

Crown Lengthening Procedure: A Boon for Restorative Dentistry

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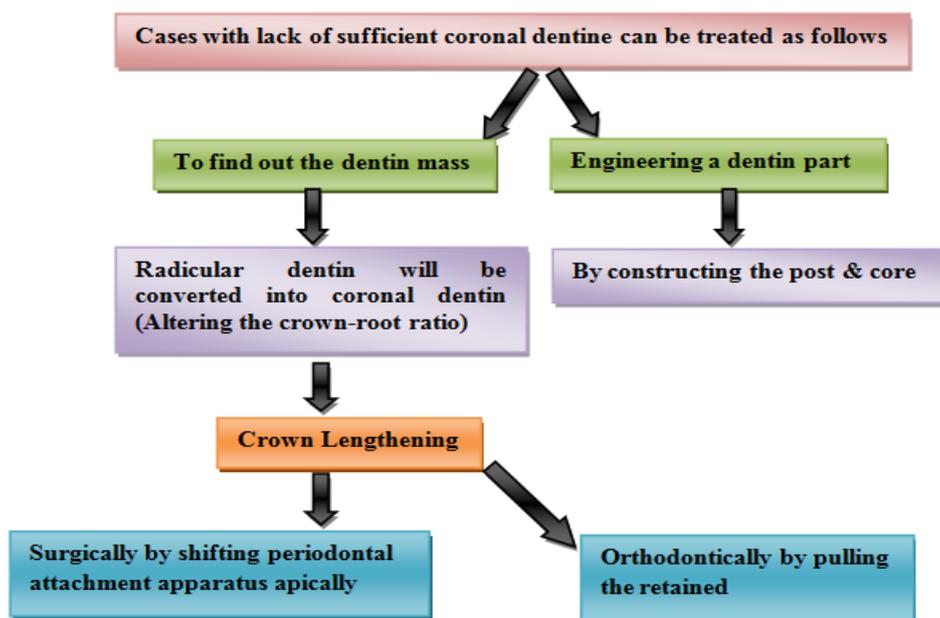
Abstract: A beautiful smile is almost always the foremost priority of a patient coming for the dental treatment but complete oral rehabilitation of patients demanding a beautiful & attractive smile involves the change of both the morphologic aspect of teeth, architecture of oral tissues, and occlusion.

An organised and systematic approach is required to analyze, evaluate and resolve esthetic problems predictably. It is of prime importance that final results are not dependant on looks alone. Our ultimate goal as clinicians is to achieve pleasing composition in smile by creating an arrangement of various esthetic, functional elements and improving the overall oral health of the patient. This case presents an interdisciplinary treatment approach for the damaged maxillary anterior teeth to achieve an optimally aesthetic and functional result.

Keywords: Interdisciplinary treatment, Rehabilitation, Biologic Width, Crown Lengthening, Post and Core.

I. Introduction

Smile is the curve which makes everything straight. One of the major component for restoring a healthy smile is the reproduction of form, function and aesthetics of the natural teeth[1]. On many occasions, patients present to our clinic with teeth, deficient in coronal tooth structure. Rehabilitation of such kind of teeth is one of the most frequent and most demanding tasks clinicians still face[2]. Whether the loss of structure is due to caries or trauma, the remaining structure must have certain dimensions to aid in the success of final prosthesis[4]. Frequently, teeth not only require prosthetic rehabilitation by means of a full coverage prosthesis, they often also need restoration of teeth by retention acquired from within the root canal space, particularly when large amounts of dental tissue have been lost because of destructive caries, superadded by endodontic treatment. Because badly mutilated teeth or the grossly decayed teeth pose problems to the restorative dentist during their treatment due to unavailability of sufficient clinical crowns, hence a crown lengthening procedure prior to restorative treatment is necessary during management of such teeth (Fig.1) [5].



