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EDITORIAL

Ethics in Dentistry - Profession or business.

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ETHICS is a subject which, of necessity, is considered in any, and all walks of life either consciously or unconsciously. Any move one chooses to make is prompted by some motive, either for himself, or for his fellowman. Ethics is indeed a broad subject and surely justice could not be done by any one particular individual, as it is something that grows and changes in various situations. It is altered by its environments and everything that goes to make up the environment. Ethics has been defined as "the science of moral philosophy." This statement may be substantiated by saying that in the strict sense of the word it is not a science, but should be regarded as a philosophy, since there is no exact universal definition. It is something which is abstract in the truest sense of the word. The concepts of ethics to any one individual depend upon how that individual thinks, what he considers right and what he considers wrong. Notwithstanding the various interpretations which have been made, it still retains its original Greek meaning which pertains to character and character-building.

It is in school that we may learn the very basic difference between a profession and a business. The people with whom we are to come in contact are looked upon entirely differently. They make this demand upon us by confiding in us. In a profession there is something, whether tangible or intangible, that places service above material gain, battles all forces which make for disintegration or demoralization of our highest ideals, lights in defense of honor of the profession and protection of material and moral welfare of the people.

In the profession the human element reigns. Personal services are rendered to supply personal needs, and do not become a matter of selling something as in business. Diseases are treated or prevented. Such services arc not objects to be transmitted. Such services do not present charges, nor are they listed under various prices as commodities. Honest thinking individuals realize that they could not possibly pay the price for such services. Instead, fees are presented to that individual for the services rendered. In making a fee, one must consider such things as the materials used, cost of production of the restoration (if required), the lime element, the benefit that the patient derives from one's services, and the cost of your training for such work. Professional service implies much more than what we actually think.

When one thinks of material gain, he immediately thinks of trade. On the other hand, when professional service is thought of, sacrifice runs hand in hand with it. Patients place all of their confidence within the hands of the professional man, who in turn should act as a protector to them. As soon as profit motives dominate a calling, it ceases to be a profession. Professions, to it

large extent, are self-governed and self – disciplined, and is left to us of the future to keep them so by ethical practices

The ADA Code is, in effect, a written expression of the obligations arising from the implied contract between the dental profession and society. The ADA Code has three main components: The Principles of Ethics, the Code of Professional Conduct and the Advisory Opinions.

Principles

The Principles of Ethics are the aspirational goals of the profession. They provide guidance and offer justification for the Code of Professional Conduct and the Advisory Opinions. There are five fundamental principles that form the foundation of the ADA Code: patient autonomy, non maleficence, beneficence, justice and veracity. Principles can overlap each other as well as compete with each other for priority. More than one principle can justify a given element of the Code of Professional Conduct. Principles may at times need to be balanced against each other, but, otherwise, they are the profession's firm guideposts.

Code of Professional Conduct

The Code of Professional Conduct is an expression of specific types of conduct that are either required or prohibited. The Code of Professional Conduct is a product of the ADA's legislative system. All elements of the Code of Professional Conduct result from resolutions that are adopted by the ADA's House of Delegates. The Code of Professional Conduct is binding on members of the ADA, and violations may result in disciplinary action.

Advisory Opinions

The Advisory Opinions are interpretations that apply the Code of Professional Conduct to specific fact situations. They are adopted by the ADA's Council on Ethics, Bylaws and Judicial Affairs to provide guidance to the membership on how the Council might interpret the Code of Professional Conduct in a disciplinary proceeding.

The ethical principles we read about should be put inter practice. When this is done, greater demands can be made upon society. This is not possible when only a few in a vast number attempt it. 'Ellis brings out the necessity of keeping these principles constantly before the minds of profesional groups. This can be done through the literature and the dental societies. It is left to us to prove that the profession is still dedicated to serving as practitioners of the healing art to the point of sacrifice if necessary. If this is done in sincerity, little will be necessary in the way of legislation. Let us preserve both burly and soul by consecration of the noblest aspirations of our lives, and by proving through act and thought that dentistry has a mission among men. The dental profession holds a special position of trust within society. As a consequence, society affords the profession certain privileges that are not available to members of the publicat large. In return, the profession makes a commitment to society that its members will adhere to high ethical standards of conduct. Although ethics and the law are closely related, they are not the same. Ethical obligations may and often do exceed legal duties. In resolving any ethical problem not explicitly covered by the ADA Code, dentists should consider the ethical principles, the patient's needs and interests, and any applicable laws.

CASE REPORT

"STITCH IN TIME SAVES NINE": REPORT OF ORAL LESIONS

DR AARTI TRAKROO

ABSTRACT

This article discusses various oral lesions reported at Clove Dental clinic and the importance of early diagnosis in satisfactory clinical outcome is emphasized. In addition, current concepts in management of these lesions that can aid practitioners are also discussed.

INTRODUCTION

"Stitch in time Saves nine" here, stresses at clinical diagnosis as the first successful therapeutic management of a patient with oral mucosal disease or oral lesion. Without the information provided by the history and physical examination, the diagnostic process and treatment outcome is reduced to hazardous speculation[1].

The purpose of this article aims at gathering relevant clinical findings for primary diagnosis of oral lesions reported and their treatment staying abreast of current concepts of management.

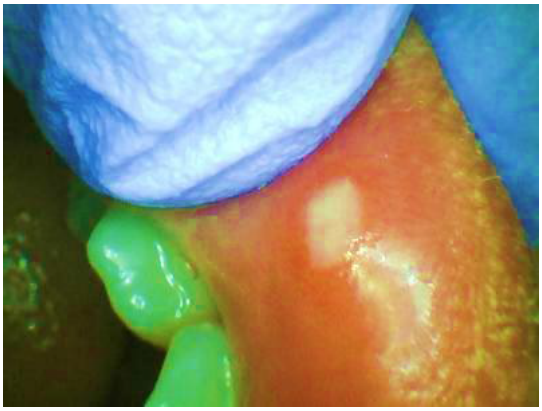
Case report **1** - Aphthous stomatitis (Canker sores, recurrent aphthous stomatitis, RAS) :

A 19 year old female patient reported with recurring painful symptoms during the ingestion of food since 3 months and that these symptoms had been previously treated with different topical medicines, however, the lesion did not regress. There was no history of any trauma, swelling, pus discharge, blood discharge, fever, paresthesia, anorexia and weight loss. On extraoral examination, no abnormality was detected. Clinical examination revealed ulcers with perilesional erythematous halos that were covered with a pseudo membrane and located in the labial mucosa and on the left side border of the tongue, exceeding 1 cm in diameter.

A clinical diagnosis of RAU was made on the basis of the history and the clinical examinations. The other aspects of the patient's medical history and family medical history were insignificant. Laboratory tests including a blood count analysis were performed to determine the levels of folic acid, iron, ferritin, as well as vitamins B2, B6, and B12, all of which showed normal results.

Recurrent aphthous ulcerations (RAU) are common oral lesions that affect approximately 10% to 20% of the population. The disease is characterized by recurrent and painful ulcerations of the oral non-keratinized mucosa, which measure from 3 to 10 mm in diameter and heal without scarring in 7 to 14 days.[1,2]

Current concepts in management of RAS primarily aims at bringing relief from pain, reduction in ulcer duration, and the restoration of normal oral function. Secondary goals include a reduction in the frequency and severity of recurrences and the maintenance of remission.



S In present report,the patient was subjected to following local therapy:a)oral rinses with benzidaminehydrochloride and 0.2% chlorhexidine in rinses or gel, three times a day without swallowing. b)The administration offixeddose doxycycline in mucoadhesive gel format RAS.C)OintmentAmlexanox(antiinflammatory and antiallergic) 5%, applied 2-4 times a day.To reduce the frequency of ulceration, levamisole hydrochloride (150 mg) for 3 consecutive days /week for three consecutive weeks. The therapeutic method used in this case provided significant relief from symptoms and no recurrence in follow ups till date.

Case report 2 - Drug Induced Gingival enlargement:

A 42 -year-old male patient reported with a chief complaint of generalized swollen gums which bled on slight provocation for the last 2 years. His medical history revealed epilepsy since the age of 20, controlled with medication (phenytoin 100 mg BID) for the last 7 years. On inspection generalized mulberry shaped gingival overgrowth which was bright pink in color, was seen involving the interdental papillae, marginal and attatched gingiva on the facial and lingual aspects of maxillary and mandibular teeth.The extent of the gingival overgrowth was such that it extends coronallyupto the middle of the crown portions of the maxillary and mandibular if gingival enlargement does not regress after drug substitution and nonsurgical periodontal therapyUnited States Food and Drug Administration (FDA) in 2000 has approved the incorporation of a systemically delivered collagenase inhibitor consisting of a 20-mg capsule of doxycycline hyclate as an adjunct to scaling and root planing for the treatment. Benefits included a statistically significant reduction in probing depths, a gain in clinical attachment levels and a reduction in the incidence ofdisease progression.[6]

Overlying mucosa was lobulated.On palpation it was non tender, firm in consisitency with no bleeding or any discharge. On probing generalized deep periodontal pockets were present.

Anorthopantomograph of the patient revealed bone loss in the lower posterior regions. Complete hemogram results were under normal limits. A diagnosis of generalized drug -induced gingival enlargement superimposed with periodontitis was made.

Current concepts in management of drug induced gingival enlargement aims initially at drug substitution followed by advocating diligent plaque control measures. Surgical therapy is planned

Patient in present report was advised to consult his physician for the replacement of phenytoin by some other anticonvulsant and he was also advised to undergo thorough oral prophylaxis.

With the consent of the patient and his physician, complete professional oral prophylaxis was performed, along with a prescription of a 0.2% chlorhexidine mouthwash. Cap.The recommended dosage is 100 mg bid the first day, then 100 mg o.d. was prescribed for 14 days. After 1 week, the gingival condition improved and the

patient was asked to maintain oral hygiene with a soft, gentle toothbrush and warm saline gargles (Fig... With the physician's consent, phenytoin was substituted with gabapentin (300 mg TID after titration of the dose). Substantial regression in gingival enlargement was observed.Patient was recalled for supportive periodontal therapy .

Case Report 3 - Oral Submucous Fibrosis :

A 52 years old male patient visited with the chief complaint of decreased mouth opening noticed since 10 years.He also gave history of burning sensation to salty and spicy foods and even in the absence of stimuli.Personal history revealed that he used to consume areca nut regularly for a period of 8 years in the past but has stopped consuming now.On the right buccal mucosa, generalized erythema was seen which was mixed with whitish areas. On palpation vertical fibrous bands were palpable and they were tender. Pliability of the mucosa was lost. On the left buccal mucosa whitish appearance was seen mixed with erythema, less of the red component. Mucosa of the lower lip and buccalmucosa was fibrosed and stiff. Tongue was depapillated and shrunken affecting its protrusion. Uvula was shrunken.Mouth opening recorded as 22 mm. A clinical diagnosis of OSMF stage2 was made on the basis of the history, clinical examinations and investigations.

Oral submucous fibrosis (OSMF) is a chronic, progressive, disabling, scarring, precancerous condition of the oral mucosa which is irreversible either remain stationary or become severe with high risk of oral cancer development due to denuded or atrophic oral mucosa vulnerable to carcinogens. OSMF has malignant transformation rate of 7–30%.Its poorly understood etiopathogenesis leads to difficulty in management.[8] Currently, after progressive understanding of its pathogenesis, concepts of therapy being followed are tabulated in table 2[9,10] .

Counselling was done regarding the discontinuing of the use of areca nut for the patient in present report.He was advised to take bland diet, diet rich in high proteins and was prescribed a BenzydamineHCl mouthwash to be used before meals5 times daily physiotherapy by interpositioning tongue spatulas between teeth and adding a new spatula every 5–10 days for 4 months was recommended.Intralesional injection therapy of dexamethasone mixed with hyaluronidasebiweekly was started for 12 weeks.Cap Lycosuf to be taken once daily.Gradual increase in the mouth opening and decrease in stiffness of mucosa was observed in 2 months period. Burning sensation and pain was decreased in intensity.

