



TAPER

Journal of Indian Dental Association, Thiruvalla



Volume 5

Issue 1

November 2021

Website : idathiruvalla.org

Email ID : idathiruvalla@gmail.com

INDIAN DENTAL ASSOCIATION, THIRUVALLA BRANCH



2021 - ONAM Celebrations



Charity Program



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Editorial

Though we have reached the grim mile stone of total covid-19 cases as 3 to 4 crores in India, what gives us hope for the future is our vaccination status. Our health administration could distribute 100 crore vaccine shots over a span of nine months, which is a great achievement, when considering the population density in our nation. In spite of all these we could achieve only 20-30 % of our population is fully vaccinated. So covid -19 is still a sword on ours heads and miles to go to achieve the ultimate aim of *covid free India*. So as health workers we need to continue the safety measures we are following in our practices for some more time.

With this words I would like to thank lord almighty, office bearers of IDA Thiruvalla, contributors for bringing up this journal in a esteemed way.

With warm greetings to all members

Dr. Minimol K Johny

Editor Taper

IDA Thiruvalla



PRESIDENTS MESSAGE

Warm Greetings to all

It is with great privilege and honour that we could publish the fifth edition of our journal 'TAPER'. At the outset, I would like to thank all the members who contributed their articles and also I congratulate Dr. Minimol K Johny for all her efforts to bring out this Journal.

The outbreak of Covid 19 has created a global health crisis and that has had a deep impact on the way we perceive our everyday lives. Masks, sanitizers and social distancing are here to stay. Despite all these hardships and uncertainties we were able to stay in touch with all our members through online meetings. During this period we released a e-photo directory which I am sure will be very useful for all of us to communicate. We conducted a national online essay competition on the occasion of Green Dentistry Day which was very well appreciated by our National IDA Office. A smile contest in connection with World Smile Day as also conducted. Even though both these programmes were online we received an over whelming response. Physical meetings were also held with strict Covid protocols. All activities are posted in our website www.idathiruvalla.org

We are coming to the end of another IDA year. It was a privilege an honour to serve our branch for two years. I would like to thank the executive committee and all the members for their support during this period.

Expecting all your cooperation and support in the future also

GOD BLESS YOU

Thank You

Dr. Simon George

President


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IMPLANT SUPPORTED OVERDENTURE-A CASE REPORT

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ABSTRACT

Implant supported overdentures have proved to be one of the best treatment options in prosthetic rehabilitation of an edentulous patient. They significantly improve the quality of life of patients with their long-term serviceability and comfort. This is a solution to many of the problems experienced by edentulous patients. This case report aims to throw light on a case of a completely edentulous patient who was rehabilitated with an implant supported overdenture in mandible and a complete denture in the maxilla.

Keywords: Implant support overdenture, edentulous, rehabilitation, Dental Implant.

Introduction

Edentulous condition is usually a challenging situation to both the patients as well as the clinician. Bone resorption especially in mandible is an important factor to be considered during rehabilitation. ⁽¹⁾ Complete maxillary and mandibular dentures have been the traditional standard of care. But many patients have reported problems adapting to their mandibular denture due to lack of

comfort, retention, stability and inability to masticate. Implant supported overdenture have proved to be an effective alternative treatment for edentulous patients for the past 20 years and have achieved predictable good clinical results.

Tallegren has reported that a mean decrease in anterior mandibular ridge

height was 4 times greater than that of the maxilla. Alveolar bone loss can be reduced by provision of implants.⁽²⁾ By placing implants in the edentulous mandible and subsequently loading them, bone resorption can be limited as light irritative stimuli lead to changes in bone architecture, shape and volume resulting in subperiosteal growth.⁽³⁾ This is supported by Wolff's law, which states that a change in function leads to a change in structure.⁽⁴⁾ Feine and Carlsson advocated the two implant retained overdenture as the standard of care for the edentulous mandible in a consensus conference held in 2002.⁽⁵⁻⁷⁾

Implant supported overdentures have many advantages like good stability, retention, preservation of bone volume, improved function, psychological benefits, proprioception and comfort. It is also a cost-effective treatment option when compared to implant supported fixed prostheses. They are relatively simple to construct and restore both dental and alveolar tissues and also provide facial support.

Implant supported prosthesis vary in design according to the available bone, the amount of inter-arch space available, method of attachment and the affordability

of the patient. The selection of attachment systems like stud, bar or magnet depends on a number of factors like type of prosthesis, number of implants, patient's expectations, amount of retention required and cost.

This case report describes step by step procedure for fabrication of an implant supported overdenture with ball attachments for an edentulous mandible opposing a maxillary complete denture.

CASE REPORT

A 61-year old male patient reported to the department of Prosthodontics, Pushpagiri College of Dental Sciences and hospital for prosthetic rehabilitation of his edentulous jaws. He presented with the chief complaint of missing teeth which disabled his dietary and speaking activities. He also demanded for the best complete denture possible both in esthetics and function.

The patient was screened according to the protocol which includes his general health and treatment possibilities. His past medical history was not significant. Dental history included recent extraction of teeth due to severe periodontal disease. Extraction was uneventful.

On intraoral examination, it was revealed that the patient has completely healed maxillary and mandibular edentulous ridges and absence of any bony spicules or undercut when palpated on both upper and lower arches. Moderate residual ridge resorption was seen in mandibular posterior region (Fig.1). Overlying mucosa appeared normal and healthy. Temporomandibular joint examination was found to be normal. Orthopantomograph reveals severe bone loss in the posterior region of mandible (Fig.2). The inter-ridge distance was also assessed. Routine blood examination revealed normal findings.

Different treatment options were explained to the patient like implant supported removable overdenture, implant supported fixed overdenture and conventional complete denture. Patient has opted for conventional complete denture in the maxillary arch and two implant supported removable overdenture in the mandibular arch.



Fig:1(Pre-op image)



Fig:2 (Pre-op OPG)

Primary and secondary impressions were made and jaw relation were recorded. Diagnostic teeth-set up was done at appropriate vertical dimension to assess the available restorative space. Maxillary and mandibular dentures were fabricated in conventional manner. Occlusion was set according to bilateral balanced occlusal scheme. All the deflecting contacts in both centric and eccentric movements were eliminated. Patient was instructed regarding the maintenance of the denture at the time of denture insertion. Surgical template was fabricated by duplicating the mandibular denture using clear auto polymerizing acrylic resin (DPI Self cured Acrylic Resin, Clear). The desired implant location B and D positions (Misch overdenture options OD-1) was marked on the duplicate denture and stone cast. ⁽⁸⁾ Markings also corresponds with the implant position and angulation. Genesis Active implant of 3.0mm diameter and

10mm length were selected to be placed on both positions. It was planned to use ball and socket type of attachment system.

Surgical phase

Implant surgery includes alveolar ridge reduction and placement of the implants with the help of a surgical template (duplicate mandibular denture). Implant surgery was carried out in 2- stage surgical protocol. The osteotomy sites were prepared in B and D region after raising a flap under local anesthesia with the help of surgical template. A guide pin was used to ensure that the second implant was as parallel as possible to the first. The selected implants were placed at the prepared sites and surgical cover screws were placed (Fig.3). The flaps were approximated using primary closure. The patient was instructed to avoid wearing the lower denture for 2 weeks following implant surgery. Antibiotics were prescribed for 7 days. Patient was advised to use disinfectant mouth rinse (Listerine) 2-4 times daily. Oral hygiene maintenance instructions were given. After two weeks sutures were removed and healing was satisfactory. The intaglio surface of mandibular denture was trimmed and replaced with soft tissue conditioning

material (GC Reline Soft TM) according to the manufacture's direction and the excess liner material was trimmed. The mandibular denture was inserted into the patient mouth after finishing and polishing. This enabled the patient to use mandibular denture till osseointegration of implants occurs. The patient was called for periodic checkup and he did not complain of any discomfort or pain during post-implant surgery. The denture was relined as needed.



Fig: 3 (intraoral view showing implant placement)

Prosthetic phase

After 4 months of healing, confirmation of osseointegration done using intraoral periapical radiograph. Then, the second stage of implant surgery was planned.

When the patient presented for second surgery, local anesthesia was given and the implants were exposed. Stability of the implants were checked by applying slight pressure on the implant. Then, surgical cover screws were removed and the sites

were irrigated with sterile normal saline (Normal Saline Flush). Gingival formers were placed on the implants and the gingival tissues were allowed for the formation of proper gingival collar. After 2 weeks, formation of proper gingival collar and the comfort and fit of the dentures was checked before proceeding with the attachment procedures. Ball and socket overdenture abutment of .5mm diameter (NP-0020) was selected. Seating of the abutments was verified using IOPA x-ray. Teflon tape was rounded over the abutments. Cellophane sheet cut into small square pieces were placed in between the ball attachment and metal cap so as to facilitate easy removal of denture. The attachments and O rings (RS-2660) Plastic Ball Cap -White were placed (Fig.4). Using an articulating paper (blue), the position of the implant was marked on the intaglio surface of the mandibular denture while placing it in occlusion. Acrylic resin from the blue marked area on the intaglio surface of the denture was removed so as to place the stainless-steel ball (RS 2675) on the denture (Fig.5). A No.6 round bur was used to vent the pick-up space toward the surface of the denture. The vent was placed lingual to the lower canine denture teeth. The pick-up space was half filled

with autopolymerising acrylic resin and the mandibular denture was placed over the abutments. The patient was instructed to bite in centric occlusion in light occlusal pressure. The complete seating of the denture was verified. The pick-up resin was trimmed and polished in the venting area (Fig.6). Mandibular denture was re-checked for fit and occlusion in centric relation position. (Fig.7) Abutments were screwed with a final torque of 35Ncm. The screw opening was blocked with gutta percha points. Post -insertion instructions were given to the patient. The patient was trained to place and remove the prosthesis without much strain on the implants. First recall was done after 24 hours and occlusion verified(fig.8). Patient was advised for a regular follow up for every six months. Also instructed to remove the prosthesis at night and clean it with soft single tufted brush using gentle soap solution so as to keep the attachments free from plaque and calculus.



Fig:4 (Ball attachments in place)



Fig :5(lower denture after trimming)



Fig:6(attachments in place before placing lower denture)



Fig:7(O-ring in place)



Fig: 7(Occlusion after placing ball attachment)



Fig: 8(Pre-op & Post-op Image ,Post-op OPG)

The patient is successfully using the overdenture in the last three years and is satisfied with it. Recently he had reported with slight looseness of the mandibular overdenture. O-Ring was replaced with a new one and the problem was solved.

