeth	70 (46.7)	80 (53.3)	53(44.5)	66 (55.5)	17 (54.8)	14 (45.2)	0.182

for (n=48, 40.4%) and SDC in permanent teeth; against (n=66, 55.5%) and for (n=53, 44.5%). PDs opinions regarding SDC in primary teeth were also divided; against (n=14, 45.2%) and for (n=17, 54.8%) and SDC in permanent teeth; against (n=14, 45.2%) and for (n=17, 54.8%). Therefore, there was, a tendency for both GDPs and PDs to have opposite views regarding SDC. PDs tended to accept SDC in primary teeth and permanent teeth compared to GDPs, although this was not statistically significant.

4. Discussion

Management of dental caries, a disease of high prevalence in the GCC region,[10] represents a challenge for those who dentally care for children, whether they are GDPs or PDs.[4] As dentists, we know that there appears to be more than one solution for a said clinical problem as such, a spectrum of solutions exist.[3] As examples for the latter, the HT,[10] in addition to sealing caries in permanent teeth as an ultraconservative modality[11] challenged the surgical caries management model. Also,

when a primary tooth pulpotomy is conducted, the dilemma of the choice of the appropriate medicament arises, the best of which has yet to be agreed upon.[5] These contemporary debates and concepts were the drive behind conducting this survey in the GCC region.

4.1. Discussion of managing a carious primary molar (RCM)

When dealing with a primary tooth the conventional surgical "*fill after drill*" philosophy had been accepted as the norm for decades[12] although this had been challenged and investigated[4]. The surgical approach means giving local analgesia (LA) to the child by injection to anaesthetise the tooth, drilling the carious tissue out using a high and slow speed drill, and restoring the primary tooth with various restorative materials such as amalgam, GIC, compomers, composite, SSCs,[12] and other newer materials like Zirconia crowns.[13] In our study a majority (n=114, 76%) would follow the classical surgical doctrine and restore with various materials, while a minority (n=36, 24%) would seal-in the caries. Although longevity studies have shown that composites[14] and SSCs,[12] last longer in posterior primary teeth[15] compared to GIC[16] no agreement between dentists exists. Our study confirmed this disagreement over which material was considered the most appropriate for a given clinical situation; in this case an asymptomatic class II "*do*" carious 74 with radiographic caries away from the pulp in a cooperative 6 year old (see x-ray inset in figures 1, 2 and 3). It was clear that the majority of those surveyed favoured the conventional "*drill and fill*" modality compared to the "*biological modality*". The single largest group (Fig 2) was "remove caries and restore with