(Fig.1)

Clinical crown lengthening refers to procedures designed to increase the extent of supragingival tooth structure for restorative or esthetic purposes. The need for crown lengthening is dictated by dental and patient factors. Clinicians have to make the best treatment decisions by addressing the biological, functional, and aesthetic requirements of every patient[8]. The amount of tooth structure exposed above the osseous crest must be enough to provide for a stable dentogingival complex and biologic width to permit proper tooth preparation and account for an adequate marginal placement, thus ensuring a good marginal seal with retention for both provisional and final restorations[9].

In cases where teeth are severely decayed, endodontic treatment and placement of some retentive features is necessary before crown fabrication. A foundation or core build-up restoration may be required to supplement retention and resistance form. The strength required of a foundation restoration will vary, depending on the location of the tooth in the dental arch, as well as on the design of the surrounding tooth preparation. Apart from acting as a transitional restoration in the management of a damaged tooth, a core build-up restoration must withstand crown preparation and impression-taking and contribute to the retention and support of a provisional crown before the definitive crown restoration is placed. When retention and resistance depend significantly on the core build-up, the strength of the foundation restoration and its retention to the underlying tooth tissue can directly influence the survival of the restoration[6].

When crown lengthening is planned to increase the length of affected available tooth, some biologic and anatomic considerations need to be considered and if not encroached upon this may lead to periodontal breakdown. Owing to the basic principle of biologic width, it has been proposed that there should be at least 3 mm of supracrestal tooth tissue between the bone and the margin of the proposed restoration[10]. The anatomical considerations that need to be considered when a patient is being assessed for crown lengthening are: Anatomy of the root (length and shape), furcation position; lip line (at rest and smiling); interdental bone width; soft and hard tissue anatomy and muscle insertions; width of attached gingival tissue[11].

This case report presents interdisciplinary treatment planning of a patient with grossly decayed maxillary anterior teeth. Analyzing, evaluating and treatment planning for such cases often involve a multidisciplinary approach such as Endodontics, Periodontics and Prosthodontics. This case report helps us to understand the roles of various disciplines in producing an aesthetic make over, with the most conservative and biologically sound interdisciplinary treatment plan possible.

II. Case Report

A 21 year old male patient reported to the department of Conservative Dentistry and Endodontics of Guru Nanak Institute of Dental Sciences and Research, Kolkata with a chief complaint of grossly decayed teeth in the upper front region of the mouth and requesting for “better looking teeth”.

In the preliminary phase a careful clinical examination was carried out. Patient’s extraoral examination revealed incompetent lips. Intraoral examination revealed poor oral hygiene, grossly carious maxillary anterior teeth with open bite. There was no tenderness on percussion, swelling, mobility or discoloration of teeth in the upper front teeth region. Clinical crown available was 0.5mm on distal aspect of 11 and 12 (Fig.2). Intraoral periapical (IOPA) radiograph showed periapical radiolucency in relation to 11 and 12 and the average diameter of the radioluscencies were 2mm mesio-distally. Also there was widening of periodontal ligament space w.r.t. 21 and 22. Radiographic examination with OPG was performed to rule out any other pathological conditions (Fig.3).



(Fig.2) Intraoral view



(Fig.3) OPG

The treatment was planned as follows:

1. Oral prophylaxis
2. Endodontic therapy
3. Surgical crown lengthening
4. Post and Core
5. Porcelain fused to metal crowns.