Discussion

The transition phase from dentulous to edentulous state is very challenging for both patient and clinician. Implant supported overdenture aids to provide better retention and stability which results in better comfort and long-term serviceability to the patient. The implant supported overdenture remains in place during mandibular movements which allows the tongue and perioral musculature to resume a more normal function, since

they are not required to control mandibular denture movements. ⁽⁹⁻¹²⁾

The design of the implant-retained overdenture can be carried out in two ways. ^(9,10,13)In the first approach, implants are splinted with a rigid interconnecting bar that incorporates an attachment mechanism for the overdenture retention. In the second approach, implants are not interconnected to each other and the retention mechanism is provided by an abutment that incorporates some form of retentive mechanism. A major advantage of the freestanding implants is the fact that they allow for the use of the prefabricated stock retentive abutments. The use of the interconnecting implant bar requires additional laboratory and clinical procedures for its fabrication and the associated increase in treatment cost. ⁽¹⁴⁾

Ball /O-ring attachment system consists of a retentive patrix, which is part of an abutment, has the shape of a small ball with different diameters and is made of metal alloy. The matrix is attached to the fitting surface of the denture and into which the patrix fits. The matrix is composed of metal or resilient nylon. A plastic ring is fitted in a groove inside a metal ring or socket, which is housed in the

fitting surface of the denture. The advantages are easy of maintenance, low cost, minimal chair-side time, ease of replacement of elements, if required. Disadvantages are the patrix (ball) violates the vertical restorative space and are not suitable to use when the implants are not parallel (an angulation $>15^{\circ}$). To overcome these disadvantages, locators were developed (Zest Anchors, Escondido CA, USA) in 2001. Locators are classified as universal hinge. Examples of the ball attachment system include the Dal-Ro[®], BioMet 3i, the Dalbo (Dalbo-B[®] And Dalbo Classic[®], the dental precision (Cendres+Matrix) and the Preci-dix[®] (Preat Corp). ⁽²⁾ Performance data of the implant-retained overdenture indicate that most of the complications and prosthodontic maintenance are related to the attachment components of the overdenture.

Follow up and maintenance is a vital step for the success of the overdenture. There should not be signs of peri-implantitis, peri-mucositis, tissue overgrowth, or calculus formation. Home care implements like tooth brushes, interdental brushes, end-tufted tooth brushes, proxy tip, nylon-woven flossing cord, denture brushes and denture cleaning tablets can be used.

It is generally accepted that for an edentulous mandible, two implant-supported overdenture treatment is the standard of care rather than conventional denture treatment.^(5,15) In studies that compared different types of attachment systems in terms of retention, ease of use, hygiene and stability, it was found that the number of implants and the type of attachment system did not significantly affect patients acceptance and satisfaction with mandibular overdentures.^(16,17) The chewing efficiency with an implant-supported overdenture is improved by almost 20% compared with a traditional complete denture.⁽¹⁸⁾

It is important to assure that overdenture should have only passive fit without any occlusal interferences so as to avoid any overloading to the dental implants which can later result in overdenture fracture, implant fracture or implant loss.

Conclusion

Implant supported overdenture is indeed a boon for patients with moderately and severely resorbed mandibular ridges. There are many studies documenting the success of this treatment modality. This case report describes the successful

management of edentulous patient with implant supported overdenture with Ball/O-ring attachment system. Among different treatment options, an implant supported overdenture is a simple, cost effective solution to the patient and it will preserve hard and soft tissues of the patient and give psychological relief to the patient.

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**ACCESSORY ROOTS AND ROOT CANALS IN RADICULOUS HUMAN
PREMOLARS: CASE REPORTS**

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Introduction:

A thorough knowledge about the root canal morphology is inevitable for successful outcome of endodontic treatment. Anatomical variations always pose challenges to the clinicians in the disinfection & obturation of the root canal space. Missed canals are one of the major reasons for failed root canal treatment. Root canals are left untreated when a dentist fails to identify them particularly in the teeth that have morphological variations of root canal patterns. In the study by Hoen & Pink, the incidence of missed canals was reported to be 42% of all the endodontically failed teeth (1, 2).

Maxillary first premolar is the most common bi-rooted tooth with occasional presentation of three roots system. It is considered as a transitional tooth between

incisors & molars. Although it usually has two canals, radicular irregularities consisting of fused roots with separate canals, fused roots with interconnections or “webbing”, fused roots with a common apical foramen & the unusual but always to be considered three-rooted & three-canal conditions can be present in maxillary first premolars (3).

Variations in number & type of root canals are widely described anomalies in literature. The presence of two canals is considered normal but ethnic differences in the root canal morphology have been established (4). The anatomy of a maxillary premolar with three canals, mesio buccal, distobuccal & palatal is similar to maxillary molars & they are sometimes referred to as small molars or radicular (5).

Similarly, the tooth which is considered by Slowey as the “enigma of endodontists” is the mandibular first premolar. Though most frequent type of root canal configuration in mandibular first premolar is one root and one canal, it exhibits aberrant configurations including the presence of a second canal, second root, three canals and even a “C” shaped canal (6).

Studies on anatomical & morphological configurations of mandibular first premolars reports that 23-30% are more prone to bifurcation of canals & 15-20% terminating in multiple apical foramina (7).

Clear knowledge of tooth morphology, proper interpretation of preoperative radiographs (straight & angled), adequate access cavity preparation & a detailed exploration of the pulp chamber floor of the tooth are needed to prevent the mishap of missing canals(5). 3-dimensional imaging (CBCT) & use of magnifying visual aids such as the operating microscope and surgical loupes offers easy identification of root canals in such cases as identifying them early is necessary to facilitate appropriate modifications in treatment protocol,

armamentarium to be used & plan optimal number of treatment sittings (4,8).

This article reports two cases, a maxillary first premolar with three canals and a mandibular first premolar with two roots which were missed initially during a root canal treatment but, later identified & managed.

Case Report - 1:

A 24 years old male was reported at Dept. of Conservative Dentistry & Endodontics OP complaining of spontaneous pain in relation to upper left back tooth. He had a non-contributory medical history & a history of previous amalgam restoration in upper left first premolar, placed 10 years ago. Clinical & radiographic evaluation revealed a secondary carious lesion in that tooth which had pain on percussion & has exhibited normal mobility. Radiographic appearance of periapical region revealed a slight widening of periodontal ligament space. Based on the findings, a diagnosis of symptomatic irreversible pulpitis with apical periodontitis was made (Fig.1-a).

Access cavity was made with no. 2 round bur (Mani) after injection of local anesthesia, 2% lignocaine with 1:2,00,000

adrenaline. Tooth was isolated with rubber dam (GDC). During inspection of pulp chamber floor, two canal orifices were located which were close to each other & were present in the buccal section. Working length was determined using electronic apex locator (Root ZX Mini, J Morita) & confirmed with radiograph (Fig.1-b). Canals were instrumented with ProTaper Gold rotary file system (Dentsply Mailleffer) upto size F1 by crown down technique. Patency was checked with a No.10 K-file (Dentsply Mailleffer) & irrigated with 3% NaOCl solution & normal saline. Master cones were selected & canals were obturated by single cone technique using AH Plus sealer (Dentsply). Temporary restoration was given with zinc polycarboxylate cement.

But postobturation radiographic examination revealed the flow of obturating material in a third canal (Fig. 1-c). Patient was recalled & temporary restoration removed. Gutta-percha removed from root canals with a No. 25 H-file (Dentsply Mailleffer). Further inspection revealed a palatal canal orifice. The positions of canal orifices were: one mesiobuccal, one distobuccal & one

palatal. Canal was negotiated with K-files upto size 20 (Fig.1-d) & cleaning & shaping done by crown down technique upto size F1 using ProTaper Gold rotary files (Dentsply Mailleffer). Irrigation was done with 3% NaOCl solution & normal saline. Master cone was checked (Fig.1-e) & obturation completed with single cone technique using AH Plus sealer (Dentsply) (Fig.1-f). Type II GIC was given as orifice restoration & composite was given as permanent restoration (Fig.1-g).

Case Report – 2:

A 43 years old male was reported at Dept. of Conservative Dentistry & Endodontics OP complaining of painful tooth in lower right back region. He had a non-contributory medical history. Clinical & radiographic evaluation revealed tooth with tenderness to percussion test & has exhibited normal mobility. Radiographic appearance of periapical region revealed a slight widening of periodontal ligament space. Based on the findings, a diagnosis of symptomatic irreversible pulpitis with apical periodontitis was made (Fig.2-a).

Access cavity was made with no. 2 round bur (Mani) after injection of local anesthesia, 2% lignocaine with 1:200000 adrenaline. Tooth was isolated with rubber

dam (GDC). Access cavity was prepared and canal negotiated. Working length was determined using electronic apex locator (Root ZX Mini, J Morita) & confirmed with radiograph (Fig.2-b). Upon confirmation of working length, while taking a shift radiograph, revealed the presence of additional root. Again pulp chamber floor was explored with surgical loupe (3.5x ErgonoptiX Prismatic) and DG16 endodontic explorer revealed the presence of additional orifice on the lingual aspect. Again working length was re-established and confirmed by radiograph. Canals were instrumented with ProTaper Gold rotary file system (Dentsply Mailleffer) upto size F1 by crown down technique. Patency was checked with a No.10 K-file (Dentsply Mailleffer) & irrigated with 3% NaOCl solution & normal saline. Master cones were selected (fig 2 c) & canals were obturated by single cone technique using AH Plus sealer (Dentsply) (fig 2-d). Type II GIC was given as orifice restoration & composite was given as permanent restoration (fig 2e).

Discussion:

The identification & accessing of root canals is challenging in endodontic

treatment of a tooth with atypical canal configuration. For a root canal treatment to be successful, it is essential to identify, clean & shape the root canals properly before placing a hermetic filling. The presence of an untreated canal, inadequate debridement & incomplete obturation of the root canal system can lead to failure of endodontic treatment (9).

The maxillary first premolar in most cases contains two canals & the access cavity is extended more buccolingually than in single-rooted premolars. Five per cent may have a third root/canal placed buccally (10,11). The classification of root canal forms found in maxillary first premolars according to Kartal *et al.* (1998) was given in Table 1(12). Various authors had studied the root canal configurations of maxillary first premolar which were tabulated in Table 2 (11).

It has been found that ethnicity is a factor in incidence of canal variations. Gupta *et al* found that among the Indian population, there was an increased incidence of Vertucci's types IV, I, II, and III canal morphologies in maxillary first premolars. They also noticed additional canal configurations, Sert&Bayirli's type

XIX (2-1-2-1) & type XIII (1-2-1-3), although they were rare (13).

Radiographs from different angles can be used during endodontic procedures to detect anatomical variations. Straight-on radiographs of maxillary premolars. Sieraski *et al.* suggests that whenever the mesio-distal width of the mid-root image was equal to the mesio-distal width of the crown or greater than it, the tooth probably has three roots (14). But, they may not provide complete information about the canals system as the images are 2-dimensional. With the recent development of CBCT and its incorporation in endodontics, it is now possible to easily identify canals that can be missed even with periapical radiographs obtained from different angles (15).

Preparing a well-shaped endodontic access cavity and investigating its floor thoroughly with an endodontic explorer are also effective in the detection of additional canal orifices. Proper use of magnification with aids such as loupes and dental operating microscope can be useful at this phase.

Balleri *et al.* reported that T shaped endodontic cavity is ideal in terms of cleaning and gaining easy access to the

pulp chamber and canals of the premolar teeth with three roots and canals. According to them, a cut at the bucco-proximal angle, from the entrance of buccal canals to cavo-surface angle, was made so that a 'T' shaped cavity was formed in this case. This T-shaped access technique is useful to locate the root canals properly (16).