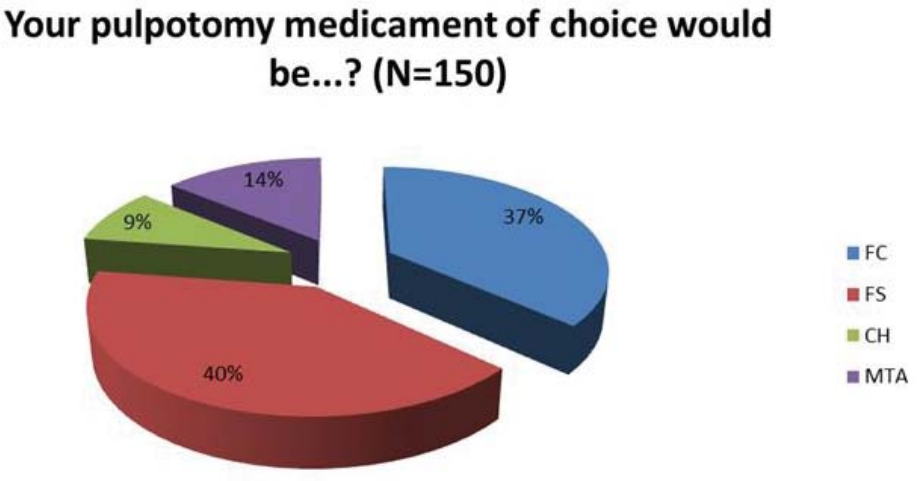
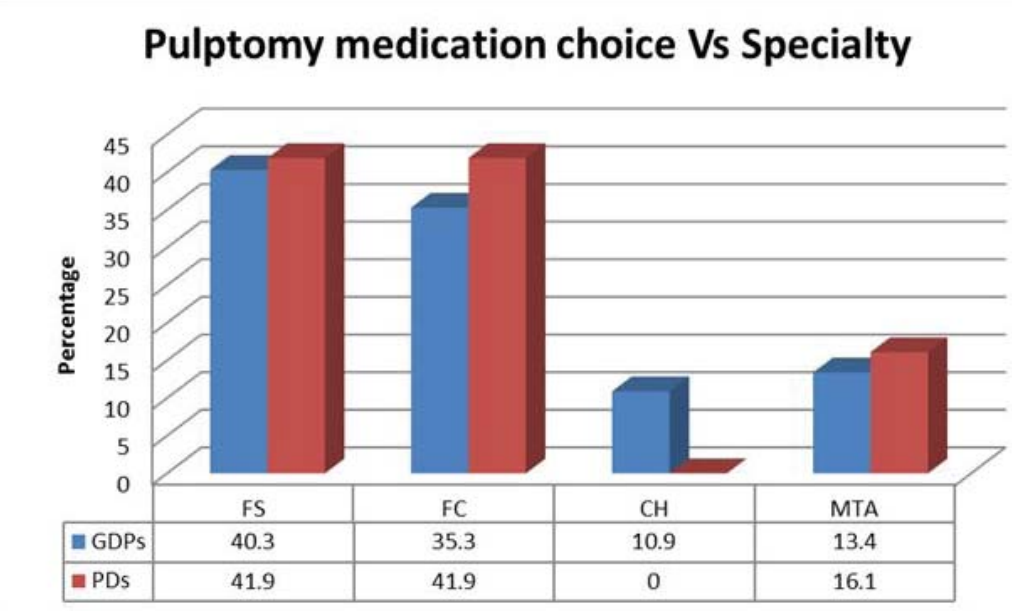


Figure 4. Overall pulpotomy medication of choice for tooth 74. FC: Formocresol; FS: Ferric Sulphate; CH: calcium hydroxide; MTA: Mineral Trioxide Aggregate.



	FS	FC	CH	MTA
GDPs	40.3	35.3	10.9	13.4
PDs	41.9	41.9	0	16.1

Figure 5. Pulpotomy medication of choice for tooth 74 and specialty (GDP or PD). * FC: Formocresol; FS: Ferric Sulphate; CH: calcium hydroxide; MTA: Mineral Trioxide Aggregate.

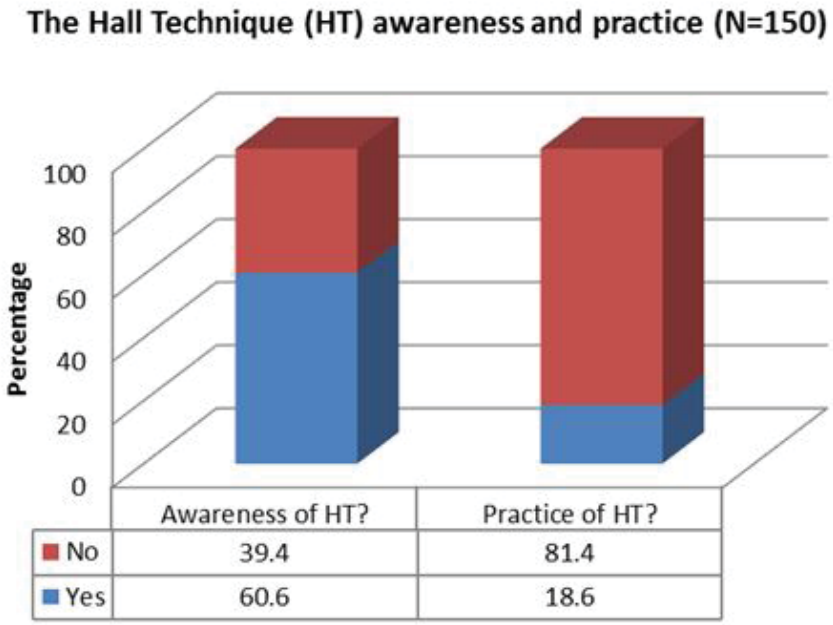


Figure 6. Overall results for Hall Technique awareness and practice.

composite' (33.3%). Although SSCs, both HT SSCs and conventional SSCs when considered together, would represent a larger majority (17.4%+24.2%= 41.8%), they were considered separately in this study, as they represented two different modalities of treatment (biological Vs conventional).

