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CLINICAL REPORT

Multidisciplinary approach for rehabilitation of debilitated anterior tooth – A Clinical case report

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ABSTRACT

The success of endodontically treated teeth requires an effective coronal seal, protection of the remaining tooth structure to restore function and acceptable aesthetics. A post retained crown can be one of restorative option for this kind of teeth. The retention and resistance of post retained restorations can be achieved through ferrule effect, interlocking devices and grooves. This case report depicts the effect of ferrule, post system and length on biomechanical stability of endodontically treated fractured anterior teeth.

Key words: *Ferrule effect, Endodontically treated teeth, Cast post.*

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INTRODUCTION

Treatment planning consists of determining a sequence of treatment logically designed to restore the patients' dentition to good health, with optimal function and esthetics. An appropriate plan informs the patient about the present conditions, the proposed dental treatment, personal and professional follow up required for the success. Treatment planning should be evidence based and ideally should protect the biologic environment while maintaining or restoring esthetics, comfort and function. The real art of dentistry is to co-ordinate and combine these perspectives and provide the best quality of care to the patient.

Modern dentistry aims at conservation of remaining tooth structure. This becomes more challenging when the involved teeth have previously undergone trauma, extensive fractures, root canal treatment and other post endodontic restoration.[1] Prosthodontist always encounter challenges in managing sub- gingival crown-root fractured cases.[2] For the long-term success of fixed restorations, the abutment teeth assessment must be done carefully. Multidisciplinary approach is very indispensable for procuring long term comfort, good function, treatment predictability, longevity and ease of restorative and maintenance care.

To ensure long-term periodontal health and functional stability, surgical establishment of at least 3 mm of sound root structure above the alveolar bone is mandatory to satisfy both the biologic width, and 1 to 2 mm gingival crevice.[3] There are several techniques for crown lengthening such as gingivectomy, apically positioned flap surgery and osseous recontouring.

The traditional approach for restoration of endodontically treated tooth with moderate to severe tooth loss is to make a post and core and subsequently, place a crown. Posts can be prefabricated or custom made. Custom-made cast post and cores is considered as the gold standard for the rehabilitation of moderate to severely damaged endodontically treated teeth. They conform better to the shape of the canal and provide maximum retention and support for the coronal restoration.[4] This allows uniform distribution of forces within the root.[5] Other advantages include their high durability, strength and the strong union between the core and the post. But common failures of cast post vary from dislodgment of post to fracture of root.[6]

Factors affecting fracture strength of teeth restored with cast post depends on tooth restored, type of post used, tooth location in dental arch, magnitude and direction of functional loads acting on the tooth.[7] Anterior teeth encounter more nonaxial forces than posterior teeth that are predominantly axially loaded.[8] Nonaxial forces are more inimical to the tooth restoration interface and increase the frequency of fracture.[9]

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There are different means to improve retention and resistance of post restorations like ferrule effect, interlocking devices, grooves, and contra bevels. According to the recent studies, the most important factor of success when restoring endodontically treated tooth with post and core is the ferrule. This encompassing band of cast metal around the coronal surface of the tooth resist stress such as functional lever force, wedging effect of post, and the lateral forces.[10] It operates as an anti-rotary device and improves the biomechanical stability of the tooth.[11] Ferrule height of at least 1.5 to 2 mm is required to ensure durability of tooth.[12] According to Rosenstiel, longer a dowel, greater its retention. A tooth with a dowel that is three- quarters the length of the crown or shorter has less chance for success than a tooth that has no dowel.

There are two techniques for fabrication of cast post and core: the direct and the indirect technique. In indirect technique, an elastomeric impression of the post space is made and poured in stone to allow the fabrication of a post and core pattern in the dental laboratory.[13] In direct technique, the pattern is fabricated in the prepared canal with casting wax or specific cold- curing acrylic resin and then invested and casted.[14]

Excessive loss of tooth structure poses difficulties for their subsequent prosthetic restorations. In such instances, an interdisciplinary approach is necessary to evaluate, diagnose and resolve esthetic problems using a combination of endodontic, periodontal and prosthodontic treatments. This case report describes the interdisciplinary approach to restore function and esthetics of maxillary left central with severe coronal destruction. Crown lengthening procedure, endodontic treatment and cast post and core built-up was planned followed by restoration with metal-free ceramic crown.