While treating teeth endodontically, anatomic variations should be kept in mind, like additional roots and canals. Because if it get untreated, it may harbour microorganisms, and may be a major cause of endodontic failure. Mandibular first premolar can have a quite complex root canal morphology with the presence of additional root. Scott and Turner described the accessory root of mandibular first premolar as Tome's root. The reported incidence of two roots in mandibular premolar is 1.8%.(Kararia et al 2012)(17). The occurrence of two or more root canals in the mandibular first premolars ranges between 2.7% and 65%(Sert and Bayirli 2004). The varied root canal morphology of mandibular premolars is well documented in table no 3 &4.

Conclusion:

Presence of a second buccal canal and root is a rare anatomical variation for maxillary first premolars. Similarly, the 1.8% of mandibular first premolars showing two roots are also rare. But, endodontists should always consider the possibility of unusual number of roots and

canals to overcome infections and prevent persistent apical periodontitis which can lead to failure of endodontic treatment. So, it is of great importance to diagnose and treat the teeth with such variations in order to have endodontic success.

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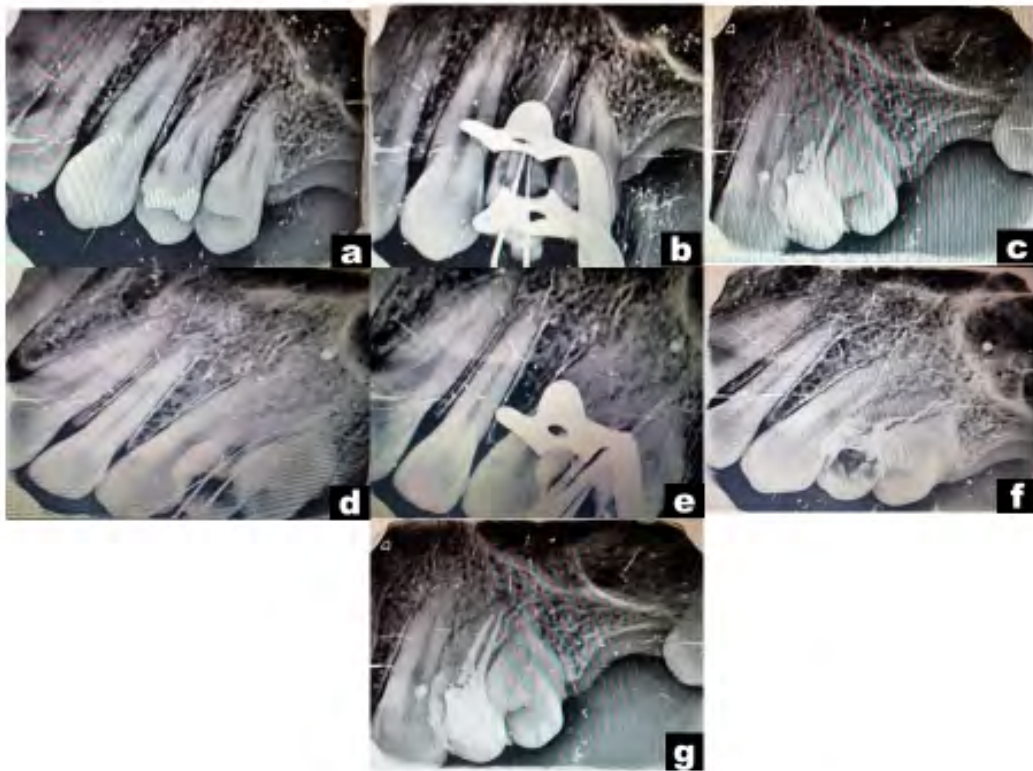


Fig – 1a- 1g: Management of Maxillary First Molar with 3 Canals

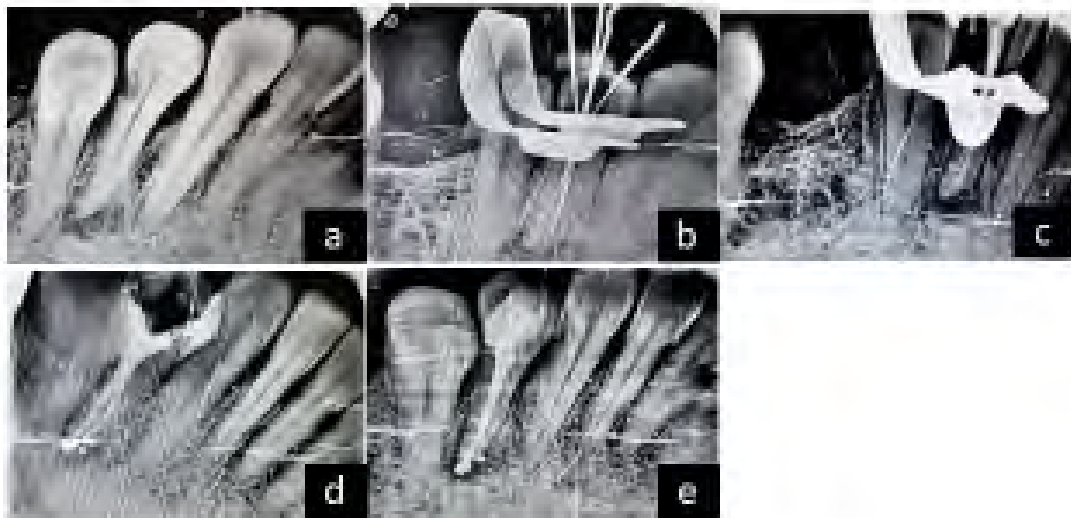


Fig 2a-2e: Management of mandibular first premolar with two roots

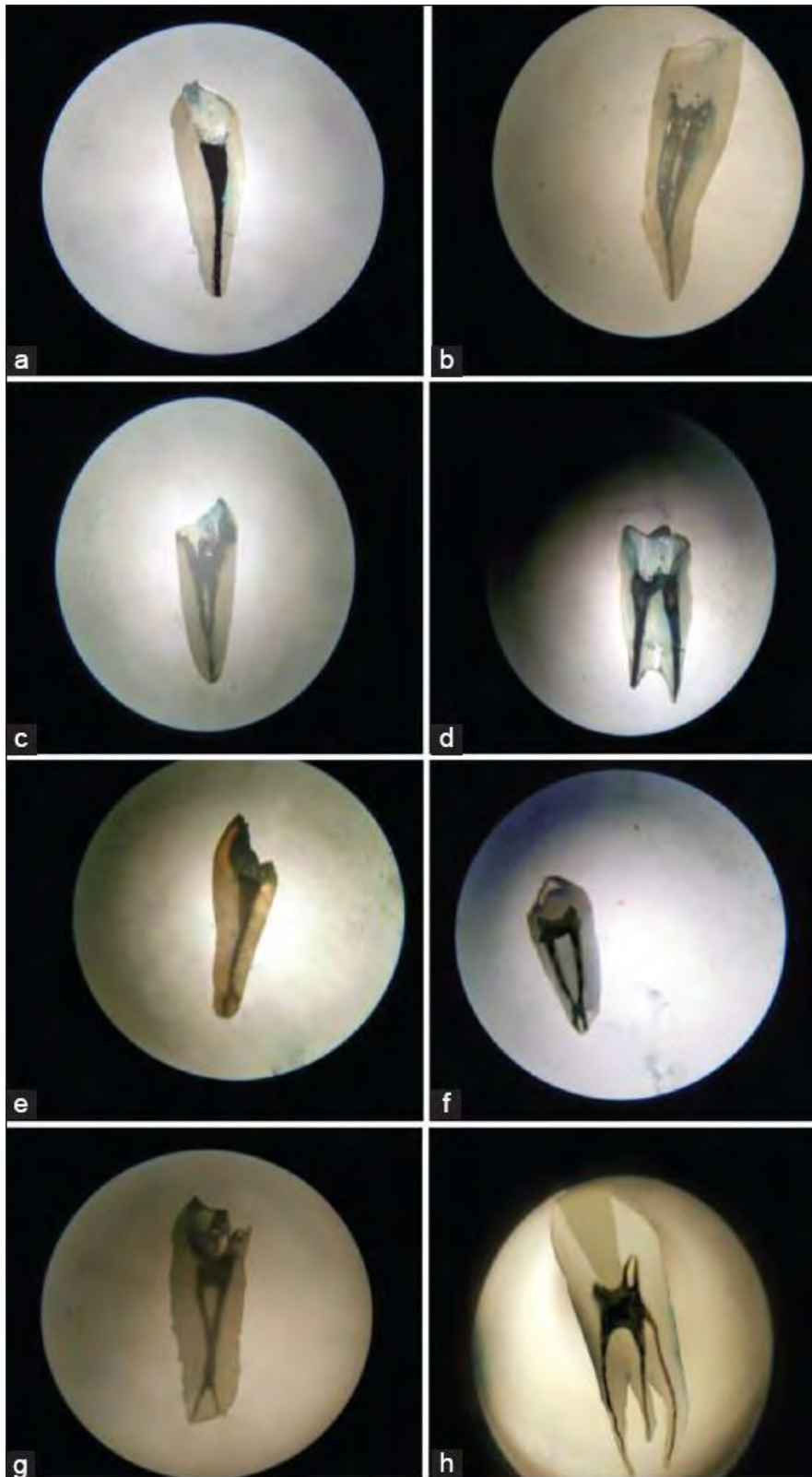


Fig 3: Root canal patterns identified in maxillary first premolar by Gupta et al among Indian population (13)

TABLE 1:- Classification of root canal forms of maxillary first premolars by Kartal <i>et al.</i> (12)				
TYPE*	SINGLE ROOT (%)	TWO-ROOTED (%)	THREE-ROOTED (%)	TOTAL
One canal at apex				9.66
Type I (1)	8.66	-	-	
Type II (2-1)	1.00	-	-	
Type III (1-2-1)	-	-	-	
Two canals at apex				88.64
Type IV (2)	16	55.33	-	
Type V (1-2) ⁺	6.33	5.66	-	
Type V (1-2) [±]	2.66	-	-	
Type VI (2-1-2)	2.33	-	-	
Type VII (1-2-1-2)	0.33	-	-	
Three canals at apex				1.66
Type VIII (3)	-	-	1.33	
Type IX (2-3)	-	0.33	-	
Total	37.31	61.32	1.33	
<p>* Notation in parentheses shows root canal numbers from the crown to the apex. ⁺ Division occurs in the middle third. [±] Division occurs in the apical third.</p>				

