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THE USE OF ROTARY INSTRUMENTS IN ENDODONTIC THERAPY OF OLDER DENTAL PATIENTS

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Abstract

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As the older population is continuously growing and many of them retain a significant number of natural teeth, it may be speculated that more endodontic therapies will be performed. The use of rotary instruments constantly grows as they offer many advantages, such as reduction in working time and better preservation of the original root canal morphology. The aim of this study was to discuss the advantages and drawbacks of rotary instrumentation techniques in older patients.

Many older people suffer from significant illnesses restricting access to the dental office and demanding fewer and shorter working sessions. The use of rotary instrumentation may offer a reduction in the number of visits and the duration of the working sessions. They may also help access the root canal system and achieve patency easier and faster, taking into consideration the increased calcification rates and the secondary dentine deposition in older teeth. The drawbacks of the method include increased risk of instrument separation and the possibility of dentine microcracks as its elasticity reduces with ageing.

Rotary systems may be useful tools for the contemporary dental clinician and can offer significant help in many demanding geriatric cases. Nevertheless, they must be cautiously applied after appropriate case selection and familiarisation with their use. More research is necessary on the comparison between the use of rotary instruments and hand files, particularly in older patients.

Keywords: gerodontology, older people, endodontic treatment, rotary instruments

Introduction

Older persons (aged over 65) (1), unlike in the recent past, can no longer be regarded as de facto edentulous. In many developed or even developing countries an increase in the retention rates of natural teeth in older persons has been recorded over the last decades (2-5). As the older population is continuously growing and many of them retain a significant number of natural teeth, it is expected that more restorative procedures will be needed including endodontic therapies (6). A large number of untreated decayed teeth and few dental visitations for a regular check-up have been recorded in older people in Greece (7) and other

countries, indicating a potential increase in the need for endodontic therapy in the near future.

A gradual change in the field of Endodontology, which has become a daily routine, is the use of rotary instruments. Rotary systems in Endodontology have offered many advantages, including reduction in working time (8, 9). Moreover, a better preservation of the original root canal morphology can be achieved, as well as a more effective standardisation of its final shape (10). Some years ago, skepticism existed concerning their use (11), but today they are regarded as a necessity rather than a luxury. To the best of our knowledge, the international

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Figure 1. Calcified root canal in an older patient's tooth (#11) diagnosed with symptomatic apical periodontitis (courtesy of Dr Konstantinos Kalogeropoulos)



Figure 2. The older patient's tooth (#11) treated using NiTi rotary instruments (courtesy of Dr Konstantinos Kalogeropoulos)

bibliography on the specific use of rotary instruments in older patients is very limited.

Ageing is characterised by great biological variability and dental management needs to be individualised and patient-centered. The older dental patients can be generally divided into three groups based on their sociomedical condition that affects clinical decision making:

1. *Independent older people*, socially active without any significant health problems. They usually belong to the "younger old" group, aged between 65 and 75 years. The dental treatment protocol for these patients does not usually differ from the one applied in younger patients.

2. *Frail older people*, who are usually medically compromised, receiving a variety of medications and needing external support in their daily life. These patients face difficulties visiting the dental office and are usually accompanied by a carer. They often belong to the "older old" age group (over 75 years of age) and dental treatment is highly individualised.

3. The last group includes the *fully dependent geriatric patients*, who suffer from increased morbidity and dependency and are usually confined at home, at a nursing home or at hospital. In these patients domiciliary or hospital dental care may be necessary and the treatment options are very limited.

This study refers to the first two groups of patients and the aim is to discuss the advantages and

drawbacks of rotary instrumentation techniques taking into consideration the specific characteristics of older patients.

1. Advantages of rotary instrumentation

1.1. Working time reduction

It has been claimed that geriatric patients often prefer fewer sessions of longer duration rather than multiple but shorter ones (12). Additionally, many clinicians prefer single-visit endodontic treatment over multiple-visits in medically compromised patients (13). Significant barriers to oral care in older people are transportation difficulties (14). On the other hand, on many occasions, it is necessary to organise shorter appointments at specific times of day when the illness is better controlled (i.e. for patients with neurological or cardiovascular disorders) (15).