Case Report 4 - Oral Lichen Planus:

A 53 years old male patient visited with chief complaint of burning sensation on taking hot and spicy food since 7 months. History of presenting illness revealed that ulcerations were noticed by the patient since 7 months back for which he was treated outside the Clove Dental with different topical medicines, however, the lesion did not regress. History of presenting illness revealed that burning sensation was continuous and aggravated on eating spicy food. No history of any type of eruptions on any other body part. Intraoral examination revealed.An erythematous area with white striae at periphery, approximately 3-4 cms in maximum diameter was present on left and right buccal mucosa starting from pterygomandibular region anteriorly upto labial sulcus. On palpation lesion was tender, and rough in ulcerated area and

mucosa was pliable. On the basis of history, clinical examination and biopsy report, diagnosis of Erosive lichen planus was made.

Oral lichen planus (OLP) is a common chronic autoimmune disease associated with cell-mediated immunological dysfunction. Erosive lichen planus (ELP) affecting mucosal surfaces is often more painful and debilitating than the non-erosive types of lichen planus. OLP lesions are consistently more persistent than the dermal lesions and have been reported to carry a risk of malignant transformation to oral squamous cell carcinoma (OSCC) of 1-2%.[1]

Due to the recurring periods of exacerbation and remission and longer duration of disease progression, and seldom non responsiveness and exuberation of lesions after conventional therapeutic modalities, such lesions poses a treatment challenge to the dentists and thereby its efficient management.Current concepts in treatment modalities are tabulated in table3.

The patient was advised T. Wysolone 10mg [Prednisone] QID x 1week which was tapered in 4 weeks duration & was instructed the local application of Kenacortointment [triamcinolone acetonide 0.1%] 3-4 times daily in due time. The patient was revaluated after 20 days during which the bilateral erosive areas were healed.During the subsequent follow up in 1 month, 2 months and 3 months, it was noticed that there was complete resolution.

CONCLUSION:

An attempt is made to report few oral lesions with emphasis on role of diagnosis and its subsequent management thus reducing the rate of morbidity and mortality.The dental practitioner bears the responsibility for the recognition of oral disease at an early stage and spread awareness among how serious lesions can turn if ignored and timely treatment is essential to prevent severe consequences that can arise otherwise.

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CASE REPORT

Full mouth rehabilitation of a mutilated dentition with zirconia crowns and precision attachment.

Dr ROHIT LAKHIYANI

Chief Complaint – Patient Mr Gian Singh 60years/ Male reported to Clove Rajouri Old centre with a complaint of damaged teeth and inability to eat and chew food properly since 6 months.

Past Medical History – Patient suffering from Diabetes Mellitus over 6 years, patient takes insulin. H/O Hypertension, Hyper thyroidism, H/O Liver cirrhosis

Past Dental History – History of gradual loss of teeth as patient has habit of Chewing Pan Masala over 30 years.

O/E – Generalized decay of teeth present

- Generalized pan masala stains present
- Fibrous bands present involving right and left buccal mucosa region, soft palate region
- Reduced mouth opening present (Three fingers)
- Collapsed bite due to multiple missing posterior teeth
- Retrognathic maxilla, Prognathic mandible
- Existing Class III Skeletal relationship with reverse cross bite

Reestablishing optimal esthetics is one of the most important challenges in replacing

Pre Operative Front

Pre operative occlusion-Rt side

Pre operative occlusion-Lt side

Treatment Plan

- Patient advised to discontinue habits
- Administration of Antioxidant
- Local application of Kenacort ointment – as patient gave a H/O burning sensation on consuming spicy food
- Oral Prophylaxis
- Extraction of grossly decayed teeth and rot stumps
- Root canal treatment of grossly carious teeth
- Fillings/restoration of teeth
- Raising the bite by 4mm planned to create interarch space and rehabilitate teeth
- Zirconia crowns advised irt 14-17, 27, 34-37, 33-43, 44-47 and precision attachment – DMLS PFM crowns irt 13-22 and replacing 23-26 through semi-rigid extension partial denture
- Patient not advised Implants placement as there was reduced mouth opening, buccal mucosa is fragile and Patient un-willing to go in for any invasive surgical process.

COURSE OF TREATMENT

a) Diagnostic impressions of Maxillary and mandibular arch recorded in rubber base, Bite recorded in modelling wax at raised vertical dimension (4mm), Face Bow transfers done, Anatomical wax up planned and done from lab at raised vertical dimension

b) Extraction of the wisdom tooth 38 was planned and done

c) Oral prophylaxis

d) Root canal treatment irt 11,13,21,22,27,32,36,37,42,45,46

47 (re-rct)

e) Post and core irt 22

f) Prosthetic r ehabiliation Started

- Tooth preparation started in stages irt 11,13,14,15,16,17, 21,27, 32,33,34,35,36,37, 42,43,44,45,46,47 – simultaneously chair side temporary crowns fabricted with pro-temp 4 temporary crown material, crowns finished and polished, cementation done with rely-x temporary crown cement, excess cement removed, post op instructions given to patient

- Once all the existing natural teeth were prepared impressions were recorded, working cast made. Temporaries at raised vertical dimension were made using Putty index of the anatomical wax up. Temporaries on the working models were mounted on Mean value articulatoe and occlusal adjustments done. After finishing, the temporary crowns were finished and polished, tried in the patient's mouth.Minor adjustments wer done after checking centric and eccentric jaw movements with temporaries in patient's mouth. Splintted temporaries were fabricated and cemented using Rely-X temporary crown cement, patient wax advised to use these temporary crowns at raised vertical dimension for 3 weeks. Patient was instructed to chew soft food with the

temporaries and maintain oral hygiene nicely. Patient advised warm saline rinsing thrice daily for 15 days, and gum massaging thrice daily for 15 days. Patient was recalled for follow up after 5 days, minor occlussal corrections were made. Patient was comfortable and adjusted nicely with temporary crowns at raised vertical dimension.

- After 3 weeks, temporary crowns removed, tooth cleared off of old cement, Maxillary and mandibular rubber base impressions recorded. Retractioncord Ultrapack 000 used for gingival retraction. Bite recorded in modelling wax at raised vertical dimension planned, face bow transfer done along with protrusive records. Work sent to lab for framework trial.

Framework / Coping trial done to assess margin fit . Margin fit is good, minor adjustment were requires in the DMLS crown 11,21 changes marked and the instructions shared with the lab.

Bite in modelling wax recorded with framework in patients mouth for reference of lab.

Provisionalisation

- After 1 week finished crowns and semi-precision work checked for margin fit, Aesthetics, Occlusal contacts, after removal of temporary crowns and cleaning the tooth. After proper isolation and conditioning, ethching and bonding of tooth the crowns were cemented using Rely-X U200 resin cement, followed by cementaton of DMLS crowns assebly with extension. Excess cement removed after tac curing with light. Interdental excess cement removed using floss. Patient instructed warm saline rinsing thrice daily for 1 week alongwith gum massaging with gum paint. Patient instructed to discontinue his habits of pan masala chewing and on maintainence of oral hygiene. Patient demonstrated and educated on removal and placement of semi-precision extension and its maintainence. First follow up done after 5 days, minor occlusal coorections done after checking the bite in centric and eccentric movements.

At the end of the treatment we were able to restore the mutilated teeth, raising the vertical dimension, restoring facial height, and enabling the patient to improve on mastication. Gaining a CLOVE AMBASSADOR.

CASE REPORT

Management of curved root canals : A Case Report

Dr SHASHANK ARORA .

ABSTRACT

A tooth with a straight root and a straight root canal is an exception rather than being normal because most teeth show some curvature of the canal. In addition, most canals have multiple planes of curvature throughout their length.[1]Tomes, in 1848, called such curvatures as "dilacerations." It refers to an angulation or a sharp bend or a curve in the root or crown of formed tooth or a deviation or bend in the linear relationship of a crown of a tooth to its root.[2] Dilaceration is the result of a developmental anomaly in which there has been an abrupt change in the axial inclination between the crown and the root of a tooth. Dilaceration can be seen in both the permanent and deciduous dentitions, and is more commonly found in posterior teeth and in maxilla.

INTRODUCTION

One of the most important aspects of endodontic treatment is the cleaning and shaping of the root canals. The most desirable shape of the prepared canal is a progressive taper with the largest diameter at the coronal end and is narrowest at the apical constriction.[3]A progressive taper allows a greater degree of instrument and irrigant contact with the surfaces of the canal walls, thereby enhancing the effectiveness of cleaning.[4]

However, the preparation of curved canals presents one of the greatest challenges in endodontics and is fraught with difficulties. Only the curvatures in mesio-distal plane can be seen on radiograph, though curvatures in the bucco-lingual plane are also evident in many teeth. Failure of root canal treatment in curved canals is mainly due to procedural errors like ledges, fractured instruments, canal blockage, zip and elbow creation.[5]

How to determine Curvature of the canal?

Before initiation of the treatment, an estimate of the curvature should be made on the radiograph. The interior angle is formed by the straigth line from the orifice through coronal portion of the root and another straight line form the apex through the apical portion of the root.

Various techniques used for management

Traditionally, canal shaping has been achieved using ISO- normed, 0.02-tapered stainless steel instruments. Sizes above #15 or #20 become inflexible and have a tendency to straighten. When carried out in curved canals, such procedure often results in iatrogenic damage to the natural shape of the canal, particularly in its apical third, resulting in errors like ledge, elbow or zipping of the canal.[5] To avoid occurrence

of such errors, even contact of the file to canal dentine should be there. But the file has the tendency to straighten up, and hence it is difficult to control removal of dentine along the entire length of file in push pull motion.

The above errors can be reduced by[6]

1)decreasingthe restoring force by meanso f which straightfile apt to bendagainstthe c urved dentinesurface and

2)decreasing the length of the file which is aggressivelycuttingat a givenspan.

Decreasing the force can be done by the following.

Precurving the file
A precurved file traverses the curve better than a straight file. Precurving is done in two ways:

Placinga gradualcurve for the entire lengthof the file
Placing asharp curve of nearly 45° near the apicalend of the instrument

Extravagant use of smaller number files as they can follow canal curvature
Because of their flexibility, they should be used until larger files are able to negotiate the canal without force.

Use of intermediate size of files
It allows smoother transition of the instrument sizes to cause smoother cutting in curved canals, e.g. cutting 1 mm of No. 15 file makes it No. 17 file as there is an increase of 0.02 mm of diameter per millimeter of length.

Use of flexible files
As they help in maintaining shape ofthe curve and avoid errors like ledge, elbow or zipping of the canal.

Decrease in length of actively cutting files is achieved by the following:

- Anti-curvature filing.
- Modifying cuttingedges of the instrument by dullingthe flute on outer surface of a pical third and inner portion of middle third, which can be done by diamond file.
- Changing canal preparation techniques,i.e. use of crown - down technique.Tendency to create narrow canals hapes minimizingaccess of irrigants and creating potential to allow debris to be pushedapically.Attempts at overcoming the deficiencies of these instruments resulted in a numberof preparation techniques that aimedto reduce iatrogenic defects and produce canals with a more flared shape.[5]

- A significant advancement in root canal preparation with hand instruments was made with the introduction of balanced force movements of files. The balanced force movements of the file are:[5]

- clockwise 60°, so that it bindsagai nst the wall and advances apically.
- anticlockwise 120° wit h apical pressure, so

as to crush and break off the engaged dentinal wall.

- clockwise 60° without apical advancement, allows flutes to be loaded with debris and removed from the canal.