TABLE – 2 :- Studies of root canal configurations of the maxillary first premolar (11)					
AUTHOR(S)	TYPE OF STUDY	COUNTRY	ONE CANAL (%) [*]	TWO CANALS (%) ⁺	THREE CANALS (%) [‡]
Pineda & Kuttler (1972)	Radiographic	Mexico	50.1	49.4	0.5
Green (1973)	Ground sections	USA	3	70	-
Carns& Skidmore (1973)	Plastic cast resin	USA	22	72	6
Vertucci (1984)	Clearing	USA	26	69	5
Walker (1987)	Radiographic	Southern China	36	64	-
Pecora et al (1993)	Clearing	Brazil	9.7	80.4	2.5
Caliskan et al (1995)	Clearing	Turkey	9.8	90.2	-
Kerekes&Tronstad (1998)	Ground sections	Norway	10	80	2
Zaatar et al (1998)	Clearing	Kuwait	21.5	74.7	3.8
Soares& Leonardo (2003)	Clinical	Brazil	-	-	Case report
Sert&Bayirli (2004)	Clearing - Men - Women	Turkey	31 29	68 67	4 4
<p>*Numbers in parentheses represent the percentage of cases with two canals joining into one canal.</p> <p>+Numbers in parentheses represent the percentage of cases with one canal dividing into two canals.</p> <p>‡Number in parentheses represents the percentage of cases with one canal dividing into three canals.</p>					

Table 3: Distributions and percentages of categories of variants in the root canal anatomy of mandibular first premolars according to Vertucci's criteria: study by Dou *et al.* 2017(18)

	Type I 1	Type II <u>2-1</u>	Type III <u>1-2-1</u>	Type IV <u>IV</u>	Type V <u>1-2</u>	Type VIII <u>VIII</u>	Other <u>1-3-1</u>	C shaped <u>shaped</u>
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				<u>2</u>		<u>1-3</u>		<u>cross section</u>
Number total: 178	114	2	19	1	39	2	1	22
Percentage	64.04%	1.12%	10.67%	056%	21.91%	1.12%	0.56%	12.36%

Table 4: Studies of root canal configurations in mandibular first premolars(19)

Author	Year	Number of teeth	Method	One coronal canal	Two coronal canal	Three coronal canal
Vertucci	1984	400	Decalcified	70%	29.5%	0.5%
Pineda	1972	202	Radiographic ex vivo	69.3%	29.8%	0.9%
Baisden	1992	106	Serial sections	74%	26%	
Caliskan	1995	100	Dyed, decalcified	64%	30%	6%
Yoshioka	2004	139	Ink- dyed	80.6%	15.1%	4.3%
Sert	2004	200	Decalcified	60.5%	38.5%	1%

Table 5: External and internal morphological features of mandibular first premolars(Chourasia et al 2020) (20)

Root numbers	One Two Three	80 18 2
Root canal numbers	One Two Three	72 26 2
Foramen numbers	One Two Three Multiple	73 19 2 6

TAPER

Canal configurations	Type I(1)	69
	Type II(1-2)	-
	Type III(1-2-1)	8
	Type IV(2)	4
	Type V (1-2)	16
	Type VI(2-1-2)	-
	Type VII(1-2-1-2)	-
	Type VIII(3)	-
	Type IX(1-3)	2
	Unusual(1-3-1-2)	1
Lateral canals	-	38

OPPORTUNITIES AFTER BDS COURSE

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Bachelor of Dental Surgery(BDS) is a professional course which trains a person to become a Dental Surgeon. Currently in India there are 313 dental colleges (both government and private) which offer BDS(Bachelor of Dental Surgery) course which is recognized by the Dental Council of India. A BDS student in India graduates after completing four years of study and one year of Internship in a recognized dental college.¹

The various opportunities for BDS graduates are;

1. Post Graduation courses(MDS)- At present in India there are 268 dental colleges which offer post graduation MDS courses.¹ MDS courses are available in 9 specialties- Oral Medicine & Radiology, Oral and Maxillofacial Surgery, Public Health Dentistry, Pedodontics and Preventive Dentistry, Periodontology, Orthodontics and Dentofacial Orthopedics, Conservative Dentistry and Endodontics,

Prosthodontics and Crown and Bridge and Oral and Maxillofacial Pathology. BDS graduates should qualify the NEET-MDS Entrance examination to be eligible for admission to the MDS courses in dental colleges. The duration of MDS course is 3 years.

2. Post Graduation Certificate courses/ Fellowship programs- BDS graduates can enroll in PG certificate/Fellowship programs offered by various Universities/Association in India. These courses are one year/two year courses. The various courses/programs available are on Oral Implantology, Esthetic Dentistry, Laser dentistry, Endodontics, Orthodontics, General Dentistry, Forensic Odontology, Sports Dentistry, Clinical Research and Dental Public Health.²⁻⁵

3. Comprehensive Clinical Residency programme- Indian Dental Association conducts this 5 week training programme for BDS graduates to enhance their clinical

skills. The training programme is conducted at Dr APJ Abdul Kalam Education & Research Centre, Mumbai.⁶

4. Short Service Commission- There are vacancies for dental surgeons in the Indian Army. Candidates should secure minimum 55% marks in their final BDS examination and qualify in the NEET – MDS entrance examination. Selected candidates will be shortlisted for interview and medical fitness test.⁷

5. Opportunity in abroad countries- Most of the countries abroad require BDS graduates to clear the qualifying exam of that country in order to work as general dentist.

USA- In order to practice in USA, a BDS graduate should qualify in the INBDE(Integrated National Board Dental Examination). The examination is an online examination comprising of 500 multiple choice questions over 2 days. In addition, students should qualify in the IELTS or TOEFL English language testing exam. After clearing the INBDE exam you should apply to various Universities for enrolling in the DDS(Doctor of Dental Surgery)/DMD(Doctor of Dental Medicine) program. The DDS/DMD program is a 2 year program. After the successful completion of the DDS/DMD

programme, students should apply for license exam of the particular state in which they wish to practice. Students after clearing the license exam can practice as a general dentist.⁸

Canada- BDS graduates should qualify in the NDEB (National Dental Examining Board of Canada) Equivalency exam and NDEB written and OSCE examination to practise as general dentist.⁹

Australia-BDS graduates should qualify in the theory and practical examination conducted by Australian Dental Council. They also should qualify in the IELTS/OET English language testing examination.¹⁰

Newzealand- BDS graduates should qualify in the NewZealand Dentist Registration Examination(NZDREX) to work as a general dentist.¹¹

UK- BDS graduates should qualify in the ORE(Overseas Registration Examination) which is conducted in April and August of every year. It includes theory and practical examination. After clearing the ORE exam, the candidate can register with the General Dental Council to work as a general dentist.¹²

Gulf countries- In most of the gulf countries, BDS graduates with 3 year

experience(Including one year of Internship) should qualify in the MOH(Ministry of Health) Examination of that country to work as general dentist. In UAE, the candidate should qualify in the DHA(Dubai Health Authority) examination to practise in Dubai, HAAD examination to practise in Abudhabi and MOH examination to practise in any Emirates apart from Dubai and Abudhabi.

6. Set up own Dental clinic- BDS graduates can set up a dental clinic in a location suitable to them. The practise can be set up with required number of dental chairs, dental equipments and dental materials. Consultants of various specialities can be hired for providing speciality treatments in the clinic. Approval from local body authorities, Pollution Control Board and Biomedical waste certification is mandatory for the starting of dental clinic. Many banks offer loan to dentists for the set-up of new dental clinic.

7. Dental Colleges/Hospitals/Clinics- BDS graduates can work as tutors in private dental colleges, and as dental surgeons in dental hospitals and private dental clinics.

8. Government job opportunities- BDS graduates should qualify in the entrance

examination conducted by the Public Service Commission of the state for the vacancies of dental surgeon posts in the state. Such candidates can work as Dental Surgeon in Taluk hospitals, District hospitals, PHC, Subcentres etc.

9. Clinical Research opportunities- BDS graduates interested in clinical research job opportunities can enroll in clinical research part time or full time courses. The scope of clinical research in dentistry is huge and many multi-national companies recruit BDS graduates in their research and development wing. Many pharmaceutical companies also recruit BDS graduates in their research department.

Life opens up opportunities to you, and you either take them or you stay afraid of taking them- Jim Carrey

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Case Report

ENDODONTIC MANAGEMENT OF MANDIBULAR CANINE WITH TWO ROOTS AND TWO ROOT CANALS : A CASE REPORT

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Abstract

In general Mandibular Canines usually have one root and one root canal. However since the beginning of the 21st century, due to introduction of new technologies related to intraoral vision magnification and innovative radiological imaging systems, there has been a noticeable increase in Case Reports that have revealed morphological variations.

The objective of this article is to present a case of a mandibular canine, a strategically important tooth in the dental arch, with a morphological variation of ROOT CANAL ANATOMY with TWO ROOTS and TWO ROOT CANALS thereby giving an awareness to clinicians and hence avoiding the possible post operative complications due to missed root canals

The occurrence of two roots and two separate root canals in mandibular canines is a rare entity Finding such variations are unpredictable and hence the clinician must be vigilant and watchful so that any

unforeseen treatment complications can be avoided

Case presentation

A 69 year old female patient visited the clinic with a small proliferated reddish growth of 2-3 mm size on the labial

surface of mandibular right canine which is not infected but comes on and off since one and a half years with history of occasional pain or discomfort. She had no history of systemic or allergic problems. On clinical examination, the tooth has gingival recession occlusal attrition with deep bite occlusion adjustment tried in the first visit but patient reported with not much relief and was anxious too. IOPA Radiographic examination reveals PDL widening at apical 1/3rd. A clinical diagnosis of chronic periodontitis due to traumatic deep bite and reversible pulpitis was made. Root canal treatment was planned on the basis of mainly the clinical signs and symptoms and radiographic findings. The treatment plan was explained to the patient. Local anesthesia was administered, Lignocaine hydrochloride with 2% adrenaline bitartrate injection (1:200000). Access cavity was prepared. Pulp chamber roof was carefully removed under abundant irrigation with normal saline and the canal was explored with a size NO 15 K file. Working length of 23 mm was determined with an IOPA radiograph. One more radiograph was taken with a more mesial angulation (Fig 1). A second root was suspected. Access cavity was lingually extended carefully with an

RS1 File and one more canal orifice was located with a DG-16 Probe (Endodontic explorer) and canal was explored slowly with a no.10# K file and a working length radiograph was taken with two no.15# K files in the two canals of the two roots (Fig 2). The working length of 23mm was corroborated with electronic apex locator-Root ZX, J MORITA. Orifice opening done with Sx file, Protaper Dentsply, TULSA. Cleaning and shaping was done with S1, S2, F1, F2 Files, Universal protaper, Dentsply, Tulsa followed by manual instrumentation upto #no.25 K file followed by #no.25 H file. EDTA gel was used during instrumentation. Apical cleaning with #no.10 K file (0.5mm more than the actual working length) after each instrumentation was done. Thorough irrigation with normal saline, and drops of 3% Sodium hypochlorite using 30 gauge x 25mm side vent irrigating needle and ultrasonic activation. After thorough drying of the canals with F2 paper absorbent points, the snug fit of F2 6% protaper GP cones were tried in both canals and master cone radiograph was taken. (Fig:3) Obturation was done with the same master cones with AH-plus resin based sealer (Fig 4). The access cavity was sealed with Fuji IX Glass ionomer cement. The deep bite was relieved completely. A

final post-operative radiograph was taken..The 3 month old follow up showed the labial proliferated growth has completely healed and normal periapical tissues upon radiographic examination is seen. Radiographic images of the counterpart canine and the mandibular incisors showed signs of two canals .

cases.Proper diagnosis and identification of the number of roots and root canals are key to success of endodontic treatment



Fig:1(Shift IOPA)



Fig:2(WL IOPA)



Fig 3(MC IOPA)



Fig 4(Obturation IOPA)

Conclusion

The of root canal morphology plays a decisive role in determining the conditions under which endodontic treatment can be performed effectively. Although the prevalence of two roots and two canals in canines is very low, the clinician should always be mindful of variations in the number of roots and canals for proper management of such

ENDOCROWN

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ABSTRACT

This article aims to provide the restorative dentist with a detailed literary analysis of endocrown restorations as they might be reluctant to apply such an effective prosthetic treatment option in their clinical practice because it is not as used frequently as other traditional fixed indirect restorations such as crowns and onlays.