As the patient preferred to retain his natural teeth, endodontic treatment was planned for maxillary central and lateral incisors (11,21,12,22). All the caries was removed with spoon excavator and a small round diamond abrasive. Access cavity preparation was made with a round tungsten carbide bur followed by tapered fissure diamond abrasive and the glide path was established with a 15 no. K file. Working length was determined with the help of apex locator and confirmed with IOPA radiographs. After working length determination, a thorough chemomechanical preparation was carried out by shaping the canals with hand Protaper file system till F3 size. After each instrumentation 3 ml of 1% sodium hypochlorite solution (warmed to 45°C) is used per canal for irrigation. A 27 gauge side-vented needle with a plastic syringe is used for irrigating solutions in the canal. After completion of shaping of the canals, 10 ml of Sodium hypochlorite (NaOCl) soln. is used to fill up each of the canals and a #15 K file is inserted 1mm short of the working length and ultrasonically activated for 30 seconds per canal followed by irrigation with NaOCl solution and the process is repeated for 5 mins. Following this 5ml of 17% Ethylene diamine tetraacetic acid (EDTA) solution is used for 1 min per canal. Finally normal saline followed by 2% Chlorhexidine gluconate (CHX) solution was used copiously as the final irrigating solution. Canals were obturated using lateral condensation method with Gutta percha cones and AH plus sealer. The whole endodontic procedure was completed in three sittings with zinc oxide eugenol cement as the temporary filling material in between the appointments. Patient was re-evaluated for periapical healing after a period of six weeks. As the patient was clinically asymptomatic and radiographic assessment showed periapical healing in progress w.r.t. 11 and 12, therefore periodontal surgery was planned.

After anaesthetising with 2% Lidocaine, an apically repositioned flap (full thickness flap) was raised with internal bevel incision (1mm from the gingival crest) from distal aspect of 13 to distal aspect of 23, followed by cervical incisions in the same region. Vertical incisions are then made extending beyond the mucogingival junction. The vertical incisions after the flap is elevated, reach past the mucogingival junction to provide adequate mobility to the flap for its apical displacement. It is elevated with a periosteal elevator (Fig.4). All the granulation tissue was debrided with area specific curettes, followed by scaling and root planning. After this, ostectomy (osseous reduction of the crest of the alveolus) was done using high speed handpiece and small diamond round bur, in relation to 11 and 12 to increase the clinical crown height with sufficient area for biologic width (Fig.5). Saline irrigation was used to prevent bone necrosis due to heat generation and also to clean the area for clear visualization, The attachment flap was repositioned at a more apical level w.r.t. to cementoenamel junction of the adjacent teeth. Interrupted sling suture was given with non-resorbable silk suture to prevent displacement of the flap (Fig.6), after which non-eugenol periodontal dressing (Co-pack) was placed. Suture removal was done after four days and patient was recalled after a week for assessment of healing of the tissues, and the clinical crown length was noted to have increased to 2mm on the distal aspect of 11 and 12 (Fig.7).



(Fig.4) Raising of full thickness flap



(Fig.5) Ostectomy performed



(Fig.6) Flap repositioned apically and sutured



(Fig.7) 2mm gain in clinical crown

Post space was prepared till Peeso reamer size 3, with 5mm of apical gutta percha remaining. Prefabricated passive, serrated, parallel and apically tapered metal posts were placed into the canals and cemented in position using chemically activated resin cement (Fig.8), in relation to 11 and 12 followed by core-build up with nanohybrid composite resin.

Crown preparation was done for PFM crowns with chamfer finish margin palatally and shoulder finish margin labially. Impression of both the arches was taken with addition silicone impression material, after which temporary crowns were fabricated with cold-cure acrylic resin and cemented with zinc oxide eugenol luting cement. Finally PFM crowns were placed in relation to 11,21,12 and 22 and cemented with type I glass ionomer cement (Fig.9).