CASE REPORT

A 19 year old female patient presented to the Department of Prosthodontics, Mar Baselios Dental College, Kothamangalam, with the chief complaint of fractured upper front tooth.(*Fig.1*) According to the past dental history, maxillary left central incisor was root canal treated two years back followed by post endodontic restoration and crown. The same tooth along with the crown and post, was fractured two months back. Clinical examination revealed horizontal coronal fracture in relation to maxillary left central incisor that extended below the gingival level.(*Fig.2,3*) The adjacent marginal gingiva was seen enclosing the fractured remaining tooth structure.(*Fig.4*) The intra- oral periapical radiograph of the involved tooth showed normal root length with obturation done 1mm short of the apex. There was no associated fracture of the root and lamina dura remained intact with normal peri-apical findings.

Figure 1: Pre-operative Photograph of the Fractured 21

Figure 2: Pre-operative intra oral photograph

Figure 3: Dislodged post and core with

A thorough clinical evaluation of the occlusion was done. Alginate impressions were made for making the diagnostic casts. A definitive treatment plan was designed with multidisciplinary approach for plaque control, conservative and endodontic treatment, periodontal surgery and prosthodontic rehabilitation. The procedures like Root canal re-treatment, crown lengthening, fabrication of custom- made cast post followed by prosthetic rehabilitation with a metal free ceramic crown was

explained to the patient. Gingival recontouring was done with internal bevel gingivectomy followed by osseous recontouring. Frenectomy was also done.(*Fig.5,6*)

Figure 4: The incisal view of 21

Figure 5: Intra-oral photograph after gingivectomy and frenectomy

Figure 6: Crown height achieved after healing

Root canal re-treatment was done. Later, the canal was prepared for post placement and the gutta-percha was removed using peeso reamers, leaving the apical 6 mm to maintain a good seal.(*Fig.7*) Indirect technique was used for fabrication of post and core. Orthodontic ligature wire was taken with length equivalent to the post space.(*Fig.8*) This was followed by selection of impression tray depending on the arch and the arch size. The elastomeric impression material used in this case is silicone light (Affinis, Zhermack) and putty consistency (Aquasil, soft putty regular set, Densply). To- prevent trapping of air bubbles in the impression, light body impression material was syringed into the canal.

Figure 7: Gutta-percha removal and post space preparation

Figure 8: Adaptaion of Orthodontic ligature wire

Orthodontic ligature wire, coated with adhesive, is inserted into the canal for reinforcement of canal impression and then the impression was taken using putty wash one-step technique(*Fig.9*) After making the impression the access cavity was sealed with a temporary restoration.(*Fig.10*) The impression was then sent to the dental laboratory for the fabrication of post. The cast post and core was made in non precious gold alloy. Before cementation, post and core was tried in to the prepared canal and a radiograph was taken to check the extent of the cast post.(*Fig.11*) Glass ionomer luting cement was used for cementation of the cast post.(*Fig.12*)

Figure 9: Pick up impression

Figure 10: Occlusal view after final tooth preparation

Figure 11: Periapical radiograph after cast post cementation

Figure 12: Intraoral view after cast post cementation

After cementation of the post and core, the tooth preparation was completed. A retraction cord was used to obtain clear margins. Two impressions were made: an alginate impression to prepare temporary crown and another with hydrophilic polyvinyl siloxane impression material to prepare the zirconia crown. The shade selection was carried out using VITA shade guide (VITA 3-D master shade guide). The zirconia crown was cemented with luting Glass ionomer cement(Glass ionomer luting cement, GC Gold label).(*Fig. 13,14,15*). At 6 months follow-up, the prosthesis exhibited no evidence of failure and the patient was satisfied with its function and esthetics.