Keywords: Endocrown, ferrule

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INTRODUCTION

For many practitioners over the years, the reconstruction of endodontically treated teeth that are grossly destroyed has been a problem. Endodontically treated teeth exhibit numerous physiological changes in dentin composition and microstructure that predispose the tooth to multiple risk factors,

such as decreased retention/stability, increased tooth fragility, decreased substrate adhesion and ultimately contributing to prosthesis failure.¹ Further studies have established and linked access preparation to decreased structural integrity, leading to a higher incidence of fractures in

endodontically treated teeth compared to critical teeth.² Studies have shown that preparations for endodontic access have led to increased cuspal deflection during function^{3,4}, so cuspal coverage of posterior teeth is recommended.⁵ The gold standard treatment was the manufacture of metal-ceramic or all ceramic full coverage crowns, with or without the inclusion of a post, if two or more endodontically treated tooth axial walls are missing. This protocol is considered time intensive and can be decreased using endocrowns that are more time and cost realistic by a one-step process.^{6,7}

In 1995, Pississ first discovered endocrowns⁸ that are defined as full-composite or complete ceramic monolithic (one-piece) overlays that restore the coronal portion of a devitalized tooth marked by a supra-cervical butt joint, retaining optimum enamel to increase adhesion and extending inside the pulp chamber and partly inside the short endo-core root canal, may be an alternative to traditional treatment to restore endodontically treated tooth.⁹ These restorations have macro mechanical retention by being anchored to the inner portion of the pulp chamber and to the cavity margins and micro retention by adhesive cementation.¹⁰ Pississ has

described it as the mono-block porcelain technique.⁸

In 1999, Bindle and Mörmann identified the endocrown as adhesive endodontic crowns for the first time and characterized it as complete porcelain crowns fixed to endodontically treated posterior teeth.¹¹ Endocrowns are easy to apply and require a short clinical duration compared to traditional crowns. The benefits of endocrowns are low cost, short preparation time, ease of use, minimal chair time and aesthetic properties. Endocrowns are also a choice for teeth with short or atresic clinical crowns, calcified, bent or short root canals that make post-application difficult.¹²

MECHANICAL PROPERTIES

In a research measuring the fracture strength of endocrowns and the post glass fibre, the findings showed significantly higher fracture strength for endocrowns of 674.75 N compared to the traditional crown of 469.90 N. The failure pattern was characterized by tooth fracture combined with displacement of restoration on the opposite side.¹³ There is a lack of knowledge on the impact of the endocrown design on the biomechanical actions of restored endodontically treated premolars (ETPM). Bindl et al. considered that endocrowns for premolars with a failure rate of 31 percent were an ineffective

restorative strategy, while molars restored with endocrowns had a failure rate of 12 percent. In addition to the unfavorable ratio between crown base and crown height, this disparity in failure rates is due to a decreased surface area available for adhesion in premolars that could cause a moment of force¹⁴. In a recent study published in 2018, it was reported that upper premolars restored with endocrowns with 2mm and 4mm long endo-cores showed similar results in terms of marginal integrity and fatigue resistance equal to classical crowns and did not appear to affect the output of endocrowns. However, further studies are needed to confirm this hypothesis¹⁵. Lin *et al.* stated that there was a major difference between the endocrown (2 MPa) and the classical crown (15.36 MPa) in the stress values at the lute cement interface. This indicates that the concentration of stress within the cement occurred in the classical crown configuration at the central groove region of the occlusal surface. Therefore, the reduced impact of multiple interfaces in the endocrown configuration restorative framework may make the restored tooth closer to a monoblock and thus reduce the failure of the adhesive interface.¹⁶ A systematic study and meta-analysis of

endocrown restorations was published in 2016. Endocrowns have demonstrated high clinical success rates in this systematic review (94 to 100 percent up to 36 months). In addition, secondary caries were the cause of failure and no study reported fracture or loss of endocrown retention. They indicated, however, that the findings should be interpreted with caution as limited sample sizes and high risk of bias were advocated by the disrupted studies and further studies and particularly long-term clinical studies are of utmost importance to explain the use of endocrown restorations for the rehabilitation of severely damaged, endodontically treated teeth¹⁷.

INDICATIONS²⁵

Endocrowns are particularly suggested in cases of short or weak roots of molar teeth. In situations of excessive loss of coronal dental tissue, they can also be used. The materials of choice for the development of endocrowns is strengthened, acid etchable dental ceramics because they ensure the mechanical strength required to withstand the forces exerted on the tooth, as well as the bond strength of the restoration to the cavity walls.

CONTRAINDICATIONS OF ENDOCROWNS²⁶

Endocrowns cannot be used in the following scenarios:

- (1) less than 3mm pulp chamber depth.
- (2) When adhesion cannot be assured.
- (3) If only negligible remaining tooth structure is present

PREPARATION TECHNIQUE FOR ENDOCROWNS

OCCLUSAL PREPARATION

It is necessary to achieve a minimum reduction of 2 mm of occlusal height in the axial direction. Usually, the ceramic occlusal thickness is 3-7 mm. Studies have shown that the fracture resistance of all-ceramic restorations increases with the increase of occlusal thickness and that the fracture resistance of endocrowns with a thickness of 5.5 mm is twice the resistance of ceramic crowns with an occlusal thickness of 1.5 mm^{18,19}.

Procedure

The reduction can be accomplished by creating grooves of 2 mm depth orientation, then the occlusal surface is reduced with a coarse grit wheel diamond. The diamond,

parallel to the occlusal plane, is directed along the long axis of the tooth. The diamond form guarantees the proper alignment of the reduction and the desired flat surface (Fig 1). The bur is aligned along the tooth's main axis and kept parallel to the plane of the occlusal. Its shape allows the orientation of the reduction to be managed and ensures a flat surface that defines the location of the cervical margin or "cervical sidewalk."The cervical margin should be supragingival, but the margin can follow the gingival margin if clinical factors or aesthetics require it. In order to prevent a staircase effect, variations in level between the different sections of the cervical margin must be related by a slope of no more than 60°. It is sufficient to remove enamel walls less than 2 mm thick

AXIAL PREPARATION²⁰

The undercuts in the access cavity should be removed at this point. To make the pulp chamber and endodontic access cavity continuous, a cylindrical-conical course grit diamond with an occlusal taper of 7 degrees is utilized (Fig: 2). The preparation is carried out without undue pressure and without reaching the pulpal floor while the bur is aligned along the long axis of the tooth. Removing too much tissue from the walls of

the pulp chamber can decrease its thickness and enamel strip width. The suggested endocrown dimensions are a cylindrical pivot of 3 mm in diameter and a depth of 5 mm for the first upper premolars and a diameter of 5 mm and a depth of 5 mm for the molars.

POLISHING THE CERVICAL BAND²⁰

The bur used in this phase has the same taper, but a larger diameter and a finer particle size, as the one used in axial preparation. To remove micro-irregularities and produce a flat, polished surface, it should be guided around the entire surface of the cervical band (Fig.3). As a regular line with a sharp edge, the margin line should appear

FERRULE

In order to improve fracture resistance and fatigue cycles to failure, the existence of ferrule in full coverage crowns was recognized. Einhorn *et al.* investigated the effect on molar endocrown failure resistance of the implementation of ferrule features.²¹ Their findings showed that adding ferrule to preparations expanded the available bonding surface of dentin. However, there were milling limitations in reproducing the endocrowns inner surface.

Hence, it was reported that the more complex the preparation design became because of the addition of ferrule, the resultant endocrown inner surface adaptation to the preparation seemed to reduce (Fig 4). Einhorn *et al.*²¹ investigated the consequence of the ferrule features incorporation, on molar endocrown failure resistance. Their results showed that adding ferrule to preparations increased the dentin surface available for bonding. However, there were milling limitations in reproducing the endocrowns inner surface. Hence, it was reported that the more complex the preparation design became because of the addition of ferrule, the resultant endocrown inner surface adaptation to the preparation seemed to reduce. (Figure 4)

Moreover, the endocrown preparations containing 1 mm of preparation ferrule design have detected fewer instances of catastrophic failure.

PREPARATION OF THE CAVITY FLOOR²⁰

There is an entrance to the pulpal Canal. To take advantage of the saddle-like anatomy of the cavity floor, gutta-percha is removed to a depth not exceeding 2 mm. To protect the dignity of the entrance to the canals, this should be achieved with a non-abrasive

instrument. No drilling is done with dentin. The cavity of the pulp chamber ensures retention and stability. In mandibular molars, its form is trapezoidal and triangular in maxillary molars, improving the stability of the restoration.

The preparation was ended with lining the root canal entrances with glass ionomer cement / composite to protect the orifice of the canal.

Thus, endocrown is a single device inserted in non-vital teeth and anchored to the inner portion of the pulp chamber and to the margins of the cavity, resulting in macro mechanical (due to the circumferential walls of the pulp chamber) and micromechanical (due to the use of adhesive materials) retention.

RESTORATIVE MATERIAL

SELECTION

The first material of choice for the Endocrown at its inception was metal in subsequent years it was changed to porcelain. Subsequently, as the advancement of (CAD-CAM) technology, the option of material extended to feldspathic ceramic, lithium disilicate, zirconia and composite opened new horizons, both in material processing and in teeth restoration, offering precision, aesthetics and expedient

restorative procedure. Based on the recorded studies, below are the different types of Artisanal (Tables 1 and 2) and CAD-CAM manufactured materials available (Table 3) for endocrown construction.²

TABLE 1 Artisanal Indirect Composites

Type of indirect composite	Commercial Designation	Composition
Solidex	ShofuInc.,Kyoto, Japan	61% UDMA and photostarters; 39% (vol) inorganic particles
Targis	IvoclarVivadent AG, Schaan/Liechtenstein,Germany	33% BIS-GMA, DMA, and UDMA; 67% (vol) inorganic particle
Artglass	Heraeus-Kulzer	30% methacrylates; 70% inorganic particles
BelleGlass HP	Belle de St. Claire	26% UDMA and DMA; 74% inorganic particles
Filtek Z250	3M ESPE,USA	40% UDMA, BIS-EMA, BIS-GMA; 60% inorganic particle
Ceramage	ShofuInc.,Kyoto, Japan	73% Zirconium silicate fillers (PFS- Progressive Fine Structured Fillers), inorganic polymer matrix.