The choice of material differed significantly between GDPs and PDs: GDPs tended to choose composite and GIC more than PDs, while PDs tended to choose conventional SSCs more than GDPs ($p<0.05$) while, interestingly, no PD chose GIC at all. The choice of GIC for Class II lesions, chosen by GDPs in the case, had been previously reported to have a high failure rate.[6] Moreover, the choice of SSCs by most of the PDs in our study was in agreement with the latest guidelines and systematic reviews that favour SSCs multi-surface carious primary molars.[15]

None of the GDPs and only one PD chose Zirconia possibly because it is a newer material on the market with a lot of promise, requires extensive crown preparation and is expensive.

Finally, a few PDs and GDPs chose amalgam, indicating that this material is falling out of favour in the GCC region.

4.2. Discussion of the choice of pulpotomy medicament (PM)

The American Academy of Pediatric Dentistry (AAPD) suggested two treatment options for vital primary teeth with deep caries approaching the pulp. These treatment options were indirect pulp therapy (IPT) and cervical pulpotomy.[17] GDPs were more likely to attempt IPT on primary teeth than paediatric dentists to treat deep caries in asymptomatic primary teeth.[18] A primary molar pulpotomy is defined as the clinical procedure involving the removal of the inflamed and infected coronal pulp tissue while maintaining vital healthy radicular pulp. Following amputation of the coronal pulp, the remaining pulp is treated with one of the following medicaments[19]: Formocresol (FC), Ferric sulphate (FS), Mineral trioxide aggregate(MTA) and Calcium hydroxide (CH). The debate about which medicament to use has engaged the dental literature for a long time, subsequently affecting the clinical decisions of PDs and GDPs alike. This was indeed reflected in our study. As there was no uniform agreement on what constitutes the ideal PM in a given scenario (Fig. 4) and not one PM had an outright majority. Historically, FC has been the medicament of choice for the primary tooth pulpotomy. Buckley in 1904 first used equal parts of tricresol and formalin, although the procedures and formulation have changed since Buckley's first publication,[20] FC has remained popular as a medicament for vital pulp therapy. Dunston and Coll[21] reported that 81% of surveyed USA paediatric dentist diplomates used either diluted or full-strength FC, 18% used FS, and only 1% used some other medicament or technique for primary tooth pulpotomies. FC popularity as a pulp therapy medicament has decreased in some countries and banned in others such as the United Kingdom (UK) because of its alleged cytotoxicity, potential mutagenicity and immune sensitization.[22,23] However, in the USA, a recent survey showed that FC is still the most popular pulpotomy medicament, despite published concerns regarding its potential toxicity among both GDPs and PDs.[18] Despite the fact that the British Society of Paediatric Dentistry (BSPD) guidelines had discouraged the use of FC[19] the AAPD most recent pulp therapy guidelines[17] recommended Buckley's Solution of FC as a pulpotomy medicament in primary

teeth, which in the GCC region had created a lot of confusion. This was even noted in our study; PDs used either FS or FC as a PM (equally n=13, 41.9% for each). MTA, FS and CH are used as alternatives to FC as pulpotomy medicaments.[19] CH has been used, but with less long term success because it has been shown to cause internal resorption in primary teeth.[24] FS is a coagulative and haemostatic agent and it has been found to have high clinical (100%) and radiographic (97%) success rates.[25] Meta-analysis of six prospective controlled trials[23] showed that both FC and FS had similar clinical and radiographic outcomes. Overall clinical success of FS was 78 -100% and radiographic success was 42 - 97%. MTA has also been reported as a pulp therapy medicament with very high (more than 95%) 2 year-follow up clinical and radiographic success rates.[26] The choice of pulpotomy medicaments vary among dental practitioners and also between countries. A 2012 USA survey[18] reported that 69% of general dentists and 68% paediatric dentists used FC; 15% of GDPs and 23% PDs used FS and only 3% of GDPs and 1% PDs reported using MTA. In an analysis of 47 trials and 3910 randomised teeth, a recent Cochrane systematic review in 2014[5] found no evidence to identify a superior PM although MTA or FS were highlighted as "preferable". Smaïl-Faugeron et al, stated[4] that the "cost of MTA may preclude its clinical use and therefore FS could be used". This seemed to be the case in our study, as the first choice by all those surveyed was FS (40.7%), followed by FC (36.7 %) but MTA came in 3rd position (14%) followed last by CH (8.7%). It was interesting to