Figure 13: Final restoration

Figure 14: Intraoral view of the final restoration

Figure 15: Post operative photograph

DISCUSSION

Tooth fracture involving cervical third of the root can cause an insult to the biologic width. Violation of biologic width while placement of the restorative margins should be considered as a potential restorative failure because it may lead to irreversible damage in the form of gingival inflammation, alveolar crest resorption and recession. There should be 2-3 mm of biologic width to protect the teeth from progression of infection from the gingival sulcus into periodontium and must be reestablished before esthetic and functional recovery.[15] In this case, the crown lengthening was done by internal bevel gingivectomy followed by

osseous recontouring. High frenal attachment can lead to gingival recession which in turn compromises esthetics and dentinal hypersensitivity. Therefore, frenectomy was also done to rectify frenal pull.[16]

The primary purpose of a post is to retain a core in a tooth with extensive loss of coronal tooth structure.[17] Whether an anterior tooth requires a post depends on the amount of remaining coronal tooth structure and the functional requirements of the tooth. Retention of the post is influenced by its length, diameter and taper, the luting cement used, and whether a post is active or passive.[18] Resistance of post is influenced by the remaining tooth structure, the post's length and rigidity, the presence of antirotation features, and the presence of a ferrule.

The "ferrule effect" is important for the long-term success of a tooth restored with post. A ferrule is defined as a vertical band of tooth structure at the gingival aspect of a crown preparation which adds retention, resistance form and enhances longevity.[19] According to Santos-Filho PC et al, a 2 mm ferrule increased the fracture resistance of the endodontically treated teeth, irrespective of crown, core or post type. This is due to an improved stress distribution to the root.[20] In certain clinical situations such as in teeth with extensive destruction, with no ferrule or unable to obtain ferrule, cast posts are preferred.[21]

The advantages of custom posts include superior adaptation to the root canal, high strength in comparison to the prefabricated post, restoration of choice in oval shaped canals, or when the angulation of post needs to be different from that of the core. It also reduces the number of interfaces because the post and core as they are fabricated together to form one single unit.[22] The difference between the modulus of elasticity of material, used for fabrication of post and that of tooth dentin is an important factor in transferring functional forces. The difference in the modulus of elasticity of these materials might result in discrepancies in distribution of tensions in tooth roots. Non-precious gold color alloy (NPG), which has surface characteristics and applications similar to gold alloys but with a lower cost is used in this case. This alloy exhibits easy casting properties, with accuracy and adaptation, have high durability, high mechanical and thermal strength, excellent fit, easy soldering, finishing, and biocompatibility.[23]

According to Mohammad R. Rayyan et al, the use of either a direct or indirect post pattern fabrication technique does not affect the accuracy of cast post and core fit. The study also concluded that the indirect technique could save chair side time and be more convenient to both patient and dentist.[24] Luting cement used for cast post and core should have adequate working time with adequate flow, be compatible with obturating materials, should not promote micro leakage, should allow the post to be retrieved easily and should possess high modulus of elasticity. When the patient is young then it is better to select a cement having anticariogenic potential.GIC adheres to dentin through chemical and micromechanical retention.[25] Zirconia crown is used in this case as it eliminates the possibility of metal margins becoming exposed due to gum recession. Gingival coloured porcelain was added to the cervical portion of the crown. The patient was extremely pleased with the final result.

CONCLUSION

This case reports demonstrated the importance of establishing a multidisciplinary approach for a successful management of complex crown fracture. By considering the age and aesthetic concerns of the patient we devised a treatment plan which was conservative, cost effective, had long lasting results and provided desirable aesthetics.

CONFLICT OF INTEREST

There is no conflict of interest

REFERENCES

1. Rani R, Chachra S, Sharma M, Bansal S, Kaur T, Sharma D. Simulating Natural Tooth Anatomy in Anterior Teeth Crown Fracture: A Case Report. International Journal of Dentistry Research 2019;4(2):38-39
2. Re Jean, Orthlieb J D. Rapid orthodontic extrusion of a subgingivally fractured incisor. The Journal of Prosthetic Dentistry 2016 ;116(3):464-466.
3. Zhen M, Wang C, Hu WJ, Zhang H, Li LS, Wei YP, Chung KH. Periodontal evaluation of crown-root fractured teeth following modified crown lengthening surgery. British dental journal 2017;222(1):21-25.
4. Ravanshad S, Ghoreeshi N. An In Vitro Study of Coronal Microleakage In Endodontically Treated Teeth Restored With Posts. Australian Endodontic Journal 2003;29(3):128-133.
5. Sendhilnathan D, Nayar S. The effect of post-core and ferrule on the fracture resistance of endodontically treated maxillary central incisors. Indian Journal of Dental Research 2008;19(1):17.
6. Landys Borén D, Jonasson P, Kvist T. Long-term Survival of Endodontically Treated Teeth at a Public Dental Specialist Clinic. Journal of Endodontics 2015;41(2):176-181.
7. McAndrew R, Jacobsen PH. The relationship between crown and post design on root stress--a finite element study. Eur J Prosthodont Restor Dent 2002;10(1):9-13.
8. J. P. Okeson, "Criteria for optimum functional occlusion," in Management of Temperomandibular Disorders and Occlusion, J. P. Okeson, Ed., pp. 97–110, Elsevier, St. Louis, Mo, USA, 6th edition, 2008.