(Fig.8) Metal post placed



(Fig.9) PFM crowns cemented

III. Case Discussion

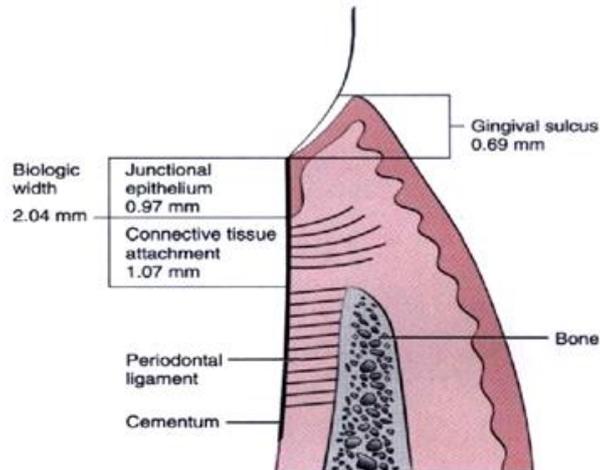
The goal of any dental therapy is to facilitate the re-institution of a healthy situation that is temporarily damaged. The treatment planning usually begins with an assessment of biological aspects of patient's dental problem, which includes patient's susceptibility to caries, periodontal health, endodontic needs and general oral health[4]. Once biological health was addressed, then the restorations of defects were considered and finally aesthetics would be addressed to provide a pleasing appearance of the teeth[6].

In this case the patient wanted a more conservative treatment approach by preservation of his natural teeth, instead of extraction and fixed prosthesis. So accordingly, to begin with, the patient's overall oral health was addressed to and taken care of, with the execution of a full mouth oral prophylaxis. The cariously affected teeth w.r.t. 11,12,21,22 and the periapical radiolucency in 11 and 12 called for the need of endodontic management before they were surgically intervened. Protaper manual file system was used to shape the canals due to increased flexibility, greater taper (multiple and progressive), reduced torsional forces and file fatigue, increased cutting efficiency without 'screwing', lesser contact area between file and dentine (triangular convex cross-section), modified safe rounded tip, variable helical flute angle. The Crown down method of canal shaping gives the advantages of prevention of apical extrusion of canal debris, reduced hydrostatic pressure in the canal, better access to the apical third of root canal, better penetration of the irrigating solutions and minimal loss of working length[25]. Sodium hypochlorite solution was used to dissolve necrotic pulpal tissue and organic components of smear layer. NaOCl solution also has broad spectrum antimicrobial activity, is an excellent lubricant, is inexpensive, easily available and has good shelf life[20]. Using warm or mechanically activated NaOCl solution increases its efficacy[18]. EDTA is used as a chelating agent to demineralize the inorganic components, thus preventing and removing formation of smear layer[19]. Also it softens the dentinal walls making the shaping of canal walls easier[21]. CHX is used as an adjunct to NaOCl specially for antimicrobial coverage of Gram positive bacteria[22]. Also CHX has an affinity to dental hard tissues, and once bound to a surface, has prolonged antimicrobial activity, a phenomenon called "Substantivity". Therefore it is used as the final irrigant[23]. AH Plus sealer provides dimensional stability, long term seal, biocompatibility, slight antimicrobial properties, good radio-opacity, low solubility, low shrinkage and good dentine adhesion. Most importantly AH Plus sealer does release formaldehyde after setting. A minimum of 6 weeks was taken for noticeable reduction in the periapical radiolucency in 11 and 12[26].

Clinical crown of the tooth is the distance from gingival margin to incisal edge or occlusal surface of the tooth. The indications of crown lengthening are as follows:

1. Subgingival caries
2. Margins of tooth crown fractures are subgingivally placed
3. Tooth crown is too short for retention of restoration[13]

In these cases it is necessary to evaluate the gingival biologic width (GBW), to clear out if it is not altered, will it remain healthy after tooth restoration. The biological width is defined as the dimension of the soft tissue, which is attached to the portion of the tooth coronal to the crest of the alveolar bone. The mean connective tissue attachment is 1.07 mm, epithelial attachment – 0.97 mm, dental sulcus – 0.69 mm. Biological width was calculated by adding widths of connective tissue attachment and epithelial attachment: 2.04mm (Fig.10)[24]



(Fig.10)

Technical restorative procedures require a well defined preparation margins to allow for optimal control of the marginal fit of a fixed prosthesis and optimal access for daily plaque control. Further more, sufficient length of clinical crown is required for optimal retention for the planned reconstruction. It is recommended that the restorative margin be a minimum of 3 mm coronal to the alveolar crest, suggesting that this margin could be achieved through a surgical intervention known as crown-lengthening surgery or orthodontic extrusion. These procedures should be considered with severely damaged teeth to expose additional tooth structure to establish a ferrule. However, in this case the patient disapproved of orthodontic extrusion of his teeth due prolonged treatment time, unpredictable treatment outcome and cost issues. Also, as less than 2 mm from restoration margin to marginal bone is present, clinical crown lengthening possibility is taken into considered in the treatment plan[14].