Advantage

- Efficient and less prone to cause iatrogenic damage and maintains the instruments centrally within the root canal.
- Extrusion of debris apically is also reduced, resulting in less postoperative pain.

Motion of file in a root canal

Enlargement of a straight canal does not pose particular problems. It could be done by a succession of inward and outward motions accompanied or not by rotary motions. However, curved canals are different where departure from the balanced force technique can result in damage of the canal wall. As it is impossible to ascertain on the basis of radiograph whether there is a curvature in a buccolingual plane or not, it is expedient to apply the balanced force technique
as a general rule for the preparation of all root canals.[7]

- Introduction of very flexible instruments made from nickel titanium alloy having a taper 2-6 times greater than the ISO standardized 0.02 files have revolutionarised the management of curved canal. They have the ability to pass around curves more readily. They are available as GT instruments and Protaper instruments (Dentsply). Both instruments appear to offer many advantages over traditional 0.02 taper hand instruments. Both instruments can be used in conjunction with or complementary to rotary instruments. Hand NiTi instruments can also be selected instead of rotary instruments in teeth with difficult canal anatomy like severe curvature in apical third and problematic handpiece access.[5]
- The crown-down sequence of instrumentation has largely superseded the outdated step-back method. The advantages of this root canal preparation from crown to apex with early coronal flaring include[5]:
- reduced coronal binding of instruments;
- less likelihood for a change in the working length measurement during preparation;
- less risk of inoculation of endodontic pathogens into the peri-radicular tissues.
- Enhanced penetration of irrigant into the root canal system

Sequence of instrumentation done with various types of curvatures

1) Endodontic therapy was initiated under local anesthesia and straight-line access was gained in all the three canals.

2) Pulp chamber was irrigated with sodium hypochlorite (NaOCl). Initial scouting of all the root canals was done with K-file no. 10, one by one, and the patency of root canals was established. This negotiating file reproduced the same curvature as that of the curved root canal.

3) File no. 10 was clipped by 1 mm and precurved in the same direction and to the same extent as the scouting file this gave us file no. 12.

4) File no. 12 so obtained was placed in the canal till the apical third.

5) Special emphasis was placed on frequent irrigation of the root canal to avoid blockage by dentinal debris and to remove the necrotic tissue. NaOCl and saline were used for irrigation.

6) Simultaneously, reverse flaring was initiated in the coronal third with K-file no. 40. It was placed in the orifice position for a slight reaming of the coronal portion.

7) Recapitulation was done with file no. 12 and coronal flaring was done in crown-down fashion with K-files no. 35 and 30.

8) Gate-glidden (GG) drills were placed sequentially in a step-back fashion (i.e. no. 1, 2 and 3) to allow easy placement of instruments and to improve the tactile sensation of the instrument placed in the canal. Coronal flaring till (GG) no. 3 was sufficient to provide unrestricted placement of the instrument.

9) Recapitulation with file no. 12 was done to check patency and to remove the dentinal debris thus created.

10) File no. 12 was placed and the pulp chamber was flooded with ethylenediaminetetraacetic acid (EDTA) that provided the necessary lubricating action.

11) A working-length radiograph was taken at this point with file no. 10 placed in the root canal to avoid over-instrumentation.

12) Sequential filing of the curved canal was done with K-files no. 15, 20, and 25 until full working length was achieved. Files were selected to take advantage of the flexibility of the files up to no. 25.

13) K-File no. 30 was placed 1 mm short of the working length.

14) To confirm the deep shape and completeness of uniform preparation, files no. 30, 35, 40 and 45, etc. were used passively in step-back fashion until 3-4 mm short of the orifice.

15) During the whole preparation, root canals were repeatedly irrigated with irrigant and frequent recapitulation was done.

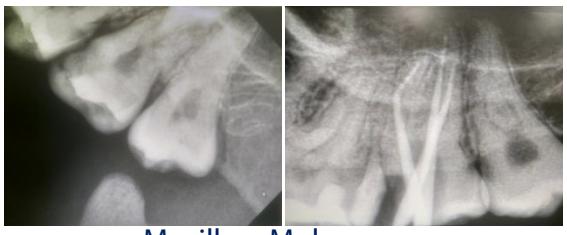
16) A final working-length radiograph was taken, Canals were flushed with saline and dried with paper points.

17) All the straight canals were conventionally prepared by using the step back preparation technique. The lateral condensation method of obturation was preferred.

CASE 1

Mandibular Molar

Case 2



Maxillary Molar

DISCUSSION

One of the most important aspects of endodontic treatment is the cleaning and shaping of the root canals. The most desirable shape of the prepared canal is a progressive taper with the largest diameter at the coronal end and is narrowest at the apical constriction.

A progressive taper allows a greater degree of instrument and irrigant contact with the surfaces of the canal walls, thereby enhancing the effectiveness of cleaning.

However, the preparation of curved canals presents one of the greatest challenges in endodontics and is fraught with difficulties. Only the curvatures in mesio-distal plane can be seen on radiograph, though curvatures in the bucco lingual plane are also evident in many teeth. Failure of root canal treatment in curved canals is mainly due to procedural errors like ledges, fractured instruments, canal blockage, zip and elbow creation.

The cases presented above were treated with hand instrumentation with K files and NiTi rotary instruments. It is important that a tooth with complex root canal morphology be treated properly the very first time, since endodontic treatment in such teeth is likely to fail if not treated carefully.

CONCLUSION -

Proper care and attention should be directed in radiographic assessment, access cavity preparation and exploration to negotiate extra and curved canals. Current NiTi preparations that use files with greater taper or variable taper are a substantial improvement over instrumentation with 0.02 tapered stainless steel files, particularly when used in curved root canals. These newer instruments produce better shape, using fewer instruments and in a shorter time.

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CASE REPORT

Endodontic and Esthetic management of Lateral Incisor - A rare Case Report.

DR SHARAD YADAV, DR NEHA SISODIYA

ABSTRACT

Complete debridement and disinfection of a root canal is essential for attaining satisfactory results following endodontic therapy. Anatomic variations such as increased number of roots, increased number of canals within a single root or increase in complexity of the root canal system present challenges to attaining this goal. In this era of technological advances use of advanced imaging modalities such as cone beam computed tomography (CBCT) allows one to accurately locate any anatomic aberrations , increasing the rate of success of non-surgical root canal therapy. Certain factors such as malpositioning of teeth, presence of fused teeth may complicate post endodontic rehabilitation. This case report highlights the restorative

KEY WORDS : central incisor,vertucci type IV canal configuration

INTRODUCTION

Missed canals are one of the well-known reasons for endodontic failures, as it acts as a source of necrotic materials, microbes and their products.[1]A good knowledge of the root canal morphology is essential for locating all the canals, occasionally however unusual root canal morphology may be encountered. Reported incidence of an additional canal in the maxillary central incisor is said to be around 0.6%.[2]These anomalies in root canal morphology are said to occur due to disturbances in the development of Hertwigs epithelial root sheath (HERS). Location of the main canal away from the centre of the tooth indicates presence of an accessory canal in anterior teeth. The most common additional aid to detect additional canals is the use of angulated radiographs (at 20-40 degrees), these however are said to be effective in locating canals which are widely separated. [3,4] Other factors such as distortion of radiographs and superimposition of anatomic structures can confuse the operator. More advanced imaging modalities such as CBCT may overcome such problems and allow for accurate localisation and treatment of aberrant root canals.

A 20 year old patient presented to the dental OPD with chief complaint of pain and pus discharge in relation of upper front teeth. Patient reported history of fall 3 years back following which central incisor became discoloured. Due to an anomalous tooth size – jaw size relation there appeared to be crowding of her anterior teeth. An OPG xray indicated periapical radiouluscencywrt upper maxillary central and lateral incisor. Vitality testing confirmed that these teeth were indeed non vital. The xray revealed anomalous root structure in relation to the lateral incisor.But this could

not be clearly demarcated due to the overlap between the incisors and the two dimensional nature of a radiograph. For further evaluation of this unusual morphology, a CBCT imaging of the tooth was advised. An informed consent was obtained from the patient, and a multislice CBCT scan of the maxillary left side was performed (Kodak 9000 3D) with a tube voltage of 80KV and a tube current of 8 mA. This revealed the presence of two canals in the lateral incisor.

The teeth were anaesthetised with 1.8mL of 2% lidocaine containing: 180,000 epinephrine (Lignox 2%, Indoco Remedies Ltd., Mumbai, India) under rubber dam isolation. A conventional endodontic access cavity was prepared. Clinical evaluation of the internal anatomy of the lateral revealed 2 small hemorrhagic points.There seemed to be 2 distinct orifices working length was estimated by an electronic apex locator (Propex II, Dentsply) and confirmed with a radiograph and was followed by cleaning and shaping upto F3. CaOH2 intracanal medicament was applied .An interim restoration of Cavit (3M Espe, Seefeld, Germany) was placed in the pulp chamber to seal the access cavity.

Discussion

Maxillary lateral incisors are said to be single rooted teeth with a single canal. Variations from this standard are rare. Studies based on radiography alone or those using radiopacifers have shown differing results. This may be due to the obliteration of any accessory canals following deposition of secondary dentin in older patients, this also highlights the importance of searching for an additional canal in younger age group.[5]

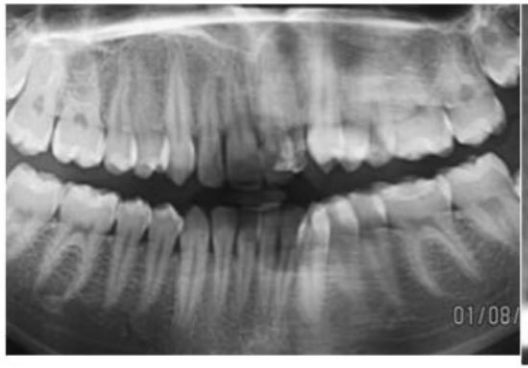
Keeping in mind the location of the tooth in the esthetic zone of the mouth attempts must be made to retain this tooth as long as possible.To ensure the long-term prognosis of the same, it is imperative that the morphology of the root canals and their numerous variations areassessed before initiating root canal treatment.[6]

Esthetic correction of malpositioned tooth is a challenging proposition. It can additionally, lead to increased susceptibility to dental caries and periodontal diseases As the patient was unwilling to undergo orthodontic correction for the blocked out left lateral incisor ,restorative correction of the same was attempted.

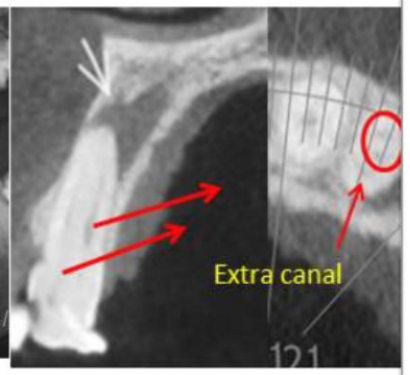
Presence of an additional root canals can be confirmed using multiple preoperative angled radiographs along with careful visualization and probing of the pulp chamber floor. Indistinct X-ray images, modified coronal access, and unusual location/size of canal openings are a few simple indicators of likely aberrant anatomy. In the current case, both conventional and digital radiographs were unable to provide definitive information on the anatomical variations. The outline of the palatal canal could not be delineated clearly on the radiographs but surely indicated presence of some aberrant anatomy .

The higher accuracy of CBCT has greatly facilitated three-dimensional imaging and visualization of unusual anatomy and/or additional root canals that can often be missed on routine radiographs. [12],[13],[14],[15] CBCT compared to conventional CT scans is an advancement in CT imaging that provides relatively high spatial resolution of anatomic structures with much reduced patient radiation dose.