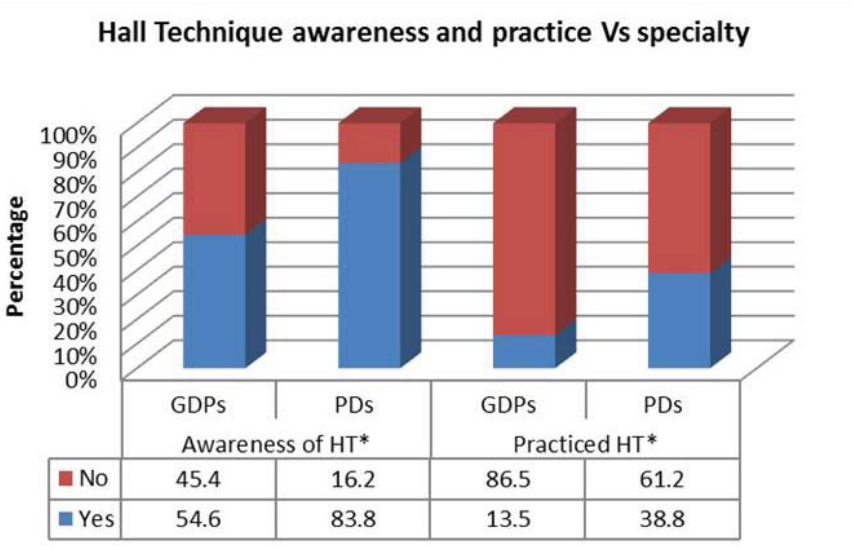


Figure 7. Awareness and practice of the Hall technique per specialty. *denotes statistical significance (*p* >0.05).

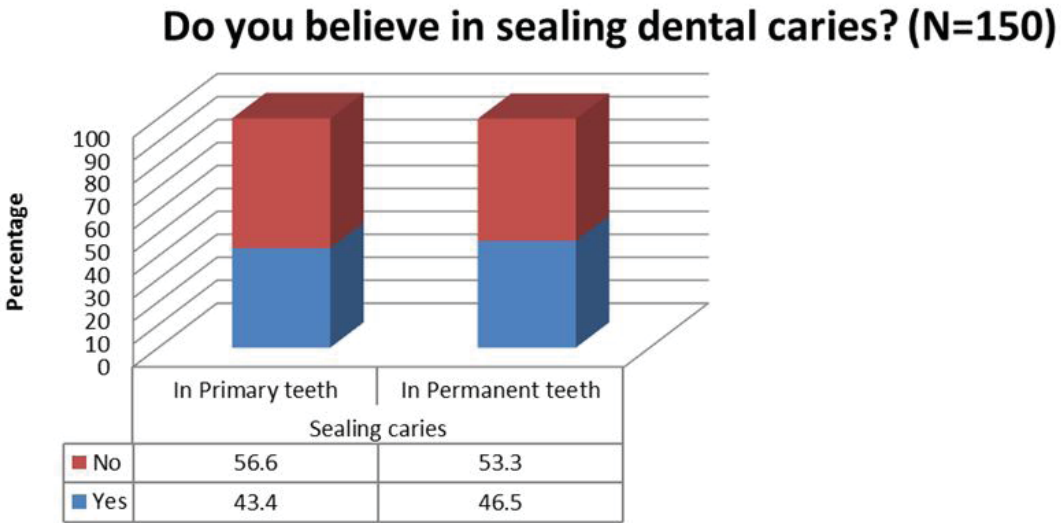


Figure 8. Sealing in caries in primary and permanent teeth. The majority of those surveyed opted for "No" in both dentitions.

notice in our study that, although not statistically significant, there was a tendency for PDs to avoid the use of CH [CH causes internal resorption[19,17]] and chose either FS or FC equally (thus adhering either to the AAPD or the BSPD school of thought). Despite this, background training of those surveyed showed no clear relationship with the PM choice. Finally small proportions of GDPs and PDs (13.4% and 16.1% respectively) chose MTA as a PM medicament. No reason can be extrapolated, however as mentioned above MTA is known to be a costly material.