BIS-GMA = bisphenol A glycidyl methacrylate
 BIS-EMA = bisphenol-A polyethylene glycol dietherdimethacrylate
 DDMA = decanedimethacrylate
 UDMA = urethane dimethacrylate
 PUDA = phenylene-included urethane di-acrylate
 DMA = dendritic multifunctional acrylate

*According to manufacturers.

TABLE 2 Artisanal Ceramic

Ceramic	Filler Product	Examples
Predominately Glass (Feldspar)	Aluminium oxide	Ceramco 3 (Dentsply, York, Pa.) IPS e.max Ceram (Ivoclar 34 Vivadent, Amherst, N.Y) Vita VM 7 (Vita Zahnfabrik, Bad Sackingen, Germany)
PartileleFilled Glass	Leucite	IPS Empress Esthetic (IvoclarVivadent) Vintage MP Porcelain, ShofuInc.,Kyoto, Japan
	Glass-infiltrated alumina	Vita In-Ceram Alumina Vita In-Ceram Spinell Vita In-Ceram Zirconia (Vita Zahnfabrik, BadSackingen, Germany)

TABLE 3 CAD-CAM fabricated materials.

Structure	Commercial Designation
Composites Resin (Nano-hybrid composite resin)	<ul style="list-style-type: none"> ▪ KATANA Avencia; Kuraray Noritake Dental Inc., Tokyo, Japan. ▪ Brilliant Crios; COLTENE, Germany ▪ Grandio blocs; VOCO, Germany.
Interpenetrating Phase Composites (Resin/Ceramic)	<ul style="list-style-type: none"> ▪ PICN such as ENAMIC;VITAZahnfabrik, Germany. (PICN : Polymer-infiltrated ceramic-network material) ▪ Lava Ultimate; 3M ESPE,USA ▪ CERASMART,GC Corporation, Tokyo, Japan ▪ KZR-CAD HR 2 GR; Yamakin Co. Ltd, Kochi, Japan ▪ Nacera Hybrid, US Inc, USA. ▪ SHOFU Block HC; ShofuInc.,Kyoto, Japan
Glass Ceramics (Feldspar)	<ul style="list-style-type: none"> ▪ VITA Mark II; VITA Zahnfabrik, Bad Sackingen,Germany ▪ VITABLOCS TriLuxe, VITA Zahnfabrik, Bad Sackingen, Germany. ▪ VITABLOCS TriLuxe Forte, VITA Zahnfabrik, Bad Sackingen, Germany. ▪ VITABLOCs RealLife, VITA Zahnfabrik, Bad Sackingen, Germany
Particle-filled Glasses	<ul style="list-style-type: none"> Leucite reinforced feldspar ▪ IPS Empress CAD; IvoclarVivadent AG, Schaan/Liechtenstein, Germany. ▪ Initial LRF, GC Corporation, Tokyo, Japan
	<ul style="list-style-type: none"> Lithium disilicate ▪e.max CAD; IvoclarVivadent AG, Schaan/Liechtenstein,Germany
Polycrystalline	<ul style="list-style-type: none"> Zirconium dioxide ▪ InCoris TZI C, Dentsply Sirona, Germany. ▪ KATANA STML Block; Kuraray Noritake Dental Inc.,Tokyo, Japan. ▪ GC ZR Disc CIP, GC Europe ▪ CeramillZolid, AmannGirrbach ▪ BruxZir, Glidewell Lab

SURFACE TREATMENTS AND CEMENTATION OF ENDOCROWN

For Endocrown to achieve high survival and success rates, adherent surface treatments prior to cementation are critical. Each stage of clinical and laboratory procedures has an impact in terms of longevity and cosmetic performance. Cementation appears to be the most significant step, and its long-term success depends on adherence to clinical guidelines. The following table summarizes the recommended clinical protocol based on the published literature for all forms of endocrown products, surface treatments and cementation procedures.^{23, 24}

TABLE 4 Recommended Dentin, Endocrown Surface Treatments and Cementation Procedures.²⁷

Endocrown	Recommended Endocrown Surface Treatments	Cementation Procedures
Glass Ceramics	Etch with 10 % hydrofluoric acid for 10-15 sec on the intaglio of restorations. Rinse and dry. Application of 37% H ₃ PO ₄ for 30 seconds, or ultrasonic bath with distilled water, 95% alcohol or acetone for 4 to 5minutes. Apply saline for 1 minute and air dry.	Cementation under rubber dam isolation. Choice of resin cements. Cementation procedures according to manufacturer’s protocol.

Zirconia	Sandblast synthetic diamond particles 50-µm aluminium oxide (Al ₂ O ₃) particles (at 80 psi). Apply an adhesion-promoting agent containing MDP and air dry	<u>APC zirconia-bonding concept:</u> APC-Step A: Air-particle abrade the bonding surface with aluminium oxide; APC-Step P: Apply special zirconia primer; and APC-Step C: Use dual-cure or self-cure composite resin cement.	Cementation under rubber dam isolation. Choice of resin cements either RMGIC or resin cement
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CONCLUSIONS

Endocrowns have been used in restoring endodontically treated tooth(ETT) with significant coronal tissue loss as an alternative to traditional post-core and fixed partial dentures. Compared to conventional approaches, the benefits of endocrowns are improved aesthetics and mechanical efficiency, low cost and short clinical time.

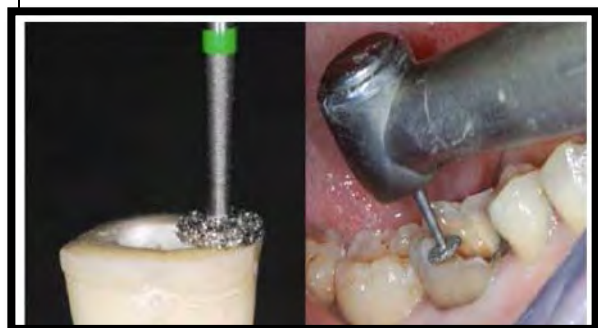


Fig1: Preparation of the cervical margin or “cervical sidewalk” using a wheel bur held parallel to the occlusal plane.



Fig 2: Axial preparation using a cylindro-conical drill to make the coronal pulp chamber continuous with the access cavity



Fig 3: Polishing the cervical band

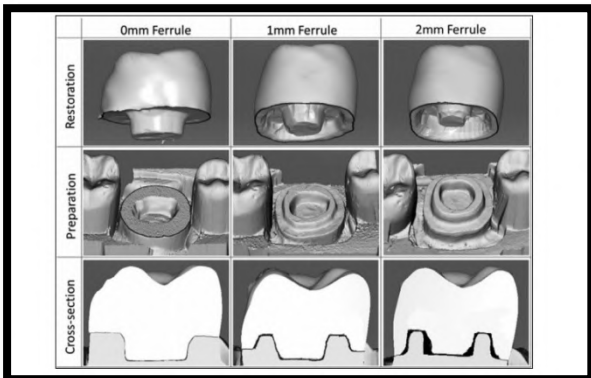


Fig 4: Preparation ferrule design effect on Endocrown failure resistance

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Case Report

GENIOPLASTY: A simple and transforming procedure

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Dentofacial deformities are commonly associated with the chin area when it is inappropriate in size, shape, and position. When three-dimensional facial analysis is made, the chin becomes an important part within the same since it can significantly alter the symmetry, balance, and facial shape. The genioplasty was first described by Hofer in 1942 and has had multiple changes through the years by multiple authors such as Converse, Trauner, Obwegeser, Reichebach, Neuner, Epker among others. It is a surgical procedure that through different techniques can descend, reduce, advance, or retract the projection of the chin. This technique is helpful in the treatment of dentofacial deformities due to its versatility and different techniques. In experienced hands the risks are almost non-existent and can improve the normal symmetry and harmony of the face¹.

A 26 year old female reported with complaint of facial asymmetry. She has past history of skin tag excision done on face. On examination she had facial asymmetry with deviation of chin to her left side. Her radiograph (OPG) revealed hypoplasia on the left side of mandible and (lateral cephalogram) with severe chin retrusion. Further evaluation with CT confirmed her diagnosis of Hemifacial microsomia [figure 1].



Fig:1(Pre operative profile views of the patient with severe retrognathic chin)

Prior to embarking on attempts to correct dentofacial defects, it was important to have

an accurate diagnosis of the existing problem. Cephalometric measurements, clinical examinations and model analysis were done with virtual surgical planning. A treatment plan was decided on the basis of patients chief complaint, this diagnosis and should included the osteotomy planned, amount and direction, the segments to be moved . It was planned for extended sliding differential genioplasty with advancement of 8mm. Often there will be a particular treatment that provides the best outcome, but ideally, the treatment plan of each patient should be individualized as two deformities are never alike based on their chief complaint.

Surgical Technique

An intraoral incision made. The incision was kept toward the labial surface instead of at the vestibular depth or toward the dentition. Initially care is needed with the lateral aspects of the incision so as to not transect the terminal branches of the mental nerves (which was preserved). Retraction of the mucosa allowed the nerves to be visualized just deep to the surface, helping in their avoidance. Then the mentalis muscles were transacted, and a full thickness subperiosteal flap is elevated in order to completely expose the anterior mandible. The mental foramina and nerves were identified and exposed bilaterally. Once appropriate exposure was achieved, the midline and para-midline area surgical bur. This was to leave a lasting reference for the procedure. Precise measurements were made to mark

out the location for the osteotomy. Marking this line, in a manner similar to that mentioned above, aids in the actual procedure. Importantly, the osteotomy should stay a minimum of 4.5 mm below the mental foramen and ideally should be closer to 6 mm below so as to not injure the mental nerves². Angulation of the osteotomy variations were done and adjusted based on the desired result of the procedure. Once the osteotomized segment was down fractured carefully inspect the lingual pedicle and floor of mouth soft tissues. Bleeding was controlled before progressing. Excess bone obtained later used as interpositional graft in the differential downward movement on the left side. Then position the inferior border segment to the desired location was done and was secure it in place. For stabilization of the inferior segment, hole was made through buccal cortex of mobile segment. Bicortical screw is tightened to pull the mobilized portion of the chin to the desired position. Appropriate symmetry was maintained by utilizing the reference lines that were placed at the time of the surgery, but in cases of pre-existing asymmetry or cases combined with other procedures it was more difficult.

Post operative care

An external dressing with minimal compression (so as not to compress the advanced chin) was give. Post operatively patient was put on antibiotic, analgesic and steroid. A soft diet was advised. Oral

hygiene was maintained with paediatric tooth brush to avoid distorting the surgical site while brushing. On the second post operative day she was discharged. Patient was on follow up with no undue complications [figure 2].

Expected complications of Genioplasty

Though genioplasty is a minimally complex procedure, surgeon always anticipates for complication which could be immediate, post operative or delayed². These includes tooth devitalization neurosensory loss, soft tissue chin ptosis, dental root exposure, asymmetry, irregularities and step deformities ,lower lip lag, over and under correction, patient or surgeon dissatisfaction^{3,4}



Fig 2 (Immediate post operative profile view of the patient.)