Preoperative photograph shows discolored central incisor and carious lateral incisor placed palatally



Preoperative radiograph (OPG) shows no evidence of extra canal in 21 note palatal location of lateral incisor



Preoperative CBCT shows presence of an extracanal palatal to the main canal in both axial and tranverse views

Post operative radiograph shows 2 canals in the lateral incisor

Postoperative photograph shows esthetic correction by placement of porcelain fused to metal crowns wrt 21,22

Post operative radiograph at 1 year follow up shows satisfactory healing.

[16],[17] Additionally, CBCT scanners use simpler, less complicated, and therefore, less expensive hardware (X-ray source and detector) making it quite popular as an office diagnostic tool. [18] Case reports in literature that have reported using CBCT for diagnosis of additional palatal canals in maxillary first molar are summarized in [Table 1]. [6],[19],[20],[21]

One disadvantage of CBCT is the scattered radiation that produces streaking image artifacts, which can prevent diagnostic accuracy.Untrue CBCT images were observed near metallic intracanal posts. Previous reports have shown contradictory findings between CBCT images and clinical aspects a big caution to be kept in mind while interpreting CBCT images is the uncommon occurrence of gross anatomic variations which cannot be correlated clinically with the help of a surgical operating microscope.[7]

Legends – The figure represents the initial presentation of the patient to her final management.

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CASE REPORT

Radix Entomolaris: A rare case report

DR MAULSREE GULERIA .

Introduction

Successful endodontic treatment involves accurate diagnosis, good understanding of the biological principles and excellent execution of the treatment.[1] To be able to execute an excellent treatment, it's imperative that the clinician has comprehensive knowledge of the root canal anatomy and the know-how to locate and treat this anatomy.[2]

Therefore, morphological knowledge of root canals is indispensable and improves the operator's ability to locate and trace a root canal to its termination, thereby increasing the degree of successful treatment.

It is known that the mandibular first molar can display several anatomical variations. The majority of first mandibular first molars are two rooted, mesial and distal. The major variant in this tooth type is the presence of an additional third root; a supernumerary root which can be found lingually.[3,4] This rare macrostructure, which is first mentioned in the literature by Carabelli (1844), is called radix entomolaris.[5]

Radix Molaris has significance in clinical dentistry. Although this aberrant morphology is rare, knowledge of their occurrence and location is important for successful treatment.

Case Reports

Case 1

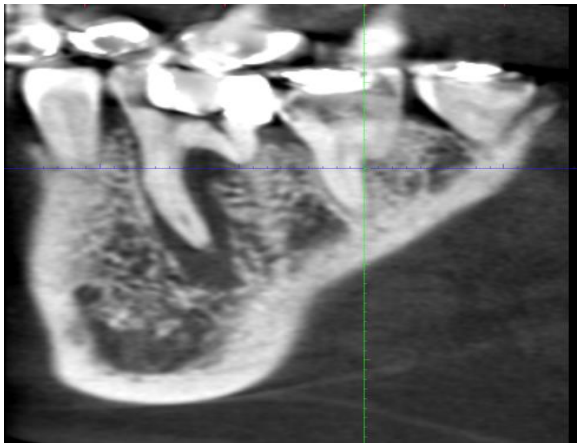
A 52-year-old female reported to the outpatient department of Conservative Dentistry and Endodontics, Bapuji Dental hospital (Davangere, Karnataka) with a chief complaint of continuous and severe pain in the lower left back tooth region since 2 weeks. The patient's medical history was non-contributory. Extraoral examination did not reveal any significant changes. Clinical examination revealed the Composite restoration along with secondary caries in the left mandibular first molar (tooth #36).Thermal and electric pulp testing elicited a delayed and prolonged response in tooth #36 which was lingering in nature. Radiographic examination showed no signs of apical periodontitis. The clinical diagnosis of symptomatic irreversible pulpitis was made, and root canal treatment was scheduled.

Tooth #36 wa s anesthetized. A rubber dam isolation was done and endodontic access opening was established in tooth #36.(Figure 1)The pulp chamber floor was shown to have four canals connected by the developmental root fusion line (DRFL). Coronal enlargement was done with a nickel–titanium (NiTi) ProTaper S1 followed by SX rotary file to improve the straight- line access. Working length was determined with the help of an apex locator and later confirmed by using a radiograph.(Figure 2) Cleaning and shaping was performed under rubber dam isolation by using ProTaper NiTi rotary instruments (Dentsply Maillefer) with a standardized technique upto apical size F3. Irrigation was performed using normal saline, 2.5% sodium hypochlorite solution and 17% ethylenediaminetetraacetic acid. After completion of cleaning and shaping, the root

canals were dried with absorbent points (Dentsply Maillefer). Calcium hydroxide was placed as an intracanal medicament with a lentulo spiral for 1 week and the access cavity was sealed with Cavit. The patient was asymptomatic on the next visit; therefore, tooth #36 was obturated using protaper gutta percha and AH Plus root canal sealer.(Figure 3)The tooth was permanently restored using composite resin followed by full coverage metal crown.(Figure 4)The patient was clinically asymptomatic on followup visits.

Case 2

A 36 year old female reported with history of pain since 2 weeks to department of conservative dentistry and endodontics. Patient gives history of spontaneous pain which aggravates during night time. Clinical examination revealed the amalgamrestoration along with secondary caries in the right mandibular first molar (tooth #46).Pulp sensibility testing elicited lingering response when compared to adjacent and contralateral tooth. Radiographic examination revealed bone loss (figure 1).CBCT (Cone beam computed tomography) revealed presence of primary endodontic and secondary periodontal lesion(Figure 2).After anaesthesia and isolation under rubber dam, an endodontic access cavity was prepared. When the floor of the pulp chamber was reached, four canal orifices were identified (Figure 3). Working length was determined with the help of an apex locator and later confirmed by using a radiograph. Cleaning and shaping was performed under rubber dam isolation by using ProTaper NiTi rotary instruments (Dentsply Maillefer) with a standardized technique. Irrigation was performed using normal saline, 2.5% sodium hypochlorite solution and 17% ethylenediaminetetraacetic acid. Canals were obturated using protaper gutta percha and AH Plus root canal sealer. Post endodontic restoration was done with composite.(Figure 4)



Discussion

The prevalence, external morphological variations and internal anatomy of the radix entomolaris and paramolaris are described. The clinical approach to diagnosis and endodontic treatment are discussed below.

Prevalence

In the African populations the prevalence of the three-rooted lower first molars is around 3%, and in Caucasians it does not go beyond 4%.
In populations with Mongolian traits it ranges between 5–40% and in Asian populations it is less than 5%. In the Indian population the prevalence of radix entomolaris is less (2.16%) than what was reported for any other Asian populations.
Radix Entomolaris (RE) can be found on the first, second and third mandibular molar, occurring least frequently on the second molar. Some studies report a bilateral occurrence of the RE from 50 to 67%. [6, 7, 8, 9]
Etiology
The etiology behind the formation of the Radix molaris is still unclear. In dysmorphic, supernumerary roots, its formation could be related to external factors during odontogenesis, or to penetrance of an atavistic gene or polygenetic system (atavism is the reappearance of a trait after several generations of absence).[2,10]
Morphology
Mandibular molars can have an additional root located lingually (the radix entomolaris) or buccally (the radix paramolaris).[2]
When Radix Entomolaris is present, the additional root in a mandibular molar is located
distolingually, below the cervical border of the tooth. Seldom is the distolingual supernumerary root equal in size (length or diameter) to the distal root, and it is cross-sectionally more circular than the distal root, projected lingually about 45° to the long axis of the tooth.[11, 12]
Classification
A classification by Carlsen and Alexandersen describes four different types of RE according to the location of the cervical part of the RE:

- Type A and B - Distally located cervical part of the RE with two normal and one normal distal root components, respectively.
- Type C – Mesially located cervical part,
- Type AC - Central location, between the distal and mesial root components.

This classification allows for the identification of separate and nonseparate radix entomolaris.[12]
Diagnosis and Clinical Approach

- A thorough inspection of the preoperative radiograph and interpretation of specific characteristics, such as an unclear outline of the root contour or the root canal, can indicate the presence of supernumerary root.[13]
- Preoperative periapical radiographs exposed at two different horizontal angles are required to identify these additional roots.[14]
- Cone beam computerized tomography (CBCT) can play siginificant role in diagnosis of extra root and canal.[15]
- Magnification aids such as microscope or loupes can enhance visibility of these canals.[16]
- Presence of a supernumeray cusp or more prominent occlusal distolingual lobe in combination with cervical convexity can indicate the presence of an additional root.[2]
- An extension of the triangular opening cavity to the (disto) lingual results in a more rectangular or trapezoidal outline form.[17]
- A dark line on the pulp chamber floor can indicate the precise location of the RE canal orifice. Pulp chamber floor can be explored with angled probe, DG-16 or micro-

openers to remove dentin overlying orifices.[12,18]

- These canals have severe curvatures which can result in complications such as instrument separation and strip perforations. Therefore, after location of orifice and coronal flaring of canal, Glide path should be established with small file such as 10 K. The use of flexible nickel-titanium rotary files allows a more centered preparation shape of the canal.[19, 20]

Conclusion

The high frequency of a fourth canal in mandibular first molars makes it essential to anticipate and find all canals during molar root canal treatment. The operator should always be aware of these unusual canal morphology. The stringent diagnostic and careful clinical approach should be adopted in these cases to avoid procedural errors such as strip perforation or missed canals.

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REVIEW

Principles of smile Designing

DR PRIYANKA MATHUR

ABSTRACT
The principles of esthetic smiles reveal the direct influence of individual tooth alignment on dentofacial relationships. The use of clinical photography is an essential means to identify esthetic problems. Smile design provides an opportunity for effective communication to discuss treatment alternatives with the patient in the consultation process. The scope of treatment can be determined, and treatment limitations can be explained. Smile design findings influence preparation design, material selection, and laboratory communication for enhanced predictability and Improved treatment success.

KEYWORDS:

INTRODUCTION

Esthetic dentistry has gone beyond the realm of pure esthetics to become an integral part of the treatment plan. Esthetic analysisor smile design that defines the end point of the treatment is critical . This helps to ensure that the outcome we provide will not only be biologically and functionally successful, but esthetically successful.

The clinician needs an objective strategy to navigate through the patient examination and evaluation process. With objective consideration of the possible treatment alternatives that could be applied to meet the patient's goals, the proper treatment options can be presented and excellence in dental treatment can be delivered.

ESTHETIC PRINCIPLES

Facial Analysis

Facial beauty is based on standard esthetic principles that involve proper alignment, symmetry and proportion of face. Analyzing, evaluating and treatment planning for facial esthetics often involve a multidisciplinary approach which could include orthodontics, orthognathic surgery, periodontal therapy, cosmetic dentistry and plastic surgery. Thus, esthetic approach to patient care produces the best dental and facial beauty.

But in our clinical practice, unless and otherwise there is an obvious discrepancy in the face, we restrict our smile makeover to the dental composition only. There are two facial features which do play a major role in the smile design:

1. the interpupillary line and
2. lips.

The interpupillary line should be perpendicular to the midline of the face and parallel to the occlusal plane. Lips are important since they create the boundaries of smile design. If we come across major discrepancies in the abovementioned two factors, then we have to seriously consider the correction of the facial composition, before we venture into the correction of the dental composition.

In classical terms, the horizontal and vertical

dimensions for an ideal face are as follows:

1.Horizontal:

• The width of the face should be the width of five "eyes".

• The distance between the eyebrow and chin should be equal to the width of the face . Figure 1

1. Vertical:

   • The facial height is divided into three equal parts from the fore head to the eyebrow line, from the eyebrow line to the base of the nose and from the base of the nose to the base of the chin.

   • The full face is divided into two parts, eyes being the midline.

   • The lower part of the face from the base of the nose to the chin is divided into two parts, the upper lip forms one-third of it and the lower lip and the chin two-thirds of it.

