How to Cite:

Doshi, K., & Ranjan, M. (2022). Comparative analysis of the knowledge, attitude and practice of calcified canals and its management by general dentists and endodontists. *International Journal of Health Sciences*, *6*(S8), 737–748. https://doi.org/10.53730/ijhs.v6nS8.11564

Comparative analysis of the knowledge, attitude and practice of calcified canals and its management by general dentists and endodontists

Krisha Doshi

Post Graduate Student, Department of Conservative Dentistry and Endodontics, Saveetha Dental College, Saveetha Institute of Medical and Technical Sciences, Chennai, India

Manish Ranjan

Reader, Department of Conservative Dentistry and Endodontics, Saveetha Dental College, Saveetha Institute of Medical and Technical Sciences, Chennai, India

Abstract---Calcifications in the pulp space pose a challenge to most dental practitioners. Although they are a common finding, their management is not done appropriately in many cases. This leads to numerous iatrogenic mishaps like ledging, gouging, perforations, etc. Hence, adequate knowledge about pulp calcifications and their proper management is necessary for successful endodontics. Such detailed knowledge is usually achieved only during post graduation in endodontics. General practitioners may or may not have the sufficient knowledge and skill to manage such cases. This survey aims at comparing the knowledge of pulp calcifications, and the attitude and practice of their management between general practitioners and endodontists.

Keywords---pulp canal calcification, calcified canals, survey, general dentists, endodontists.

Introduction

Pulp calcification is a process involving the reduction in size of the intra-dental cavities as a result of hard tissue formation by the cells of the vital pulp. It may end in complete calcification as a result of dentin deposition inside the tooth. Calcified canals are a challenging problem for all dental practitioners. It may affect both healthy and diseased teeth. [1, 2] Trauma, aging, various systemic diseases such as cardiovascular diseases could be causes of calcifications. [3] In

Manuscript submitted: 9 April 2022, Manuscript revised: 18 June 2022, Accepted for publication: 27 July 2022

International Journal of Health Sciences ISSN 2550-6978 E-ISSN 2550-696X © 2022.

addition long-term irritation such as deep caries and restorations with close proximity to the pulp, non-vital tooth without endodontic treatment and crowns that exert constant force on the tooth. have been proposed as possible factors in the development of pulpal calcifications [4]. The exact mechanism of canal obliteration is unknown but is believed to be related to damage to the neurovascular supply of the pulp at the time of injury [2].

Negotiation of calcified canals is a challenge to most dental practitioners and requires patience, adequate knowledge, good magnification, illumination and proper armamentarium. The challenge begins with identification and diagnosis of these cases. It is a misunderstanding that all teeth with calcified canals require endodontic treatment [5]. The incidence of calcified teeth developing a pulpal pathology is 1-16% [6–8]. It is in such scenarios that endodontic therapy becomes a necessity. Adequate knowledge and understanding of the subject will clear out such misconceptions and aid in their better management. Over the years, newer instruments have come into the market to improve the efficiency of the clinician while treating these teeth. Ultrasonics, gooseneck burs, various files like C pilot files, pathfinders, etc have been introduced [9]. The clinician must know about these advances and their proper technique of use to make a decision as to what instruments to use for a particular case.

This knowledge is usually achieved during the elaborate post graduation course in endodontics. Graduates or postgraduates from various other dental branches who practice endodontics, may not have sufficient knowledge about this subject. This makes it all the more important to assess the severity of this situation and take appropriate measures to overcome the risk of mishaps occurring due to the clinician's lack of knowledge and skill. This survey aims at comparing the knowledge of pulp calcifications, and the attitude and practice of their management between general practitioners and endodontists. Previously our team has a rich experience in working on various research projects across multiple disciplines [10–25]. Now the growing trend in this area motivated us to pursue this project.

Materials and Methods

A cross sectional survey was conducted in the month of April 2020. The questionnaire consisted of 20 questions. It consisted of 5 questions on knowledge, 5 questions on attitude and 10 questions on the practice of calcified canals. The questionnaire was circulated among general dental practitioners as well as endodontists in different states of India. The circulation was done via google forms and personal emails. A total of 120 forms were circulated from which 106 responses were obtained. After collecting the data, statistical analysis was done and results were obtained and analysed.

The questionnaire was as follows:

- 1) Which category do you belong to?
 - a) General dentist
 - b) Endodontist

- 2) How often do you come across calcified canals in your practice while performing root canal treatments?
 - a) Very often
 - b) Often
 - c) Rarely
 - d) Very rarely
- 3) What age group do the patients most commonly belong to?
 - a) < 20 years
 - b) 20-40 years
 - c) 40-60 years
 - d) > 60 years
- 4) What do you think are the reasons for the occurrence of pulp calcifications?
 - a) Trauma
 - b) Ageing
 - c) Calcific metamorphosis
 - d) All of the above
- 5) How do you best diagnose a calcified tooth?
 - a) Clinically, yellow discolouration of the tooth
 - b) Radiographically radiopacity seen in pulp space
 - c) CBCT
 - d) All of the above
- 6) How often do you advise a preoperative CBCT of the tooth in calcified teeth?
 - a) Always
 - b) Frequently
 - c) Rarely
 - d) Never
- 7) Do you prefer to perform root canal treatment on every tooth with calcified canal/s ?
 - a) Yes
 - b) No
- 8) If not, which teeth do you treat?
 - a) Vital teeth
 - b) Non vital teeth
 - c) Symptomatic teeth
- 9) How confident are you in performing root canal treatment for a tooth with calcified canals?
 - a) Very confident
 - b) Confident
 - c) Apprehensive
 - d) Very apprehensive
- 10) How often do you refer a case of calcified canals to another dentist or endodontist?