Conclusion

Osseous genioplasty is an extremely stable procedure associated with a relatively low risk of complications. It is also a particularly versatile procedure and can be used to correct a wide range of deformities related to the chin, including horizontal and vertical excess, horizontal and vertical deficiency, asymmetry, and abnormal contour^{5,6}.

It provide obvious and satisfactory outcome in severe chin deformity which seem very concerning and may seem to include other complex osteotomies. Hence with proper planning and assessment, prioritising patient's chief complaint genioplasty can give very satisfactory outcome.

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Case Report

Customised Microtube method: A Novel and Economic alternative for separated instrument retrieval systems – A Case Report.

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ABSTRACT

This article show-cases an endodontic retreatment case of retrieval of wire fragments from root canal using a customised microtube method, a novel and economic alternative for various separated instrument retrieval systems.

Key words: Customised microtube, Retrieval, Wire fragments, Root canal.

Introduction

One of the major challenges faced by various endodontists around the globe is retrieval of separated instruments or any other metallic obstacles from the root canal. The reported success rate of separated instrument retrieval comes around 55 to 79%.^{1,2} But it considerably adds lots of anxiety & stress to the clinician. Though so many efficient instrument retrieval devices are available in market, high cost & learning curve has limited its universal use especially in developing countries. Also attempt to

remove separated fragments can result in several complications like:

separation of the ultrasonic tip or file used for bypassing or removing the instrument; further separation of the fragment; perforation; ledge; extrusion of the file into periapical tissues; tooth weakening due to dentin removal, as well as excessive temperature rise in periodontal tissues.³ According to the literature the most successful method of retrieving separated instrument is by using ultrasonics and

magnification aids like dental operating microscope (DOM).^{4,5}

Presented is a case of retrieval of metallic wire fragments from an upper lateral incisor with a customised microtube and magnification which was done as a part of its retreatment.

Case Report

A 40-year old man reported to the Dept. of Conservative Dentistry and Endodontics with chief complaint of dislodged filling with upper front tooth. On examination upper left lateral incisor (22) has been grossly destroyed with 2mm of coronal tooth structure and discoloured left central incisor (21) [Fig 1]. There was a history of root canal treatment with 21 & 22 twenty years back. Intra oral periapical radiograph shows poorly obturated canals with inadequate lateral & apical seal and an increased radiopacity seen in the middle third of left lateral incisor's root canal suggestive of some metallic wire used in previous root canal treatment may be to aid in post endo restoration (Fig 2). Both teeth were asymptomatic. Since patient wanted aesthetic correction of upper anteriors, retreatment was planned for both

teeth, followed by post and core & prosthetic crown.

Re access opening has been done with 22 and gutta-percha in the canal was removed using RC solve and 25 H files (mani). After determination of working length with 20 k file, cleaning and shaping has been completed using protaper gold files (Dentsply Sirona) till F2 size. But fragments of wire from previous endodontic treatment was still persisting in the middle third of the canal of 22(Fig 3). A straight line access was created till the coronal end of the wire. Since bypassing had been already done, the wire was loose with in the canal but was not able to retrieve it with forceps because it was far beyond in the canal and was bounded to the dentinal wall. So an alternate method which is economical and conservative was planned to retrieve it. An 18 gauge needle was modified in to a microtube by removing the hub and bevel. Under magnification of 3.5x using magnifying loupe, coronal end of the wire was seen binded to the palatal side of canal. Using ultrasonic activation (IPiezo engine, Varios 970, NSK, Fig 4) the wire fragment was moved so that it is centralised in the canal with space all around the coronal end of it.

Then the microtube was introduced into the canal so that the coronal end of the wire fragment was engaged by the microtube. Through the other end of the microtube a 55 size H file (Mani) was introduced and the entire assembly was made tight. The wire fragment was then retrieved by rotating the assembly counterclockwise, with an upward motion (Fig 5). Removed fragment with microtube & H file is showed in Fig 6. One more fragment was there in the canal, which was also removed by the same way (Fig 7). Post -op radiograph shows no radio-opacity of any wire fragments with 22 (Fig 8).



Fig:5(Fragment removal) Fig:6(The microtube,H File & fragment assembly)



Fig:7(Removed Fragments)

Fig:8(Post -op IOPA)

Discussion

Endodontic retreatment will become hectic if the root canal contains wire fragments from previous root canal treatment. Retrieval of these wire fragments will be stressful to the clinician especially if you don't have an efficient instrument retrieval system. Retrieval or bypassing of metallic fragments or separated instruments from root canal depends upon lots of factors. According to Ruddle the nonsurgical removal of a broken instrument will be influenced by



Fig 1(Pre-op)

Fig :2(Pre-op IOPA)

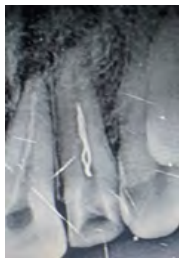


Fig:3 Intra-op IOPA

Fig :4(Varios 970)

the diameter & curvature of the canal, thickness of root dentin and the depth of external concavities, length of the separated fragments, position of fragment with in canal, make of the fractured segment etc.⁶ If the separated fragment lies in the straight portion of the canal and the coronal portion of the fragment can be well exposed and seen by magnification aid, it can be retrieved. If the fragment is below the curvature and can't be seen by DOM, it is better to bypass it if possible or else better do extraction/periapical surgery/obturate till the level of fracture depending upon the signs & symptoms.⁷

Various devices are available to retrieve metallic fragments from canal. We need to evaluate each case separately and decide which technique or device has to be used to retrieve it after considering the factors like root canal anatomy, curvature of canal & position of fragment in the canal. However, none of these devices guarantee success in every cases.

Presence of metallic fragments will hinder the effective cleaning and shaping procedure especially in retreatment cases which can affect the prognosis of the treatment. So removal of these fragments is very important as far as the treatment

outcome is concerned. In this particular case report the metallic fragment was located in the straight portion of the canal, well mobilised using ultrasonics and coronal aspect was seen using a surgical flip up loupe with galilean optics of 3.5x magnification. Since many factors are favourable for retrieving it, an alternative method of instrument retrieval was planned using customised microtube. This microtube can be easily made from an 18 g needle and is very economical. This method can be easily employed in cases where separated instrument is mobile and coronal aspect can be exposed by creating a staging platform and if it can be clearly seen through DOM or surgical loupe.

Therefore, retrieval of separated instruments should not be routinely attempted, the decision of removal should be based on the judgement of an experienced clinician after weighing the advantages and disadvantages of retrieval, keeping in view the prognosis of the procedure and its effect on the structural integrity of the tooth.⁷

Conclusion

In the present case an alternative method of using customised microtube and magnification aid in retrieval of wire

fragments from root canal. This method can be used by any clinician to retrieve fragments from canal, in the absence of expensive and efficient instrument retrieval systems easily. This method is simple and cost effective and at the same time can result in predictable success.

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LEGAL ASPECTS OF MEDICAL NEGLIGENCE

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ABSTRACT

Public awareness of medical negligence in India is growing ever since the Consumer Protection Act, 1986 came into force. As a result of this, increasing number of legal cases are being filed against doctors. Complaints regarding the standards of professional competence and the appropriateness of the therapeutic and diagnostic methods were questioned in courts. In a number of such cases, courts have found that the doctors were indeed negligent in their medical service and the patients were awarded compensation in such cases. This article aims to give an idea about the concept of medical negligence to healthcare professionals.

INTRODUCTION

Healthcare professionals are often faced with issues of medical negligence in their routine clinical practice. Therefore, it is essential that health care professionals have some knowledge about the legal aspects of medical negligence. Medical negligence results from the failure on the part of the doctor to act in accordance with medical standards in practice, which are being practiced by an ordinarily and reasonably competent man practicing the same profession. There may be so many instances in which a medical professional

may act in a highly negligent manner. Similarly, commission of illegal acts beyond the scope of duty of medical practitioner may hold him guilty of a negligent act. In order to understand the concept of medical negligence, it is important to learn about the definition of negligence.

NEGLECTENCE

The noted jurist, Winfield has defined negligence as “the breach of a legal duty to take care which results in damage, undesired by the defendant to the plaintiff.” From the above stated

definition, it can be very well seen that negligence comprises of the following elements: a) existence of legal duty; b) breach of legal duty; c) damage caused by the breach.

a) Existence of legal duty:

One of the essential conditions of liability for negligence is that the defendant owned a legal duty to take care towards the plaintiff. ie; negligence is nothing but the breach of a duty to take care. That duty arises by reason of relationship in which one person stands to another person or authority. This duty of care must be owed to the plaintiff. It is not sufficient to show that the defendant owed a duty to take care. It must also be established that the defendant owed a duty of care towards the plaintiff.

b) Breach of legal duty:

Another essential condition for the liability in negligence is that the plaintiff must prove that the defendant committed a breach of duty to take care or he failed to perform that duty. In order to decide whether there has been a breach of duty, it is necessary to keep in mind the standard of care which law requires from a person who owes a duty to take care. The standard of care which law requires is that of a reasonable and prudent man.

c) Damage caused by the breach:

The last essential condition for the liability in negligence is that the damage caused to the plaintiff was the result of the breach of the duty and must not be too remote a consequence of it. The burden rests on the plaintiff to prove on a balance of probabilities, a casual connection between his injury and the defendant's negligence.

NEGLIGENCE IN THE CONTEXT OF MEDICAL PROFESSION

Negligence in the context of medical profession necessarily calls for a treatment with a difference to infer rashness or negligence on the part of a professional, in particular a doctor; additional considerations apply. These considerations are summarized below:-

- 1) A case of occupational negligence is different from one of professional negligence.
- 2) A simple lack of care, an error or judgment or an accident is not proof of negligence on the part of a medical professional.
- 3) So long a doctor follows a practice applicable to the medical profession of that day, he cannot be held liable for negligence merely because a better alternative course or method of treatment was also available or simply because a more

- skilled doctor would not have chosen to follow or resort to that practice or procedure which the accused followed.
- 4) When it comes to failure of taking precautions, what has to be seen is whether those precautions were taken which the ordinary experience of men has found to be sufficient.
 - 5) A failure to use special or extra ordinary precaution which might have prevented the particular happening cannot be the standard for judging the alleged negligence.
 - 6) The standard of care, while assessing the practice as adopted, is judged in the light of knowledge available at the time of incident, and not at the date of trial.
 - 7) A professional may be held liable for negligence on one of the two findings : either he was not possessed of the requisite skill which he professed to have possessed or he did not exercise, with a reasonable competence in the given case, the skill he did possess.
 - 8) The standard to be applied for judging, whether that person charged has been negligent or not, would be that of ordinary competent person exercising ordinary skill in that profession.
 - 9) It is not possible for every professional to possess the highest level of expertise or skills in that branch which he practices.
 - 10) A highly skilled professional may be possessed of better qualities, but that cannot be made the basis of the yardstick for judging the performance of the professional proceeded against on indictment of negligence.
 - 11) The concept of negligence, differs in civil and criminal law. What may be negligence in civil law may not necessarily be negligence in criminal law. For an act, to amount to criminal negligence, the degree of negligence should be much higher, ie; gross or of a very high degree, negligence which is neither gross nor of a higher degree may provide a ground for action in civil law, but cannot form the basis for prosecution.
 - 12) To prosecute a medical professional for negligence under criminal law, it must be shown that the accused did something which in the given facts and circumstances

no medical professional in his ordinary senses and prudence would have done or failed to do so.