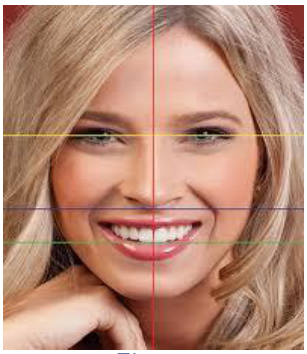

Fig 1

The basic shape of the face when viewed from the frontal aspect can be one of the following:
1. Square
2. Tapering
3. Square tapering
4. Ovoid

The lateral profile of an individual can be any one of the following:
1. Straight
2. Convex
3. Concave

These factors play a role in determining the tooth size, shape and the lateral profile; in short, the tooth morphology is dependent on the facial morphology.

The vital elements of smile designing include the following:
1. Tooth components

a) Dental midline

b) Incisal lengths

c) Tooth dimensions

d) Zenith points

e) Axial inclinations

f) Interdental contact area (ICA) and point (ICP)

g) Incisal embrasure

h) Sex, personality and age

i) Symmetry and balance

1. Soft tissue components

   a) Gingival health

   b) Gingival levels and harmony

   c) Interdental embrasure

   d) Smile line

The role of each of the above-mentioned factors in smile designing is given below.

Dental Analysis

Dental midline

The midline refers to the vertical contact interface between two maxillary centrals. It should be perpendicular to the incisal plane and parallel to the midline of the face. Minor discrepancies between facial and dental midlines are acceptable and, in many instances, not noticeable.[8] However, a canted midline would be more obvious, and therefore, less acceptable. The maximum allowed discrepancy can be 2 mm and sometimes greater than 2 mm discrepancy is esthetically acceptable so long as the dental midline is perpendicular to the interpupillary line. Various anatomical landmarks such as midline of the nose, forehead, chin, philtrum, interpupillary plane can be used as guides to the midline assessment.

The philtrum of the lip is one of the most accurate of these anatomical guide posts. It is always in the center of the face except in surgical, accident or cleft cases. The center of the philtrum is the center of the cupids bow and it should match the papilla between the centrals. If these two structures match and the midline is incorrect, then the problem is usually incisal inclination. If the papilla and philturm do not match, then the problem is a true midline deviation. A midline that does not bisect the papilla is more noticeable than the one that does not bisect the philturm.

To evaluate the midline, one must always consider
1. location
2. alignment.

Midline should be

a. parallel to the long axis of the face: the line angle that forms the contact between the centrals should be parallel to the long axis of the face;
b. perpendicular to the incisal plane: the line angle that forms the contact between the centrals should be perpendicular to the incisal plane and
c. over the papilla: the midline should drop straight down from the papilla.

A face bow transfer or even a reference stick aligned parallel to the interpupillary plane provides useful information in laboratory communication regarding midline inclination and the possible presence of a canted incisal plane.

Maxillary and mandibular midlines do not coincide in 75% of cases. Therefore, it is not advisable to use the mandibular midline as a reference point for establishing the maxillary midline. Mismatch between maxillary and mandibular midline does not affect esthetics since mandibular teeth are not usually visible while smiling.

Incisal lengths (incisal edge positions)

Maxillary incisal edge position is the most important determinant in smile creation because once set, it serves as a reference point to decide the proper tooth proportion and gingival levels. The parameters used to help establish the maxillary incisal edge position are:

1. degree of tooth display,
2. phonetics and
3. patient input

Degree of tooth display: When the mouth is relaxed and slightly open, 3.5 mm of the incisal third of the maxillary central incisor should be visible in a young individual. As age increases, the decline in the muscle tonus results in less tooth display.

Phonetics: Phonetics is a major determinant of the tooth length. In order to determine proper lip, tongue and incisal support and tooth position, it is necessary that the patient sits either erect or stands during the phonetic exercises. The various phonetics used are as follows:

- M sound: After pronunciation, the lips return to their normal rest position, allowing evaluation of the amount of the tooth display in rest position.
- E sound: The maxillary incisal edge position should be positioned halfway between the upper and lower lip during the "E" sound.
- F and V sounds: Fricative sounds are produced by the interaction of the maxillary incisal edge with the inner edge of the lower lips' vermilion border. Thus, fricative sounds help to determine the labiolingual position and length of the maxillary teeth.
- S sound: During pronunciation, the mandibular central incisors are positioned 1 mm behind and 1 mm below the maxillary incisal edge.

Patient input: Intraoral cosmetic preview and provisional restorations help to confirm proper placement of the final incisal edge position. The patient desires must be met as best as possible, provided they do not interfere with the parameters previously discussed.

Correct incisal edge position is crucial because it is related to the pitch of the anterior teeth, labial contours, lip support, anterior guidance, lingual contours and tooth display. The pitch of each anterior tooth is determined by the combination of correct lip support and the lingual labial position of the incisal edge. This location influences anterior guidance and the labial and lingual contours. In short, all these factors play a dominant role in both esthetics and function.

Tooth dimensions

Correct dental proportion is related to facial morphology and is essential in creating an esthetically pleasing smile. Central dominance dictates that the centrals must be the dominant teeth in the smile and they must display pleasing proportions. They are the key to the smile. The proportions of the centrals must be esthetically and mathematically correct. The width to length ratio of the centrals should be approximately 4:5 (0.8-1.0); a range for their width of 75-80% of their length is most acceptable. The shape and location of the centrals influences or determines the appearance and placement of the laterals and canines. Various guidelines for establishing correct proportions in an esthetically pleasing smile are

1. golden proportion (Lombardi),
2. recurring esthetic dental proportions (Ward),
3. M proportions (Methot) and
4. Chu's esthetic gauges.

The important point to be noted here is that it is not the actual size, but instead the perceived size, that these proportions are based on when viewed from the facial aspect (in short, it is the distance between proximal line angles of the teeth).

1. Golden proportion (Lombardi): When viewed from the facial, the width of each anterior tooth is 60% of the width of the adjacent tooth (mathematical ratio being 1.6:1:0.6). It is difficult to apply as patients have different arch form, lip anatomy and facial proportions. Strict adherence to golden proportion calculations limits creativity and this may leadto cosmetic failure. Figure 2
2. Recurring esthetic dental proportion (Ward): The successive width proportion when viewed from the facial aspect should remain constant as we move posteriorly form midline. This offers great flexibility to match tooth properties with facial proportions.
3. M proportions (Methot): This method compares the tooth width with the facial width using a software. The whole analysis is done in the computer and hence involves more of mathematics rather than artistic analysis.
4. Chu's esthetic gauges: Dr. Chu's research supports Levin's RED concept and refutes the golden proportion. A series of gauges are available to make intraoral analysis easier. The gauges allow for

    - fast, simple analysis and diagnosis of tooth width problems, tooth length problems and gingival length discrepancies;
    - color coding predefines desired tooth proportions, quicker and easier to read than any other instrument;
    - used as a reference guide between clinician and lab technician, hence reduces the incidences of miscommunications errors.

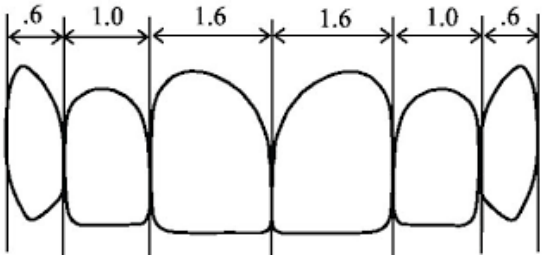

Fig 2

These principles are used as a guide rather than a rigid mathematical formula. Most authors recommend creating harmony and balance by eye via proper adjustment and evaluation of provisionals rather than any formula. The factors guiding individual tooth dimensions are as follows.

Maxillary central incisor: Centrals are the focal point of an esthetic smile and create the central dominance as described earlier. Approximate length of the central should be 10-11 mm and the width is calculated accordingly so that the ratio falls between 75 and 80%

Maxillary lateral incisor: These are the playful part of the smile. They provide individuality, are never symmetrical and influence gender characterization.

Maxillary canine: They play a critical point in creating a pleasing smile as they are

- the junction between the anterior and posterior dental segments; hence, only the mesial half of the canine is visible from the frontal view when the patient smiles;
- support the frontal muscles - the size and characteristic of the buccal corridor is determined by the size, shape and position of the canine and
- canine depicts the personality characterization (masculine: vigorous and aggressive; feminine: delicate and soft).

Also, we have to keep in mind that

- central incisor is wider than the lateral by 2-3 mm and canine by 1-1.5 mm;
- canine is wider than the lateral by 1-1.5 mm and
- canine and central are longer than lateral by 1-1.5 mm.

Maxillary bicuspids: They play a very important role for arch design. They should fill the buccal corridor.

Buccal corridor refers to dark space (negative space) visible during smile formation between the corners of the mouth and the buccal surfaces of the maxillary teeth(Figure 3) . Its appearance is influenced by

1. the width of the smile and the maxillary arch,
2. the tone of the facial muscles,
3. the positioning of the labial surface of the upper premolars,
4. the prominence of the canines particularly at the distal facial line angle and
5. any discrepancy between the value of the premolars and the six anterior teeth.

Fig 3

Arch form has a direct influence on the buccal corridor. [16] The ideal arch is broad and conforms to a U shape. A narrow arch is generally unattractive. The unattractive, negative space should be kept to a minimum. This problem can be solved or minimized by restoring the premolars.The buccal corridor should not be completely eliminated because a hint of negative space imparts to the smile a suggestion of depth.

Ultimately, there is no formula for anterior esthetics; instead, the final esthetics is a combination of

1. tooth proportion guide lines,
2. patient's own perception,
3. cultural and social influences,
4. dentist artistic influences and
5. effective communication with laboratory.

Zenith points

Zenith points are the most apical position of the cervical tooth margin where the gingiva is most scalloped. It is located slightly distal to the vertical line drawn down the center of the tooth. The lateral is an exception as its zenith point may be centrally located. Establishing the proper location of zenith points is a critical step in alteration of mesial and distal dimensions, Figure 4.

1. closure of diastema: move the zenith points to
2. provide the illusion of bodily movement and reduce exaggerated triangular form and
3. correction of tooth angulation.

Figure.4

Tooth inclinations

Axial inclination compares the vertical alignment of maxillary teeth, visible in the smile line, to central vertical midline. From the central to the canine, there should be natural, progressive increase in the mesial inclination of each subsequent anterior tooth. It should be least noticeable with the centrals and more pronounced with the laterals and slightly more so with the canines. If the incisal plane is canted, the axial inclination of the anterior teeth and the midline itself, if it is at right angle to the incisal plane, will be correspondingly incorrect.

The evaluation of axial inclination can be done on a photograph of the anterior teeth in a frontal view. A line is sketched on each tooth from the middle of the incisal edge through the midline of the tooth at its gingival interface. Axial inclination can also refer to the degree of tipping in any plane of reference. The guide for labiolingual inclination is as follows:

1. Maxillary central incisor - positioned vertically or slightly labial
2. Maxillary lateral incisor - cervical is tucked in, incisal edge inclined slightly labially
3. Maxillary canine - cervical area positioned labially, cusp tip lingually angulated

Interdental contact area and point

1. Interproximal contact area (ICA):

   • It is defined as the broad zone in which two adjacent teeth touch.

   • It follows the 50:40:30 rule in reference to the maxillary central incisor [Figure 5].

   • The increasing ICA helps to create the illusion of longer teeth by wider and also extend apically to eliminate black triangles.
2. Interproximal contact point (ICP):

   • It is the most incisal aspect if the ICA.

   • As a general rule, the ICP moves apically, the further posterior one moves from the midline.