The goal of surgical crown lengthening is to provide the restorative dentist with sufficient clinical crown to permit optimum restoration of a tooth and place the margins of the restoration on sound tooth structure. Some authors have questioned the necessity of this procedure, suggesting that if the biologic width is invaded, the body can re-establish the necessary dimensions on its own over time[15]. However, it is generally accepted that crown-lengthening surgery helps to relocate the alveolar crest at a sufficient apical distance to allow room for adequate crown preparation and reattachment of the epithelium and connective tissue. Clinical crown lengthening is performed in restorative dentistry to achieve margins on sound tooth structure, maintenance of the biologic width, access for impression techniques, and esthetics. Invasion of the biologic width due to restorations could result in crestal bone loss, gingival recession with localized bone loss, localized gingival hyperplasia with minimal bone loss, or a combination of the three[16].

Ideally the margins of restoration should be supragingivally or in the same level as marginal gingiva. As a general rule, when the margins of restoration is kept supragingivally, the distance from marginal bone to margins of restoration should not be less than 3 mm. Therefore, at least 4 mm of sound tooth structure must be exposed at time of surgery. During healing the supracrestal soft tissues will proliferate coronally to cover 2-3 mm of the root thereby leaving only 1-2 mm of supragingivally located sound tooth structure[24]. The positioning of the alveolar crest at a distance of 4mm from the future reconstruction margin was done to maintain the biologic width. This would help the artificial crown to enjoy an extra support from within the core and also at the crown margins[17].

An endodontically treated anterior tooth which lack sufficient clinical crown structure requires restoration with a crown, supported and retained by a post and core system. Therefore in this case post and core preparation is used together with clinical crown lengthening for better prognosis of the PFM crowns. 5mm of apical GP was left after creating the post space with paeso reamers, to maintain the proper apical seal and eliminate chances of microleakage or percolation (by blocking of lateral canals in the apical delta region)[3].

The parallel-tapered design of the post used permits preservation of dentin at the apical portion thus preventing chances of root fracture, and also at the same time achieves sufficient retention and uniform stress distribution along the long axis of root[4]. The serrations on the metal surface provides better retention and adaptability without concentration of stress within the root canal wall causing wedging effect, unlike threaded posts. The resin cement used for cementation of the metal post provides increased retention, reduced leakage and greater resistance to cyclic loading[26]. Nanohybrid composite core material provided adhesive bonding to dentin, thereby resulting in strengthening of the remaining tooth structure and prevention from fracture. Finally all the teeth under consideration were restored prosthodontically with PFM crowns for good esthetic results (Fig.11)[7].



(Fig.11)

IV. Conclusion

The present case reports a interdisciplinary management of maxillary anterior teeth with preservation of the natural root system and prevention of premature sacrifice of teeth by endodontic therapy, surgical crown lengthening to maintain stable periodontal tissue levels, prefabricated posts for retention and finally prosthetic rehabilitation with porcelain fused to metal crowns.

The beauty and harmony of dental restorations are controlled by several aspects, that serve as parameters and help in the reconstruction of smile, and these factors are called aesthetic principles. Esthetics in dentistry has become a major concern for the patient. Hence a proper interdisciplinary approach is required for the treatment planning to achieve a pleasant smile.