CONCLUSION

Negligence becomes accountable on account of injury resulting from the act or omission amounting to negligence attributable to the person sued. The essential component of negligence are three – ‘duty’, ‘breach’ and ‘resulting damage’.

The concept of negligence can be summarized in the words of Alderson; B thus – “Negligence is the breach of a duty caused by omission to do something which a reasonable man guided by those considerations which ordinarily regulate the conduct of human affairs would do or doing something which a prudent and reasonable man, would not do.”

In my next article, I shall explain about the civil and criminal liability in cases of medical negligence. Even though healthcare sector has been kept out of the purview of Consumer Protection Act, 1985 by the latest amendments to the Act. Liability in case of medical negligence still exists in both civil and criminal laws of our country.

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**First prize won article in National Level Essay Competition
conducted by IDA Thiruvalla Branch**

INNOVATIVE IDEAS IN GREEN DENTISTRY

The word “GREEN” has multiple *ramifications* in its meaning. In the context of our essay on “Innovative ideas in Green Dentistry”, it means an environment-friendly dental care. In any discipline we should strive for practicing methodologies, which will not harm our eco-system and dear Mother Earth i.e. the fine tune of natural ecological balance should not be disturbed by our activities. As a dentist or rather as a “*Green Dentist*”, it should be our motto, commitment and motivation to gradually modulate or adapt ourselves to different eco- friendly dental practices.

Dental wastes are usually generated from different dental care facilities which may be hospitals, clinics, research facilities and many more. This can be divided into two main categories – **Non Hazardous** like gloves, masks, gowns, head caps etc. & **Hazardous** like chemicals, toxic or poisonous medicines, pathogenic or radioactive wastes. The need of safe disposal has attained importance and prominence especially during the COVID pandemic. Improper management can have both direct and indirect health consequences on personal, community and the environment level as a whole.

Different methods of waste disposal have been practiced for a long time in different countries. *Incineration* is still the most favored and widely used treatment technology, but this method leads to production of toxic ash and air pollution. *Non- incineration* methods like thermal auto-clave, chemical treatment, irradiation (gamma sterilization) are being deployed to decontaminate waste by destroying pathogens. The high volume of plastic articles used in dental-field is also a definite threat to our environment. The recent COVID-pandemic has aggravated this problem to a great extent as there is large scale utilization of PPE kits, gloves and masks.

So far we have discussed incineration and non-incineration method that are being mostly employed. Some innovative or some new innovations of dental waste management are brought into focus recently mainly based on the concept of recycle. A successful project where bricks are being made from PPEs, masks and head caps is showing a lot of promise. These **e-bricks** can be used in architecture and interior designing of dental clinics. The concept of **eco-bin** is another prospective idea. The **micro-auto-gasification** system

is a simple and compact method capable of converting any combustible dental waste into renewable thermal energy and bio char. **Solar heating** which is an environmental friendly cheap procedure, can be used to disinfect infectious dental wastes. The very basic concept of Green-Dentistry is based on the model of 4 R's – *Re-think, Re-duce, Re-use and Re-cycle*. We need less chemical contamination and fewer disposables, we need less radiation and better diagnostic details, we need more natural looking dental restorations and less heavy metal waste. The *Hi-tech* innovations as previously mentioned will definitely reduce the amount of waste and pollution in the environment. Dental procedures that uses huge amount of electricity can be reduced by using eco-friendly gadgets and more use of CFL bulbs etc. Radiation can be curtailed by opting for digital X-rays rather than Conventional ones. Use of computers and AI (artificial intelligence) will help eliminate the paper usage to great extent and at the same time it will help in proper documentation and data-keeping.

The impact of heavy metal contamination of water systems via dental amalgam waste is a matter of serious concern. This can be prevented by using alternate substances or composites and recycling waste amalgam. Different disposables like

latex-gloves, plastic pouches, head-rest covers can be replaced by cloth head-rest covers, re-usable metal suction tips etc. Saliva ejector system where there is tremendous wastage of water can be replaced by dry-vacuum system.

Innovations in Green-Dentistry will go a long way in reducing costs of therapy and at the same time increase our productivity by efficient use of time. Ray Kroc once said,

”As long you are *Green*, you are growing. As soon as you are ripe, you start to rot.”

It should be our pledge and commitment for our future generation that we will keep this planet livable for them. There is no denying of the fact that change of human attitude, behavior as well as strict legislation and penalties are urgently needed for proper disposal of dentistry related waste. Progress is impossible without change, and those who cannot change their minds cannot change anything. Green Dentistry and its innovative ideas are definite dental social movement to make this planet a better place to live and we, the budding dentists, should take adequate responsibility in this perspective and change our mindset, eventually adapting ourselves to this movement.

IT IS EASY... BEING GREEN

Going green is more than a trend it's a reality. When we think of the color green, what actually comes to our mind is the healing power of green, the color which enhances our vision, the color which indicates growth and hope.

Directly or indirectly every human being is responsible for environmental pollution and of course dentistry is not an exception. Human beings are the biggest threat to their own race. Thus it is essential for each individual to be aware of his or her carbon footprint and what all changes that can be incorporated in his lifestyle. Global warming is a term almost everyone is familiar with, which actually refers to the gradual rise in overall temperature of atmosphere of earth. There are many causes for this and as dentist we are a part of this danger and every little step, no matter how small, carries a lot of weight. So from our side a small initiative is the concept of Green Dentistry.

It is an attempt that combines dental practice and environmental conservation. It helps to prevent the harmful chemical or materials of dental office from polluting environment which in turn cause global

warming. It helps to maintain a balanced environment. The key concept of green dentistry include conservation of water and energy, use of non toxic products, reduce waste and eliminate hazardous toxins that affect patient and environment negatively and to promote green products.

Conservation is the manthra of green dentistry. Ecofriendly dentistry uses a sustainable approach to encourage dentist to implement new strategies like **4 R's**.

Rethink: Rethinking the way dental offices are running is the first step. It includes rethinking the dental procedure, construction and administration of a clinic in accordance with ecofriendly dentistry

Reduce: Reduce the consumption of resources given by our planet. By reducing the consumption of paper and disposable products, we can save large number of trees and thereby global warming. Also give importance by reducing the usage of water, electricity by turning off lights and other devices after use.

Reuse: This means the extended use of an item thus debaring the item from contributing to waste. Reusable cotton towels, prefer reusable stainless steel suction, biodegradable cups

instead of paper cups are some ways to save the resources and energy.

Recycle: Actually it is the process of converting waste into reusable objects. By recycling we can reduce the generation of waste being produced by making new products.

Some of the innovative ideas of green dentistry include

- Practice metal free, mercury free dentistry with noamalgam.
- Recycling of broken instruments.
- Use of mercury separators.
- In conventional radiography waste developer solution should be recycled properly.
- Steam or dry heat can be used for sterilizing instruments.
- Paperless record to reduce paper consumption.
- In dental office, use fluorescent light.
- Energy and money can be saved by using solar panels.
- Digital patient charting and scheduling.
- Green plants in operating rooms to increase oxygenation.
- Use LED operating lights.
- Use ecofriendly hand sterilizers.
- Construct rain water harvesting plant for water conservation.
- Reusable glass irrigation syringes can be used.
- Use chlorine free paper products.
- Consider solar charges for charging phones, laptops etc.
- Use digital version of journals and publications.
- Consider windmill generated electricity for power consumption.
- CAD/CAM systems

Despite the benefits offered by ecofriendly approach, dentistry as a whole has been slow to catch on to the trend. Few of the shortcomings are, first and foremost barrier is unawareness and a few worked on implementing the concept of green dentistry. Another barrier is the cost. And those who already have a conventional dental clinic would give a difficult time in getting convinced to rebuild it.

Dentistry is a healing profession. Being a part of profession responsible for spreading smile, we should try to make our dental practice ecofriendly for a greener future. It is the ethical duty of all dentists in developing sustainable solutions. Try to install the use of 4 R's in dental clinics.

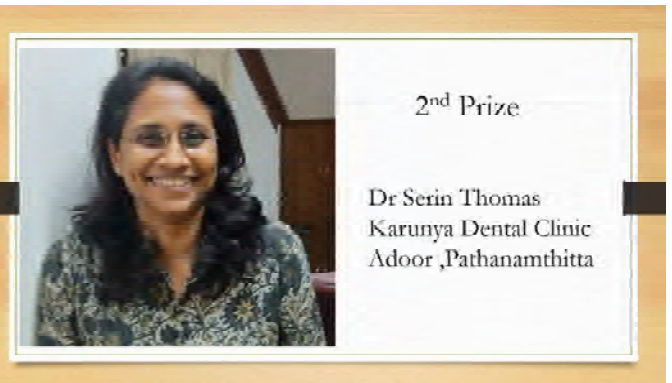
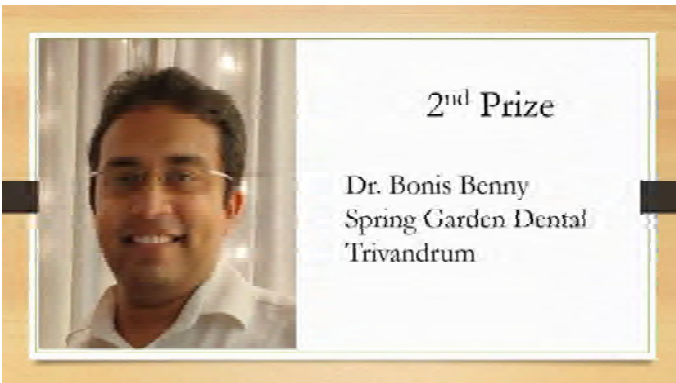
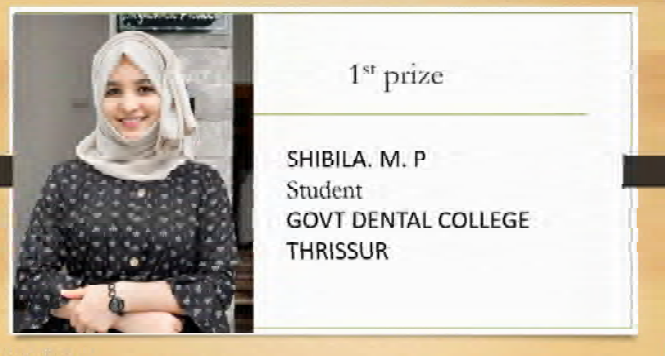
As a dentist, I will try to become a part of dentistry's clean, green and profitable future.

So that the planet and eventually the patients will thank us.

GO GREEN AND SAVE EARTH



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