When the sessions must be kept short or the therapy must be completed in a single appointment, rotary instruments may offer an advantage to the clinician. The use of rotary systems may reduce the duration of mechanical preparation of the root canal system (8), making the endodontic procedure easier for both the patient and the clinician. However, there is lack of published data on the exact time earned through rotary instrumentation during root canal preparation, but it has been mentioned as a side-observation (16). Consequently, better cooperation with the patient and high quality endodontic therapy can be achieved.

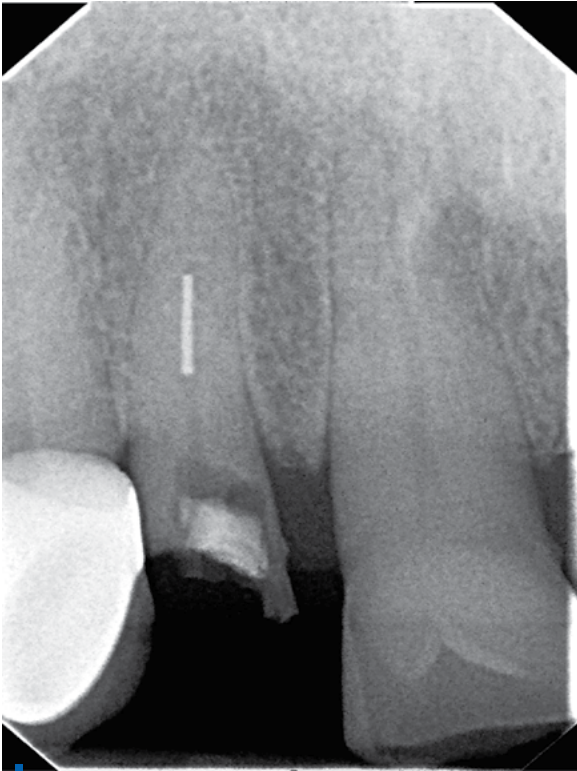


Figure 3. Instrument separation case in an older patient's tooth

It must however always be kept in mind that when a patient is medically compromised, and the basic principles of endodontic therapy cannot be maintained, it would be better to avoid endodontic treatment and modify the treatment plan accordingly (17).

It should be highlighted that the reduction in working time offered by the rotary systems concerns solely the duration of mechanical preparation. A common mistake that needs to be avoided is the omission of an accepted amount of irrigation, for the purpose of chemical disinfection (18, 19).

1.2 Easier access to the root canal system

The access stage is the most important step in endodontic therapy (20). A common phenomenon with geriatric patients is the obstruction of the root canal orifices, due to the calcific degeneration of the pulp chamber and the tertiary dentine formation (17, 21). In many cases, calcification is limited to the cervical third of the canal, resulting in problems mostly in locating and preparing the orifices and not in accessing the apical areas (22). Orifice detection is traditionally achieved with the use of the endodontic explorer DG16. After the orifices have been located, access can be achieved using rotary instruments and more specifically with the help of GG burs, which are recommended by various authors, since the early years of Endodontology (23). Other burs can be used as well, specifically designed for achieving access to calcified orifices, such as the LN burs (Maillefer, Denstply) and the Munce Discovery

Burs (CJM Engineering). The respective use of hand instruments may require extra working time.

1.3 Achieving patency

Secondary dentine deposition is continued throughout one's lifespan (24). It is therefore expected that the root canals of elderly patients' teeth are thinner compared to younger patients, to a point that even after accessing them, achieving patency is challenging. Moreover, tertiary dentine is deposited over the root canal walls as a result of the pulp reacting to multiple external stimuli. The root canals in older teeth may be barely visible or not depicted at all when observing the preoperative x-rays (Fig.1). Figures 1 and 2 show an older female patient's tooth (#11) diagnosed with symptomatic apical periodontitis. The root canal was not visible either radiographically or clinically without microscope magnification (Fig. 1). The preparation was performed using NiTi rotary instruments that helped both achieve patency and shape the canal. Due to the patient's orthopedic problems, the transportation to the dental office was very difficult; therefore the endodontic therapy was completed in a single appointment (Fig. 2).