Figure .5

Incisal embrasures

The incisal embrasures should display a natural, progressive increase in size or depth from the central to the canine. This is a function of the anatomy of these teeth and as a result, the contact point moves apically as we proceed from central to canine(Figure 6). The contact points in their apical progression should mimic the smile line. Failure to provide adequate depth and variation to the incisal embrasure will

1. make the teeth appear too uniform and
2. make the contact areas too long and impart to the dentition a box like appearance. The individuality of the incisors will be lost if their incisal embrasures are not properly developed.

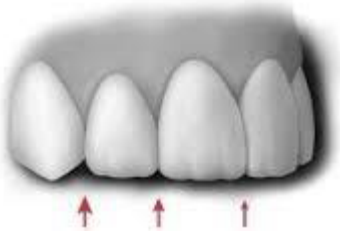

Figure.6

Also, if the incisal embrasures are too deep, it will tend to make the teeth look unnaturally pointed. As a rule, a tooth distal to incisal corner is more rounded than its mesio incisal corner.

Sex, age and personality

Minor differences in the length, shape and positioning of the maxillary teeth allow for dramatic characterization.

- Age - maxillary central incisor

  Youthful teeth: unworn incisal edge, defined incisal embrasure, low chroma and high value

- Aged teeth: shorter; so less smile display, minimal incisal embrasure, high chroma and low value
  Sex - maxillary incisors

  Female form: round smooth, soft delicate

- Male form: cuboidal , hard vigorous
  Personality - maxillary canine

- Aggressive, hostile angry: pointed long "fangy" cusp form Passive, soft: blunt, rounded, short cusp form

Symmetry and balance

Symmetry is the harmonious arrangement of several elements with respect to each other. Symmetrical length and width is most crucial for the centrals. It becomes less absolute as we move further away from the midline

- Static symmetry: mirror image, maxillary central incisors
- Dynamic symmetry: two objects very similar but not identical. Playing with perfect imperfection in the laterals and canines allows for a more vital, dynamic, unique and natural smile.[16]

Balance is observed as the eyes move distally from the midline, so that both the right and left sides of the smile are well balanced.

Soft tissue component of smile design

Gingival health

The gingiva acts as the frame for the teeth; thus, the final esthetic success of the case is greatly affected by the gingival health. It is of paramount importance that the gingival tissues are in a complete state of health prior to the initiation of any treatment.[19] Healthy gingiva is usually

1. pale pink in color, stippled, firm and it should exhibit a matte surface;
2. located facially - 3 mm above the alveolar crestal bone and
3. located interdentally - 5 mm above the intercrestal bone papilla should be pointed and should fill the gingival embrasure right up to the contact area.

Gingival level and harmony

Establishing the correct gingival levels for each individual tooth is the key in the creation of harmonious smile. The cervical gingival height (position or level) of the centrals should be symmetrical. It can also match that of the canines. It is acceptable for the laterals to display the same gingival level. However, the resultant smile may be too uniform and it is preferable to exhibit a rise and fall in the soft tissue by having the gingival contour over the laterals located toward the incisal compared to the tissue level of the centrals and canines(Figure 7). The gingival margin of the lateral incisor is 0.5-2.0 mm below that of the central incisors. The least desirable gingival placement over the laterals is for it to be apical to that of the centrals and or the canines.

Figure.7

The gingival shape on the mandibular incisors and the maxillary laterals should exhibit a symmetrical half oval or half circular shape. The maxillary centrals and canines should exhibit a gingival shape that is more elliptical. Thus, as mentioned earlier, the gingival zenith is located distal to

the long axis of the maxillary centrals and canines and coincides along the long axis of the maxillary lateral incisors.

Interdental embrasure (cervical embrasure)

The darkness of the oral cavity should not be visible in the interproximal triangle between the gingiva and the contact area. If the most apical point of the restoration is 5 mm or less from the crest of the bone, then black triangles will be avoided. At times, this will require long contact area that will be extended toward the cervical. This will encourage the formation of a healthy, pointed papilla instead of the blunted tissue form that often accomplishes a black triangle(Figure.8) Conversely, an improperly developed cervical embrasure that involves overextended, bulky restorations will result in an improper emergence profile and swollen and inflamed gingival tissues.

Figure.8

Smile line

Smile line refers to an imaginary line along the incisal edges of the maxillary anterior teeth which should mimic the curvature of the superior border of the lower lip while smiling. Another frame of reference for the smile line suggests that the centrals should appear slightly longer or, at least, not any shorter than the canines along the incisal plane. This approach is particularly useful in cases of lip symmetry or extreme lip curvature during smile formation[Figure 9]. Reverse smile line or inverse smile line occurs when the centrals appear shorter than the canines along the incisal plane.

F I G U R E 9 . The smile line generally follows the curvature of the mandibular lip, and the esthetic zone is appropriately filled with “white space.” The overall visual impact of the arrangement is pleasing from social distances despite obvious asymmetry in lateral incisor rotation.

Lip line should not be confused with the smile line. It refers to the position of the inferior border of the upper lip during smile formation and thereby determines the display of tooth or gingiva at this hard and soft tissue interface. Under ideal conditions, the gingival margin and the lip line should be congruent or there can be a 1-2 mm display of the gingival tissue. Showing 3-4 mm or more of the gingiva (gummy smile) often requires cosmetic periodontal recontouring to achieve an ideal result.

Finally, the individual tooth morphology has to mimic nature, once all the above

mentioned factors are fulfilled. Also, the appropriate shade selection has to be done to bring out all the hard work of our smile design. Shade selection must be customized for each individual. It should be natural and polychromatic. The body of the tooth can be fairly uniform in color but the gingival third should be noticeably richer in chroma. The chroma should also increase from central to the canine, canine having a higher chroma.

CONCLUSION

Smile design techniques expand the use of photography to analyze existing esthetic problems and communicate possible treatment alternatives. Treatment acceptance occurs when patients perceive the recommended treatment will resolve current and future concerns for a fee that is commensurate with the benefits they gain. Patient satisfaction is achieved when the clinician meets or exceeds the patient's expectations. It is only through a balance in objective diagnosis, effective communication, and evidence-based planning that proper recommendations can be made for the delivery of excellence in cosmetic dental treatment.

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REVIEW

Dental Stem Cells

In dentistry the first procedures to regenerate pulp started almost half a century ago by introducing blood clots at the apical foramen (Östby, 1961). The key elements of tissue engineeringare a set of regenerative cells,morphogens and physical framework scaffolding for cell attachment in 3D. It then serves as a platform for the layingdown of tissues by those attached cells coating the frameworks. Regeneration occurs via the intricate interplay of these 3 components. If these components have been formulated properly they can promote the formation of complete mature tissues.

Stemcells

Stemcells can be categorized into embryonic and adult/somatic cells and induced pluripotent stem cells (iPS). Induced pluripotent stem cells are a special class of stem cells. They are the direct products of adult somatic cells that have been re-programmed into embryonic like cells (Oct3/4, SOX -2, Klf 4, c-myc) (Takahashi and Yamanaka, 2006). They can be also categorized according to the number of tissue types they can differentiate into like totipotent, pluripotent, multipotent, oligopotent and unipotent categories. Their high capacity to reproduce and proliferate into various cell lineages is what makes them so potent and so significant in cell therapy and tissue engineering strategies. However, clinical implementation has been slow and challenging. Currently, induced pluripotent stem cells (iPS) are of significant interest because the total number of stem cells that can be generated is much greater than the quantity extracted from adult or embryonic tissues.

Dentalstemcells

These cells have self-renewal and multi-lineage differentiation characteristics isolated from teeth and other regions of the oral cavity. These include dental pulp stem cells (DPSC), stem cells from human exfoliated deciduous teeth (SHEDs), periodontal ligamentstem cells (PDLSCs), dental follide progenitor stem cells (DFPCs) and stem cells from the apical papilla(SCAPs) (Table 1.1).

They have been used extensively after 2000 since the use of hESC (human embryonic stem cells) has been attached with it ethical and legal hurdles. These dental stem cells also have a better clinical potential due also to their higher immune tolerance compared with hESCs. These dental cells have odontogenic lineage characteristics compared to any other mesenchymal stem cell like the BMSC.

Table 1.1 – Various oral dental derived stem cells

Dental pulp stem cells (DPSCs) isolation

DPSCs are extracted from the pulp of permanent extracted tooth (wisdom teeth, supernumerary teeth or extracted teeth for orthodontics) by one of two methods: by "enzymatic digestion"or by an "outgrowth" method. A heterogeneous

Cells	Source	Lineage	Reference
DPSC	Pulp of permanent teeth	Osteogenic/dentinogenic,adipogenic, neurogenic, chondrogenic, myogenic	(Gronthos et al., 2000; Gronthos et al., 2002)
SHED	Exfoliated deciduous teeth	Osteogenic/dentinogenic, chondrogenic, myogenic, neurogenic, adipogenic	(Miura et al., 2003)
SCAP	Apical papilla	Dentinogenic, adipogenic and neurogenic	(Sonoyama et al., 2008)
PDLSC	Periodontal ligament	Osteogenic/cementogenic, adipogenic, neurogenic, chondrogenic	(Seo et al., 2004)
DFPCs	Dental follicle	Odontogenic, cementogenic, adipogenic, chondrogenic	(Morsczeck et al., 2005)

population of cells that is obtained from isolating cells from the dental pulp can adhere and proliferate in the scaffold. This population of cells has shown multiple cell lineage characteristics The use of heterogenous population of cells has a number of advantages over using immune selective cells Alikely advantage is of eliminating immunoselection as these cells will later be used for clinical application and thus should be devoid of any contaminant.Cell specific markers are used to obtain pure stem cells from tissue extracts containing a mixed population of cells according to their specific immunophenotypes. Two methods used include FACs (fluorescent activated cell sorting) or MACs (magnetic activated cell sorting). It is still debatable as to what is better to isolate the cells by MACs or FACs (Gronthos et al., 2000) or the heterogeneous population of cells.

DPSCs seeded onto biomaterial frameworks and then placed inside a canal of the cross-sectioned tooth have shown to generate pulp-like structures (Demarco et al., 2010)and when implanted in non-dentine surface they failed to differentiate to odontoblasts.
DPSCs are almost identical to bone marrow mesenchymal stem cells (BMMSCs). However, they show higher cell proliferation capacity as compared to BMMSCs in vitro (Gronthos et al., 2000). It was shown that when DPSC implanted in immune compromised mice dentine-like structure surrounding a pulp-like structure was formed that was not seen in case of BMSCs. Studies have shown that they can differentiate into odontogenic, osteogenic lineages, chondrogenic, adipogenic, neurogenic and endothelial lineage. The DPSCs also have differences in properties when compared to other dental stem cells. They can form a dentine-pulp like complex. However, DPSCs have lower proliferation rate as compared to SHEDs (Miura et al., 2003).
Recently, a study showed third molars stored in saline overnight at 4^0C elutes DPSCs. These can be isolated and cultured for clinical use in medium devoid of FBS and also retain its phenotypic characteristics. The analogy behind using FBS free medium is to make sure that the DPSCs don't come in contact with animal serum. This is one way of making them clinically more feasible and acceptable to use. Human serum (HS) has been used as an alternative to fetal bovine serum (FBS) for culturing DPSCs. When fibronectin was added for initial DPSCs isolation it produced higher proliferation rate, however the expression of CD73, CD 90, CD105 or multipotency characteristics remained unaltered irrespective of the type of serum (Eubanks et al., 2014).
Cryopreservation of DPSCs is a techniqueby which the cells or the whole tooth are stored at -196^0C, a temperature where all the cell activities are stopped, thereby achieving a high cell survival rate (Chen et al., 2011). Even after 120 hours of extraction of tooth viable DPSC could be isolated when the tooth is cryopreserved.

Currently many companies are storing these dental stem cells with a potential to be used by the patient for the treatment of various diseases currently being researched upon. Unlike human embryonic stem cells, Dental stem cells are ethical and have no legal complication associated with its storage.