4.3. Discussion of the Hall technique (HT)

The HT[6,10] is a method in which an asymptomatic, non- pulpally involved and aseptic carious primary molar lesion is managed unconventionally. The lesion is "biologically" treated by isolating it from the oral cavity; by cementing a conventional SSC on the tooth with glass ionomer cement in a child friendly play manner.[27] There is no LA, drill nor is there any tooth cutting carried out[6]. The first appointment involves fitting orthodontic separators mesially and distally to the tooth intended for restoration with the HT. The second appointment involves removal of separators 3- 5 days after the first appointment and selection and cementation of the SSC with GIC by digital and patient bite pressure.[10]

There was a mixed international reaction to the development to the HT in paediatric dentistry circles[28] with many authors supporting it[29,30] and others condemning it outright.[8] In the UK, some had gone so far as to describe it as the "Gold Standard" for restoring the multi-surface carious molar.[9] Our study investigated the knowledge and practice of the HT. It showed that a majority of those surveyed had heard of (n=91, 60.6%) but not practiced (n=122, 81.4%) the HT. The speciality had a significant impact on this as PDs were more aware of, and had practiced the HT more, when compared to GDPs (p=0.003 and p=0.003 respectively). This can be understood as the HT trials were designed and spearheaded in postgraduate paediatric dentistry environments[29] and developments disseminated in specialists postgraduate conferences, attended mostly by PDs.[1] However, some of the said studies were conducted in the primary dental service setting, i.e., GDPs.[6] Ideally; the ultimate aim of developing the HT was for GDPs becoming the end users of the HT in order to share the burden of caries management between GDPs and PDs. This was because most children are seen by GDPs not PDs. It appeared that our study had shown that there is a large gap between knowledge and practice of the HT in this region. One can also apply conjecture and assume that other confounding factors, such as opposition to the HT may also play a part in avoidance of practice, in addition to lack of appropriate hands on courses to cover the subject. However, the latter points were not investigated in this study and warrant further investigation. Finally, it may be useful to recall the responses highlighted in section a) of this paper's discussion (RCM), as less than a quarter of the respondents only, would choose the HT as a treatment modality, in the given straight forward scenario.

4.4. Discussion of sealing dental caries (SDC)

The therapeutic treatment of carious lesions in primary and permanent teeth by complete removal of caries and restoring the defective tooth structure had classically been advocated as the only treatment modality for many years. When taking primary teeth into account, this was confirmed to be the case by those surveyed in the first question in our study. On the other hand, the thought of SDC, especially in a permanent tooth, may be considered malpractice by many; however, it is now becoming acceptable that the therapeutic treatment of carious lesions by complete removal

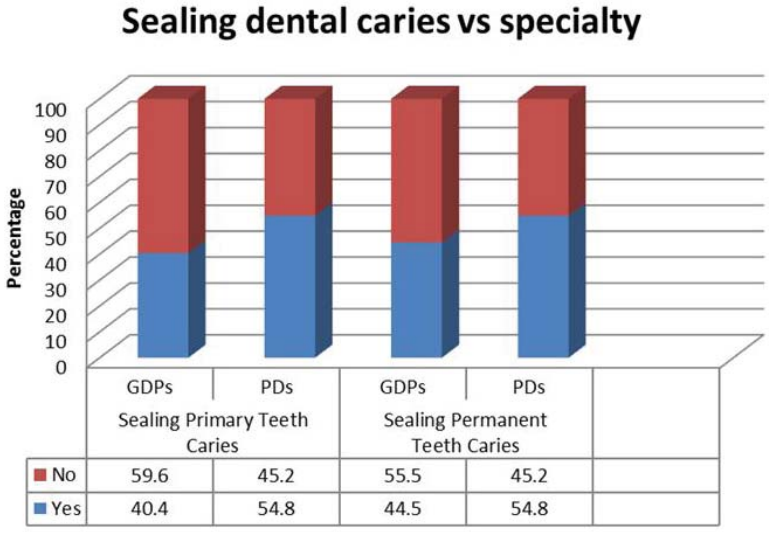


Figure 9. Sealing-in caries and specialty (GDP or PD). No statistically significant results were found between GDPs and PDs.