Patency is usually achieved with the use of small file sizes (ISO #6, #8, #10), with a preference for stainless steel files, due to more effective apical transportation of the applied force. Special files have been developed for this purpose with appropriate design (i.e. PathfinderS, C Files). However, the use of rotary instruments with specific design to achieve patency in the root canals (i.e. Pathfile, ProGlider, and Dentsply) seems to have simplified the procedure, ensuring acceptable results in less time. The traditional patency achievement with hand files has been occasionally shown to cause significantly greater root canal transportation and infraction of its original morphology as compared to rotary instruments (25, 26).

2. Drawbacks of rotary instrumentation

2.1 Instrument separation

As mentioned earlier, older patients' teeth often present calcifications. Additionally, root canal wall dentine, due to the physiologic process of sclerosis with aging, displays increased hardness and a high modulus of elasticity (27), which impedes instrument rotation inside the root canal. The root canal size reduction due to deposition of secondary dentine (28), along with the common calcification process, hampers access and obstructs the clinician's visual field. All the above-mentioned factors, in addition to the lack of tactile sensation in rotary systems and the increased cutting efficiency compared to hand files, can lead to iatrogenic events, especially in cases of limited familiarity with their use (Fig. 3).

Many clinical studies have focused on the rotary instruments separation and its prevalence

(29-36), monitoring different systems' behavior and mentioning varying results. The incidence ranges from 1.3% - 10% (36) with a mean prevalence of 1.6% (37). Retrospective clinical studies have shown that the separation incidence for rotary NiTi instruments is 7 to 8 times greater than that of hand instruments (38, 39).

The use of rotary instruments can be significantly improved with the combined use of lubricant agents inside the root canal. These agents facilitate the movement of the instrument inside the narrow environment of the root canal, by decreasing cyclic fatigue and torque load of rotary instruments, especially when they have extra chelating action (40). This way the clinician can handle the rotary instruments more easily and decrease the chance of iatrogenic events and particularly instrument separation. The application of sodium hypochlorite and aqueous chelating solutions (i.e. EDTA) compared to agents in paste form (PC-Prep) has been shown to cause less instruments' fractures (41).

2.2. Dentine microcracks

The use of rotary systems for root canal preparation has been related to the creation of deformations and mostly microcracks in

the inner walls of dentine due to tensions' accumulation, especially in the apical third (42-44). Similar deformations were not observed after preparation with hand files.

Dentine loses its elasticity with age. Consequently, it is possible that these microcracks appear to greater extend in elderly teeth, which may affect their prognosis and increase the possibility of a root fracture. However, this hypothesis has not yet been confirmed.

Discussion

The investigation of the existing literature has shown that more research is necessary on the application of rotary systems in older people and more emphasis should be placed on Geriatric Endodontics.

Conclusions

Rotary systems may be useful tools for the contemporary dental clinician and can offer significant help in many demanding geriatric cases. Nevertheless, they must be cautiously applied after appropriate case selection and familiarisation with their use.

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Questions

The older dental patients can be generally divided into the following groups:

- a. Independent and frail older people.
- b. Fully dependent and frail older people.
- c. Independent older, frail and fully dependent older people
- d. There are no specific patients' categories. We treat every dental patient older than 65 years of age according to similar principles.

Endodontic procedures in geriatric patients :

- a. Should be completed in a single appointment, in order not to burden the patient with multiple visits.
- b. Should be distributed in multiple and shorter appointments, in order not to burden the patient with long-duration procedures.
- c. Should only be scheduled in the morning.
- d. Should be adapted to each patient's individual needs.

Separation prevalence of rotary NiTi instruments has shown to be :

- a. Greater than that of hand instruments.
- b. Less than that of hand instruments.
- c. Almost the same with hand instruments.
- d. No clinical instrument separation has been reported for rotary NiTi instruments.

Specify a common problem when performing endodontic treatment in older patients' teeth:

- a. Local anesthesia is very difficult to perform.
- b. The teeth roots often present internal resorption.
- c. Rubber dam isolation placement is very difficult.
- d. Dentine deposition narrows the canal and makes access and patency very difficult.