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REVIEW

Bonding Systems -Present and Future

Mandeep S Grewal, Stutee B Grewal, Neerja Sharma.

ABSTRACT

There have been great advances in knowledge about bonding to dentin during the past decade. From the total etch three step bonding to current no etch one step bonding, adhesive dentistry has evolved. The development of self-etching primer adhesive systemshas greatly simplified resin bonding but the simplification of bonding steps has not improved the quality or the durability of resin–dentin bonds. This article aims to give an insight on the newer generation of bonding systems.

INTRODUCTION

Dental bondingsystems have evolved in the past 45 years, with variations in chemistry, application, mechanism, technique, and effectiveness. The evolution was accompanied by the development of improved esthetic dental materials, like composite resin and ceramic, and an increasing demand by patients for esthetic dentistry. As the demand for bonded esthetic restorations has increased, the evolution of bonding agents accelerated. Variations in the number of bottles and the mechanism of bonding have defined each "generation" of bonding systems. The latest generation of bonding agents have reduced steps and components, having the etchant, primer and adhesive in a single bottle, making it the "All-in-one" bonding system.

This article aims to discuss the latest generation bonding agents with respect to their properties, advantages and disadvantages and the future of these systems.

EVOLUTION OF THE BONDING SYSTEM

In 1960's and 70's came the first and second generation bonding agents which did not recommend dentin etching and relied on adhesion to smear layer. Hence, they had weak bond strength. In 1980's came the third generation of bonding agents which etched the dentin, had a separate primer thus increasing the bond strength .Fourth generation systems were introduced in 1990's having the etchant, primer and adhesive in separate bottles which gave very good bond strengths but were extremely technique sensitive .These were followed by the fifth generation systems which combined the primer and adhesive in one bottle, reducing the number of application steps to 2. Around the turn of this century, self etching primers were introduced, which were termed as the sixth generation of bonding agents. These systems combined the etching, priming and bonding but it still was a two bottle system. Some systems had to be mixed outside the tooth in a well while others were mixed inside the tooth. The so called Seventh-Generation was introduced in late 2002 and combines the acid, primer, and resin in one bottle. These materials involve only a single step, which eliminates separate etching, rinsing, and mixing, eliminating all additional steps needed in the previous generations claiming to reduce the technique sensitivity.[1]

Was there any need for this newer generation of bonding agents? The answer would be yes as

1. Post operative sensitivity still a major problem.
2. 4th and 5th generation use the phenomenon of moist bonding introduced by Kanca and Gwinnet et al in 1990's [2] Proper degree of wetness is hard for dentist to visually access and hard for manufacturer to explain. And the debate of how wet is wet? And how dry is dry?
3. Over etching of the dentin results in nanoleakagewhen the demineralised dentin is too thick to be fully penetrated by the adhesive resins within the given time.
4. 6th generation must be sequentially applied or mixed properly to work efficiently, and they required multiple bottles.

MECHANISM OF BONDING

The fourth and the fifth generation s of bonding systems were based on the concept of 'total etch' wherein the smear layer was completely removed from the dentin and the demineralised dentin formed a 'Hybrid layer' or 'Resin dentin inter diffusion layer' with the bonding agent.

The Sixth and Seventh-generation bonding agents use the smear layer as a bonding substrate. The acidic primer demineralizes the smear layer and the top layer of the underlying dentin surface. The acidic primer also infiltrates the exposed collagen along with the hydrophilic monomers which then copolymerize Because the etched surface is not rinsed, the demineralized smear layer is incorporated into the hybrid layer.[3,4]

For the total etch technique the hybrid layer ranges in thickness from 3-5µm, and for the sixth and seventh generation bonding systemsthis layer ranged from .0.5 um to 2 um, depending on the pH of the acidic monomer.[5]

In 2003, depending on the pH , Van Meerbeck et al[6] classified the acidic monomer, into -

- Mild pH 2, hybrid layer is 1-2µm in size (Clearfill S3,GBond)
- Intermediate pH 1.5, hybrid layer is 2-3µm in size (AdheSE,iBond)
- Strong pH 1, hybrid layer is 3-5µm in size(Prompt L pop 2)

Hence, the more acidic the primer, deeper is the mineralization.[7,8,9,10] The acidic primer and adhesive monomers infiltrate collagen fibres together as the primer decalcifies the inorganic component in dentin to the same depth, this should minimize voids, potential leakage, postoperative sensitivity by decreasing the hydraulic conductance and nanoleakage resulting from an insufficient penetration depth of the adhesive[11]

The etching ability of these self etching agents is questionable. So, whenever unground enamel is present should it be etched with phosphoric acid before the use of a seventh-generation bonding agent? The problem with pre-etching the enamel with phosphoric acid is that the washing process tends to cause a diluted acid to contact the dentin. This then may result in a partial decalcification of the dentin to depths greater than the extent to which the self-etching bonding agent will penetrate. An alternative to application of phosphoric acid to unground enamel is pumicing of the enamel. This technique provides a similar bond strength to that found with etching with phosphoric acid.[12,13]

ADVANTAGES AND DISADVANTAGES OF THE ONE STEP BONDING AGENT

- One-step procedure, no mixing or rinsing the tooth
- Delivery option, single bottle or unit-dose
- Less postoperative sensitivity.
- The shallow etch ensures good resin infiltration.
- Tolerant to moist or dry environments - Most seventh-generation bonding agents have water as a solvent. Thus, the wetness or dryness of the tooth surface is less critical than it is with bonding agents with solvents containing ethanol or acetone.
- Available in lightcured and dualcure d formulations Lightcured seventh-generation bonding agents are not compatible with dual and self cured composite cores and resin cements. The dual-cured seventh-generation bonding agents (Clearfil DC BOND, Futurabond DC, Xeno IV DC) solve this problem.

Ideal bonding agent is still a future and hence it has few disadvantages too-

- Less effective bonding of enamel
- Immediate bond strength (24MPa) is in the same range as the previous generations but the initial bond might deteriorate with aging, which could lead to premature failures.
- Bond strength to cut enamel-20 MPa, superficial dentin25 MPa and deep dentin-18 MPa.

This can be attributed to the acidic, hydrophilic and hydrophobic monomers, organic solvents and water placed together in one bottle which affects the efficiency of the individual component. As the concentration of hydrophobic crosslinking monomer is reduced, the strength is also reduced. The prescence of acid in the same bottle as the bonding components results in two types of degradation reactions

Firstly the reactive solvent molecule can add at the polymerizable group, which results in loss of polymerizable function.

Secondly, reaction of water with the polymerizable group doesn't destroy its function but separates the group from rest of the monomer by hydrolysis.

The above degradation reaction[14] leads to decreased density of the polymerizable group. The acidic components produced by hydrolysis are not polymerized into the network thus etching of the dentin further.

There is also a problem of chemical degradation of the adhesive which may occur at high temperatures; so long term storage requires refrigeration like for G-Bond 1-28˚C, Clearfill S3 Bond 2 -8˚C, iBond <8˚C, Xeno IV 2 -8˚C, 3M ESPE Adper 2-8˚C, Xeno V >24˚C.

To solve this problem acrylic amide resins have been used in few products like Xeno V and AdheSE One instead of acrylic esters. They are less prone to hydrolysis. Tertiary butanol instead of ethanol as solvent doesn't react with acrylate resins in the same way as ethanol does. Hence, the solvent type should also be taken into account when choosing the adhesive system. It has been found that the shear bond strength of acetone based one step adhesive is lower than that of ethanol based

adhesives due to the water chaser effect of acetone.[15]

Other problems with these bonding agents are-

- Bonding to sclerotic and caries affected dentin might be problematic.[16]
- Shear bond strengths of different bonding systems may also be affected by dentin depth, orientation of the tubule, but not by location of the dentin (ocdusal or cervical).[17]
- Insufficient long term research.
- Light cured seventh generation bonding agents cannot be used with dual cure or self cured composites and resin cements chemical-cured composites that utilize tertiary amine as a component of the catalyst. This is because the acidic monomers deactivate the more basic amines
- May inhibit set of self cure or dual cure resin materials.

Both single-bottle total-etch adhesives and single-step self-etch adhesives are utilized without an additional bonding resin layer. In these adhesives, the oxygen-inhibited layer contains acidic monomers that come into direct contact with the chemical-cured composite where they can titrate the basic amine accelerators and inactivate them. Clinically, this may result in the debonding of core buildups with self- or dual-cured composites during impression taking

This has largely been rectified in many single-bottle adhesives by the introduction of dual-cured versions that include an additional bottle of chemical co-initiator containing sodium benzene sulphinate. However, the use of a chemical co-initiator improves its tensile bond strength with self or dual- cured composites only to a certain extent.

Another question is are self etch-adhesives too hydrophilic? The single-step self-etch adhesives having hydrophilic resin systems attract water. It is difficult to evaporate water from these adhesives, and even if evaporation is successful, water will rapidly diffuse back from the bonded dentin into the adhesive resin. Thus it behaves as permeable membranes after polymerization.[18]

During this period, water will diffuse through the adhesive layer and is trapped in the form of water blisters along the adhesive-composite interface, with the hydrophobic resin composite taking an impression of these transudated water droplets. Such a process is commonly known to the resin-coating industry and is termed "osmotic blistering". It has also been suggested that the osmotic gradient that is responsible for the induction of this type of water transport is derived from the dissolved ions that resided within the oxygen inhibition layer of these polymerized adhesives.

The more easily recognized pattern is in the form of fractal-like, water channels that originate from the surface of the hybrid layer, and extend through the adhesive layer to reach the adhesive-composite interface. These water channels have been given the term "water trees" [19]. Hydrophobic HEMA-free self etching agents such as G Bond were prone to phase separation, while HEMA-containing hydrophilic Self etching agents, such as Clearfil S3 Bond and Xeno III were predisposed to forming osmosis-induced droplets. Hybrid bond, Absolute, and iBond featured both phase separation as well as osmosis. Optibond,

All-in-one exhibited a clustering reaction of the filler particles upon solvent evaporation.

From a clinical perspective, as the diffusion of dentinal fluid across the adhesives occurs relatively slowly, it is unlikely to result in severe post-operative sensitivity.

CONCLUSION

Use of seventh generation bonding agents has made adhesive dentistry more easy and predictable for the practitioner. Clinically, they can be used with direct light cured resin restoration, indirect resin restoration, core build up and ceramic veneers, inlays & onlays. They can be used on bur cut dentin and enamel but when uncut enamel is present, it needs to be prepared. Manufacturer's instruction and adequate isolation are still one of the key factors responsible for achieving predictable results. To ensure success long term research on the efficacy of these bonding agents is required along with improvements in the chemistry to overcome the present disadvantages.

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Original Article

Attachments for implant - supported overdentures - Dr Kritika

Abstract

Objective - The main aim of this review article is to discuss advantages , disadvantages and complications in implant supported overdentures (ISOs) as treatment in edentulous patients

Material And Methods : We performed a Medline search and review of pertinent articles on the mentioned subject from 1986 to 2011.

Results And Conclusions : Implant-supported overdentures constitute an accurate and predictable treatment option and achieve a higher patients' satisfaction. This type of treatment constitutes a cheaper treatment than fixed prostheses and in some patients, with loss of lip support or with an interoclusal space larger than 15 mm, the choice of implant-supported overdentures seems to prevent future aesthetic or phonetic problems.