Reference

- [1] Case Report : TREATMENT OF MUTILATED MAXILLARY PRIMARY INCISORS: TWO CASE REPORTS. Int J Dent Case Reports Jan 2012, Vol.2, No. 1
- [2] Case Report : A simple method for reconstruction of severely damaged primary anterior teeth,. Dental Research Journal / Oct 2011 / Vol 8 / Issue 4
- [3] Case Report : Custom-Made Polyethylene Fiber-Reinforced Composite Resin used as a Short Post for Pediatric Anterior Teeth. Asian Journal of Oral Health & Allied Sciences - Volume 1, Issue 1, Jan-Mar 2011
- [4] Restoration of endodontically treated teeth. RSBO. 2011 Jul-Sep;8(3):e33-46
- [5] Multidisciplinary Approach in Restoration of Form, Function and Aesthetics of Grossly Decayed Anterior Teeth, Journal of Case Reports, Vol. 3, No. 1, Jan-June 2013
- [6] Contemporary Restoration of ENDODONTICALLY TREATED TEETH. Evidence-Based Diagnosis and Treatment Planning. Nadim Z. Baba, dmd, msd
- [7] Atraumatic surgical extrusion using periosteal elevator in esthetic zone: A case series. Journal of Conservative Dentistry | Mar-Apr 2013 | Vol 16 | Issue 2
- [8] Management of an abutment with less clinical crown height by preserving biological width through an interdisciplinary approach. Journal of Interdisciplinary Dentistry / Jan-Apr 2012 / Vol-2 / Issue-1
- [9] Crown Lengthening Surgery (CLS): A Mini Review & Series Of 4 Case Reports. Indian Journal of Dental Sciences. (December 2014, Issue:5, Vol.:6)
- [10] Lip Repositioning with Crown Lengthening & Gingival Depigmentation: A Case Report. Journal of Periodontol Implant Dent 2011; 3(1): 38-42 (2011e2)
- [11] Periodontal surgery report for crown lengthening of tooth number 24,25. Dr. Nahid Ashri : 2009 k s u - d e n t a l c o l l a g e - 4 1 1 P D S
- [12] Anterior Esthetic Crown-Lengthening Surgery: A Case Report Journal de l'Association dentaire canadienne Novembre 2001, Vol. 67, N° 10
- [13] Biologic width and crown lengthening: Case reports and review. General Dentistry September/October 2010
- [14] CASE REPORT: Clinical Crown Lengthening: Laser-Assisted Versus Conventional surgical therapy Journal of the Laser and Health Academy Vol. 2014, No.1
- [15] Surgical lengthening of clinical crown: Aperiodontal concept for reconstructive dentistry. Perio 2007;4(3)193-207
- [16] Surgical lengthening of the clinical tooth crown Stomatologija, Baltic Dental and Maxillofacial Journal, 2006, Vol. 8., No. 3
- [17] Crown Lengthening Procedures- A Review Article. IOSR Journal of Dental and Medical Sciences (IOSR-JDMS) Volume 14, Issue 4 Ver. I (Apr. 2015)

- [18] A Predictable Protocol for the Biochemical Cleansing of the Root Canal System. ORAL HEALTH MAG - Jul 2001 ; Gary D. Glassman and Kenneth S. Serota
- [19] Root Canal Irrigation. FAMDENT PRACTICAL DENTISTRY HANDBOOK Vol. 6 Issue 4 April - June 2006
- [20] Sodium hypochlorite and its use as an endodontic irrigant. Australian Dental Journal 1998;43:(4)
- [21] Irrigation of root canal by Edgar Scafer. Endo 2007 : 1(1) ; 11-27
- [22] Root Canal Irrigants. JOE — Volume 32, Number 5, May 2006
- [23] The principles of techniques for cleaning root canals, Australian Dental Journal Supplement 2007;52:(1 Suppl):S52-S63
- [24] Review Article; Biologic Width: Evaluation and Correction of its Violation. J Oral Health Comm Dent; www.johcd.org _ January 2009;3(1) : 20-25
- [25] Instruments For Canal Preparation. Endodontic Week For 5th Year Students. Universiti Sains Malaysia: 10-14 September, 2007 ; Dr. Sam'anMasudi
- [26] AH Plus Sealer by Densply : Scientific Compedium July 2004-2005 (19)