- a) Always
- b) Frequently
- c) Rarely
- d) Never
- 11) How often do you make the use of a dental operating microscope when performing root canal treatment in calcified canals?
 - a) Always
 - b) Sometimes
 - c) Never
- 12) What method of locating canal orifices do you prefer for calcified teeth?
 - a) DG 16 Endodontic Explorer
 - b) Different dentinal colours
 - c) Dyes
 - d) Ultrasonics and Gooseneck burs
- 13) Are you aware of the Champagne Bubble Test?
 - a) Yes
 - b) No
- 14) If YES, do you perform the "Champagne Bubble Test" to locate canal orifices in calcified canals?
 - a) Yes
 - b) No
- 15) How often do you precurve stainless steel hand files before introducing them into calcified canals?
 - a) Always
 - b) Sometimes
 - c) Never
- 16) Which technique of biomechanical preparation of the root canal do you prefer for calcified canals?
 - a) Step back
 - b) Crown down
 - c) Hybrid
 - d) Other
- 17) Which irrigants do you prefer to use while treating calcified canals?
 - a) Purely saline
 - b) Saline + Sodium Hypochlorite
 - c) Saline + Sodium Hypochlorite + EDTA
 - d) Saline + EDTA
- 18) What concentration of EDTA do you prefer to use as a chelating agent in calcified canals?
 - a) 15%
 - b) 17%
 - c) 19%

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- 19) Are you aware of Guided Endo Access with 3D technology?
 - a) Yes
 - b) No
- 20) If YES, do you think Guided Endo Access with 3D technology is a preferable approach in performing root canal treatment in teeth with calcified canals?
 - a) Yes
 - b) No
 - c) Maybe

Statistical Analysis and Results

Out of the 106 responses obtained, 56.7% were general dentists and 43.3% were endodontists. When asked about how often preoperative CBCT was advised before starting endodontic treatment of calcified teeth, 72.1% of the population did not consider it a necessity.



Figure 1: Pie chart showing frequency of advising a pre-operative CBCT for calcified teeth.





When asked about the Champagne Bubble Test, although 81.2% of the population was aware of the test only 46.9% actually practiced it.



Figure 4: Pie chart representing the use of dental operating microscopes by clinicians during management of calcified teeth.

When asked about the use of a dental operating microscope while treating calcified canals, 53.8% practitioners do not use it at all.

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Discussion

Spontaneous calcification of the pulp chamber in a young person's tooth is not common; this may occur idiopathically or following direct pulp capping or trauma. In a process termed `calcific metamorphosis', early obliteration of the pulp chamber and canal can occur following significant traumatic injury to the affected tooth [26]. A high incidence of calcified canals has been observed following pulpotomy and direct pulp capping [27, 28]. This has been postulated to be a result of uncontrollable mineralization in which the normal self-limiting enzyme, the pyrophosphatase, fails to operate [29]. A reduced capillary permeability following the increased number of calcium ions could reduce serum flow within the dental pulp resulting in a low concentration of inhibitory pyrophosphate ions [29].

Age changes such as reduction in size of pulp due to secondary dentin deposition, occur throughout life resulting in reduction in root canal length and width. In addition, the blood supply decreases with age. The pulp horns and the floor and roof of the pulp chamber in molars, may be converted from a large rectangular cavern in the young, to a flat disc in the elderly [3]. This diminished pulp space occurs throughout life by the deposition of secondary dentine.

Pulp stones or denticles are the calcifications that occur in the coronal region. According to morphology; the pulp stones are classified as true or false. True pulp stones have dentinal tubules like dentin, odontoblastic processes, and few odontoblasts, whereas false pulp stones are concentric layers of calcified tissue with a central cellular area, which might be necrotic and acts as nidus of pulp stone formation. According to their location; they can be classified into embedded, interstitial, adherent, and free denticles [30].

The mechanism underlying the pulp canal obliteration is an enigma. According to Torneck (1990) [31] the deposition of hard tissue is either a result of stimulation of the pre- existing odontoblasts or a result of the loss of their regulatory mechanism containing a maze of small irregular spaces and cul-de-sacs, which extend from the pulp chamber to the apical foramen. Andreasen and Andreasen et al, [32] described calcific metamorphosis as a response to severe injury to the neurovascular supply to the pulp, which after healing leads to accelerated dentin deposition, and is closely related to the loss and re-establishment of the pulpal neural supply. Ten Cate (1998) [33] identified this process as the deposition of tertiary or reparative dentin in response to irritation or trauma.