Introduction

Teeth loss may be due to trauma, caries, periodontal diseases and congenital defects. Loss of teeth has a negative impact on masticatory function, esthetics and self-image. As a normal phenomenon residual alveolar bone undergoes resorption after extraction. Edentulous patients with severe resorption may experience a problem with conventional complete denture treatment because of impaired load bearing capacity. These include pain during mastication, loss of retention and stability of complete denture. To overcome these problems the overdenture concept came into existence in the year of 1960s . Treatment of edentulous patients with implant-retained removable prosthesis has been shown to provide a predictable and successful outcome that overcomes the functional deficiencies associated with conventional dentures. Clinically, placing implants in the edentulous mandible has become a standard treatment for patients who are not satisfied with conventional complete dentures. According to McGill consensus statement on overdentures, evidence exists suggesting that a 2- implant overdenture should become the standard care for treatment of the edentulous mandible. This implant supported treatment option has reported a survival rate of 94.5- 100 %. Most of these attachments are compatible with the majority of implant systems. All available attachment systems are designed to prevent vertical movement of the denture, and can be used as an isolated attachment mounted directly to the implant or attached to a bar system. The choice of the attachment is dependent upon the retention required, jaw morphology, anatomy, mucosal ridge, oral function, and patient compliance for recall. Clinicians have selected different attachment systems based on factors such as durability, patient demand, cost effectiveness, technical simplicity, and retention (1). Attachments can be classified depending on its function as a) rigid, if they do not allow any denture dislodgements, or b) resilient, when they allow translation, rotation, axial or hinge over posterior axes movements or a combination of them because of their flexibility. With rigid attachments, the implant will receive 100% of occlusal load, whilst, with resilient

attachments, occlusal load will be supported by implant, denture or fibromucous. Currently, the most used attachments are:

Bar Attachments - It is now proven fact that bar type of attachments provides good retention and stability.The disadvantages of this attachment system are:

• Vertical dislodgement, bar type attachments show maximum stress generation around implants

• Fabrication is technique sensitive

• Higher cost

• Maintenance of hygiene is difficult which can lead to problems like mucosal irritation

• Frequent loosening of retentive clips.

The ideal length of a single bar should be minimum of 20-22 mm to accommodate two clips. Hence, while placing implants one should keep this aspect in mind. Shorter bar attachments cannot provide adequate retention and support.

Ball Attachment System - It contains the matrix part in the denture and the patrix part in the implant. They are indicated for the simplicity and low price and it has a better score on retention and patient satisfaction. Problems encountered with ball attachment are the implant should be parallel to each other and there must be enough vertical height for the patrix part (inter arch space must be adequate for attachment height).

To overcome the problem of angulation and limited inter-arch space, Locator Attachment has come in to existence. In this locator attachment the matrix part is placed in the implants and patrix part is placed in the denture. The matrix is composed of a Locator abutment made of Titanium with a Titanium-nitride coating. It is inserted into an implant and torqued with a specific torque wrench. This locator attachment has a restriction to certain degrees of angulation without compromise of the retention and can function well in reduced inter arch space when compared to ball attachment. The patrix is a Locator cap with an interchangeable nylon insert. The patrix engages the matrix to provide a sufficient retention force to stabilize and retain the overdenture. Clinically, the patrix is embedded in the overdenture and the matrix remains intraorally. The patient is able to manually engage There are 5 main advantages to the Locator system advertised by the manufacturer.

1) It has a low vertical height compared to other systems allowing the clinician to use it in areas of restricted vertical space. It is important to consider that its diameter is larger than most other attachment systems which can represent a limitation.

2) The self aligning design allows for the patrix and the matrix to attach together without precise alignment, which makes the connection easier to execute by the patient.

3) The Dual Retention is patented and has been incorporated in the clear, pink and blue nylon inserts to increase the retention surface area ensuring long lasting retention life in the 0° to 10° situation.

4) The rotational pivoting action allows a resilient connection for the prosthesis. This feature reduces the amount of retention loss. The nylon remains in contact with the abutment while

the metal cap moves over the nylons

Finally, they can be used in non-parallel implant situations. The clear, pink and blue can compensate for up to 10° of divergence from vertical (20° between implants) while the green and red inserts can be used for up to 20° of divergence from vertical (40°between implants). The internal extension is absent from the green and red insert to compensate for the angulation and disengage the overdenture.

Selecting An Adequate Retention System.

1. Depending on upper and lower jaw: in the mandible it will be easier to place parallel implants, thus, ball or Locator attachments would be indicated. In the maxillary, implants divergent emergency, worse bone quality and the use of short implants due to sinus proximity, will mandate the use of bar attachments

2. Depending on the arch form: bar attachments will be indicated in wide arches. On the other hand, in narrow arches using ball or Locator attachments would be indicated.

3. Depending on bone reabsorption rate and implants length: if implant is at least 10 mm long, it can be used as unsplinted, but if it less than 10 mm long it will be indicated that the implant be splinted with bar attachments. According to Jemt and Lekholm (5), there were more failures (24%) in implants less than 10 mm long.

4. Depending on implant location: if implants are placed quite far from each other, it will not be indicated to use bar attachments due toincrease of bone stress.

Material And Methods

We performed a Medline search and review of pertinent articles on the subject in a period from 1986 to 2014. After a selection process, we have included some comparative studies based on the efficacy of different attachment systems, complications associated with ball , bar and locator attachments.

Results And Discussion

A) Maxillary Treatment Choices.

ISO will be indicated in severe bone reabsorption, as it might compensate the loss of lip support avoiding airor saliva lost when speaking as it often occurs with fixed implant rehabilitations. Due to biomechanical requirements and worse bone quality, treatment options are just two: four or six-implantsupported overdentures, with an antero-posterior extension as wider as possible. Preferably, implants should be splinted with a bar without cantilevers that follow the arch shape to avoid fractures. On the other hand, there are some clinicians who prefer using a Locator system (Fig. 3), although this fact is less documented in the literature. Slot et al. (9), in a meta-analysis to evaluate the most successful maxillary treatment, concluded that six implants and a bar followed by four implants and a bar and last, four implants and ball attachments, constitute the most successful treatment

B) Mandibular Treatment Choices.

If there are good or excellent anatomical conditions with an inverted “U” shape alveolar ridge, without great bone reabsorptions, with support and lateral stability and basic patient demands, the ideal choice would be a splinted or unsplinted two-implantssupported overdenture. Implants should be parallel, perpendicular to

the occlusal plane, and be situated at the same height to avoid faster wear in the highest or more leaning implant. Another option would be to use a splinted three-implant-supported overdenture that will limit denture rotation dislodgement. Geckili et al. in a 3-year follow-up study, of patients wearing mandibular three-implant-supported overdentures, found 100% of survival rate.

If there are severe or moderate anatomical conditions, with great bone posterior alveolar ridge reabsorptions and retention, support and stability loss, as well as high patient´s demand, it will be indicated to use a splinted or unsplinted four-implant-supported overdenture. In 2011, Burns et al. concluded that the greatest retention was found with four splinted implants with a bar although patients show a higher satisfaction with ball attachments in a survey of 30 patients treated with four-implant-supported overdenture and ball or bar attachments.

ISOs with five or more implants will be indicated on fixed implant supported rehabilitation, although there are some clinicians who might use these types of overdentures in square-shaped arches. Comparative studies by Rashid et al. and Assunção et al. , in patients wearing conventional dentures and ISOs, they concluded that: ISOs produced less bone reabsorption, had greater retention and stability and that they possess a better chewing function, thus increasing patients' satisfaction and improving their quality of life.

Ueda et al. performed a 24-years follow-up study in patients wearing a mandibular ISO with bar or ball attachments, obtaining 85.9% of survival rate and concluded that ISOs constitute a long-term success treatment.

In an in vitro study, Sadig et al.concluded that Locator attachments had greater retention and stability than ball or magnetic attachments. Van Kampen et al. also argued that magnetic attachments had a weaker retention and needed more maintenance than ball or bar attachments. According to Kleis et al. Locator attachments need a greater maintenance due to their progressive loss of retention. On the other hand, Cakarer et al. claimed that Locator attachments show less complications and that they possess better maintenance outcomes than ball or bar attachments. Menicucci et al., in a comparative study with different attachment systems, reported that bar attachments produced a greater marginal bone stress than ball attachments.

Maxillar overdenture with four implants and Locator´s attachments.

Mandibular overdenture with six implants behaving as a fixed denture but with easier hygiene

A study was carried out in the Department of Oral and Maxillofacial Surgery, Istanbul University, Dentistry Faculty .The population of this study, constituted of 36 patients (16 male, 20 female) who have

been treated with implant supported mandibular or maxillary overdentures. The implants were placed between between the time period from 2004 to 2009. The age of the patients ranged between 43 and 89 years with a mean age of 66.3 years. Patients with adequate bone volume and with a complete edentulous mandible or maxilla, were included in the study. Patients with uncontrolled systemical health problems were excluded. The patients agreed with a written informed consent. The individuals have been randomly assigned to the ball, bar and Locator attachment groups. Bilaterally balanced occlusion was performed on all of the prosthesis. Once treated, each patient's information was updated regularly according to the frequency of recall visits.

The complications encountered, were associated with the overdentures, attachments and implants. Fractured overdentures, replacements and/or activations of O-rings and retention dips, implant failures, hygiene problems, mucosal enlargements, attachment fractures and retention loss in the attachments were recorded. A total of 21 complications (14 in ball group, 7 in bar group) were observed. The distribution of patients with regard to the complications is summarized in table 1. Nineteen patients were present without any complication. On the other hand, seventeen patients were present with various complications associated with attachment types, prostheses or implants.

Table 1. The distribution of the patients with regard to complications.

Complications	Ball group N=19	Bar group N=9	Locator group N=8
Replacement of attachment components	3	3	0
Overdenture fracture	2	1	0
İmplant failure	4	1	0
Activation of attachment components	0	1	0
Hygiene problem	1	0	0
Mucosal enlargement	3	0	0
Attachment fracture	0	1	0
Peri-implantitis	1	0	0

Several studies evaluated the ball and bar attachments regarding the retention force and prosthetic complications. Sadowsky (7) reported that solitary ball attachments appear to be less costly and less technique sensitive. However, ball attachments seem to be less retentive than the bar design. Naert and colleagues (16) reported that single attachments provide lower retention than do bars for fixation of overdentures. Kiener and colleagues (11), evaluated the prosthetic complications with implant supported overdentures in the maxilla. The most frequent finding was retightening of the bar screw and adjustments of the bar retainers. In a multicenter study on overdentures which were splinted with 2 implants, the need of clip activation was reported as 62% of the study group and clip fracture was reported in 33% of the patients.

Within the limitations of this study, it is concluded that all the attachment systems were useful. No significant difference was observed between the attachment systems regarding the implant failure, replacement of the attachment fragments and fractured overdentures. However ball and bar attachment fragments required more service. On the other hand Locator attachment was found more advantageous

to ball and bar sytems, regarding the rate of complications in clinical practice. Further studies are still needed, including the comparison of ball, bar and Locator attachment sytems used in implant overdentures.

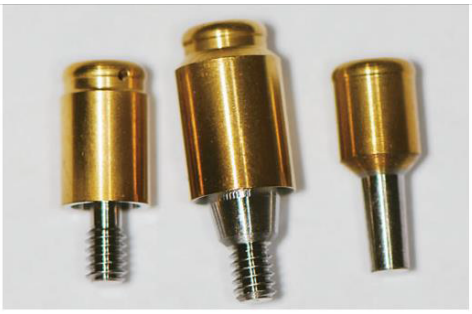

Fig. 2: Connector variations of the Locator Implant Abutment permit its use on various implant systems. (l-r external hex, conical connector, morse taper)

Fig. 3: Various cuff from 1mm to 6mm

Ball and locator Attchments with Nylon rings

Fig. 4: Two Locator attachments placed to improve the retention on a stable mandibular denture.

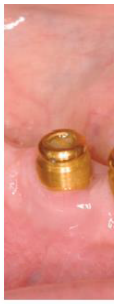

Fig. 5: Five Locat denture retention.

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