9. Arunpraditkul S, Saengsanon S, Pakviwat W. Fracture resistance of endodontically treated teeth: three walls versus four walls of remaining coronal tooth structure. Journal of Prosthodontics: Implant, Esthetic and Reconstructive Dentistry 2009;18(1):49-53.
10. Zhi-Yue L, Yu-Xing Z. Effects of post-core design and ferrule on fracture resistance of endodontically treated maxillary central incisors. The Journal of prosthetic dentistry. 2003;89(4):368-373.
11. Mamoun JS. On the ferrule effect and the biomechanical stability of teeth restored with cores, posts, and crowns. European journal of dentistry 2014;8(2):281-286.
12. Singh S, Thareja P. Fracture resistance of endodontically treated maxillary central incisors with varying ferrule heights and configurations: In vitro study. J Conserv Dent 2014;17(2):115-118.
13. Hofstede TM, Ercoli C. An indirect technique for fabrication of a post and core wax pattern. The Journal of prosthetic dentistry 2002;87(3):341-2.
14. Stern N. A direct pattern technique for posts and cores. Journal of Prosthetic Dentistry 1972;28(3):279-283.
15. Padbury Jr A, Eber R, Wang HL. Interactions between the gingiva and the margin of restorations. Journal of clinical periodontology. 2003;30(5):379-385.
16. Ustun K, Sari Z, Orucoglu H, Duran I, Hakki SS. Severe gingival recession caused by traumatic occlusion and mucogingival stress: a case report. European Journal of Dentistry 2008;2:127-133.
17. Goodacre CJ, Spolnik KJ. The prosthodontic management of endodontically treated teeth: a literature review. Part I. Success and failure data, treatment concepts. Journal of Prosthodontics 1994;3(4):243-250.
18. Standlee JP, Caputo AA, Hanson EC. Retention of endodontic dowels: effects of cement, dowel length, diameter, and design. The Journal of prosthetic dentistry 1978;39(4):400-405.
19. Stankiewicz N, Wilson PR. The ferrule effect: a literature review. International endodontic journal 2002;35(7):575-581.
20. Santos-Filho PC, Veríssimo C, Soares PV, Saltarelo RC, Soares CJ, Martins LR. Influence of ferrule, post system, and length on biomechanical behavior of endodontically treated anterior teeth. Journal of endodontics 2014;40(1):119-123.
21. Akhtar A, Godla N, Vedavathi B, Nadig RR. Custom cast posts-A diminishing reality?-A case report. Int J Appl Dent Sci 2018;4(3):01-04.
22. Rosenstiel SF, Land MF, Fujimoto J. Restoration of the endodontically treated tooth. Contemporary Fixed Prosthodontics. Vol. 12., Ch. 12. Elsevier; 2006. p. 351.
23. Gholami F, Kohani P, Aalaei S. Effect of nickel-chromium and non-precious gold color alloy cast posts on fracture resistance of endodontically treated teeth. Iranian endodontic journal. 2017;12(3):303.
24. Rayyan MR, Roa'a AA, Alsadun SF, Hijazy FR. Accuracy of cast posts fabricated by the direct and the indirect techniques. The Journal of prosthetic dentistry 2016;116(3):411-5.
25. Gaikwad BS, Badgujar MS. An alternative technique for cementation of cast post and core restoration. Journal of Dental and Allied Sciences 2015;4(1):44.

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