According to the Jacobsen & Kerekes (1977) [7] the crowns 79% of 122 teeth with pulpal obliteration of the tooth showed yellow discoloration .these teeth with pulp obliteration is darker in hue than the adjacent teeth and exhibits a dark yellow color because of a decrease in translucency due to a greater thickness of dentin under the enamel. Some teeth also have a grey discoloration; it is not mandatory that all teeth with radiographic signs of pulpal obliteration undergo a color change [34]. It has also been found that more than two-thirds of teeth with pulpal obliteration are asymptomatic. The radiograph of PCO appears either as partial or total obliteration of the pulp canal space with or without associated per apical pathosis [35]. Complete radiographic obliteration of the pulp space does not necessarily mean the absence of the pulp canal space; in the majority of these cases, a pulp space with pulp tissue is present, but the sensitivity of conventional radiographs is too low to allow their image to be captured [36].

Treatment of calcified canal is delayed until there are symptoms or radiographic signs of periapical disease are clearly evident [37]. Teeth demonstrating pulpal obliteration but no periapical disease should be managed conservatively through clinical observation and periodic radiographic examination. In the tooth with calcified canals Oginni et al. (2009) recommended that root canal treatment should be initiated in teeth with tenderness to percussion. Teeth with periapical index scores more than or equal to 3 are included for root canal treatment [38].

Before the access preparation the practitioner should assess the distance from the occlusal surface to the pulp chamber by placing the bur on preoperative periradicular film. After the initial access opening, the bur is left in place and three radiographs are taken by applying the buccal object rule to aid in the determination of calcified root canals. Using a rubber dam is mandatory. Surgical operating microscopes are recommended for magnification and improved visualization. Adequate lighting and magnification removes all the guesswork as most of the general dentists could not afford operating microscopes in their clinical set up, dental loupes could be an alternative tool. Access must be straight line. Recently EndoGuide® was introduced, to increase visibility and control during endodontic exploration while locating hidden orifices apart from the traditionally used long neck (LN-bur) round bur, extended-shank round burs, such as the Mueller bur, and the Munce Discovery bur. DG-16 explorer, Dyes such as methylene blue and transillumination are used to locate canal orifice [39].

In Transillumination technique the lights in the room and dental unit are turned off, then fiber optic light is used and it is passed through the tooth at the CEJ level, at this point the tooth will appear like a Jack O'Lantern' with Calcified canals appearing as dark dots and not as wide canals. In champagne' test 5% sodium hypochlorite is placed into the pulp chamber over a calcified canal containing remnants of pulp tissue resulting in a stream of bubbles emerging from the oxygenation of the tissue. This can be seen under the microscope and be used to identify the canal orifice [40].

Recently ultrasonic tips with finger tips are preferred over bur to remove less dentin with minimum perforation risk. BUC 1 tip is used for uncovering the pulp chamber floor and in removal of pulp stones. The BUC-3 is a sharp diamond-coated pear tip used to create a smooth, clean flat troughing groove that facilitates canal location under water port for increased washing and cooling of the operative site. Start-X is a set of 5 ultrasonic ips, in which tip #3 is a canal opening scouter and helps in removing any obstruction in the pulp chamber and tip #5 reveals the original pulp chamber floor anatomy .Micro-Orifice Opener aid in initial penetration and locating canals [41].

Canal Pathfinder which has reduced flute or instruments with greater shaft strength such as the Pathfinder CS (Kerr Manufacturing Co.), can also be used which are more likely to penetrate highly calcified canals. C+ Files (Denstply, Tulsa, OK, USA) are also ideal for initial instrumentation of calcified root canals. They have a cutting tip that engages the dentin. Use of nickel titanium files is contraindicated because of lack of torsional strength [39].

Chelating agents containing ethylene-diamine- tetra-acetic acid (EDTA) are used for lubrication, emulsification, and holding debris in suspension. RC Prep (viscous chelator) is unloaded onto the pulp chamber using a syringe, then precurved files are gently inserted into the root canal. The lubricant encourages the file to slip and slide by intracanal calcifications, such as pulp stones or sheaths of fibrotic tissue thus facilitating the negotiation of the canal. After creating clean, tapered canals, clinicians need to adequately obturate the root canal system, provide an impermeable fluid tight seal within the entire root canal system, and prevent coronal and apical microleakage. Our institution is passionate about high quality evidence based research and has excelled in various fields [42–48]. We hope this study adds to this rich legacy.

Conclusion

In this survey, it is evident the knowledge, attitude and practice of endodontists towards calcified canals is sufficient, but that of general dentists is not. Hence more effort needs to be made towards educating the general dentists about such topics. If still not sufficient, the general dentist must understand that such cases are out of their ability and must not feel ashamed to refer it to a specialist. Calcified canals can be managed efficiently by their patient and diligent sequential negotiation. Sequential use of the recent armamentarium under adequate illumination and magnification aids in treating calcified canals which had been a nightmare to the dentists.

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