of caries and restoring the defective tooth structure is only one of the treatment modalities used.[31] SDC in permanent teeth where the carious lesion is partially removed or completely left has been employed as an accepted therapeutic technique by some with ten year results[32] and current available evidence supports the SDC approach.[31,33,34] There are several techniques of SDC that are currently employed, ranging from indirect pulp capping[17] either by incomplete removal of caries and sealing over the carious lesion closest to the pulp or by stepwise caries removal where only partial removal of caries is employed, followed by temporary restoration of the tooth for few months. Finally the tooth is re-entered the rest of the carious lesion, if any present, is removed and the final restoration is placed.[31] Another technique[35] is the no caries removal technique where the entire carious lesion is sealed in permanent teeth as well as primary teeth as highlighted above in the HT section. In permanent teeth, the amount of bacteria detected after conventional caries removal was higher than that which remained in sealed caries lesions.[36] A systematic review and meta-analysis of incomplete caries removal studies[37] concluded that in complete caries removal appeared superior compared to complete caries excavation, especially in lesions very close to the pulp. However, evidence levels are currently insufficient for definitive conclusions because of high risk of bias within the studies. A qualitative examination of private dentists' treatment decisions towards non-cavitated carious lesions concluded that the practitioners based their their decisions on their practical clinical experience and dentists' knowledge of the evidence-based recommendations did not lead to higher compliance with these recommendations.[38]
In our survey, we had attempted to assess the opinion of the surveyed dentists regarding sealing decay in primary and permanent teeth. It was clear that the majority did not believe that SDC was a viable option for both the primary and permanent teeth (56.6% and 53.3 %) although we specified "enamel non-cavitated lesion" in the latter question. This indicated that there was reluctance in the GCC region to accept this new concept, and concurred with the pro "*drill and fill*" results from the first question in this survey. Whether the participant was a PD or GDP had no significant bearing on this result (p=0.517 and p=0.182), although there was a slight tendency for PDs to be tolerant to SDC in both dentitions. This correlated in part with the result seen above with regards to the HT, in essence a method for SDC in primary teeth.
Therefore, the hypothesis, that the surveyed GCC dentists; agreed on treatment options for RCM when faced with a non-pulpally involved carious primary molar in a *cooperative child*, agreed on the PM used in a primary molar pulpotomy, had practiced the HT, and agreed to the concept of SDC in primary and permanent teeth was rejected. However they were aware of the HT. Therefore, there is a great need to organise continuing dental education courses for GDPs and PDs in the GCC region to update them with contemporary guidelines and recommendations related to RCM, PM, HT and SDC.
On a final note, ideally we would have liked the sample of PDs to be the same size of GDPs in this study, however, it is known that there are fewer specialist PDs per paediatric dental population (average 7 per 100000 in the USA) compared to GDPs (60 per 100000 persons in the USA).[39] In the UK, there are 242 registered PDs, compared to 41,000 GDPs (personal communication, General Dental Council, UK, 2016). Therefore, our study sample effectively reflected the relative proportions of the said groups in society.[40]

5. Conclusion

Upon surveying the opinion of a group of dentists in the GCC region, we can conclude that there were disagreements amongst them in relation to the concepts of RCM, PM, HT and SDC. They did not agree on treatment choices for RCM, although the majority would surgically remove rather than seal asymptomatic non- pupal caries in a primary molar. There was no agreement of the PM choices for a primary tooth pulpotomy. The majority were aware of the HT but only a minority used it. A majority did not believe in SDC in both dentitions. Therefore there was a reluctance to accept new concepts, such as the HT and SDC. PDs choice of RCM significantly differed from GDPs, and their awareness of HT and practice of HT were more favourable.

Disclosure of potential conflicts of interest

Ethical approval: "All the procedures (questionnaires) performed in this study were in accordance with the ethical standards of Mohammed Bin Rashid University of Medicine and Health Science (MBRU) and the Hamdan Bin Mohammed College of Dental Medicine (HBMCDM), Dubai, United Arab Emirates and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards."
Informed consent: "Verbal informed consent was obtained from all individual participants included in the study."
Conflict of Interest: The authors declare that they have no conflict of interest.
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Authors Contributions: IH (principle author): Concept and design of study, bulk of write up of article, editing, data gathering, analysis and graphs. MH: Design of study, data gathering and sealing caries section in article. MK: Design of study, data gathering and pulpotomy section in article. AKH: Protocol and statistical analysis and tables.

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