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Post Endodontic Restorations – An Overview Of Direct And Indirect Restorations. Running Title: Post Endodontic Restorations- A Review

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ABSTRACT: Restoration following root canal treatment and retreatment are carried out in order to restore form, function and aesthetics. Mechanically restored restorations have demonstrated good reliability and predictability as treatment option, where there is a biological cost. The emergence of adhesive based restoration is purely based on the purpose of minimally invasive dentistry philosophy and also due to development of reliable adhesive systems. Adhesive restoration offers many advantages like conservation of tooth structure by which conservative preparation will reduce periodontal problem and possibility of re-intervention if required. Long term success of endodontically treated teeth depends upon the operative choices opted by clinician keeping in mind about the individual clinical case, to restore with direct or indirect restorations, overlays or full crown, using or not using posts and the materials and principles utilized for restoration preparation. The treatment plan is purely based on the amount of remaining coronal structure and functional requirement of the tooth which is root canal treated.

KeyWords: Minimal invasive dentistry, Re-intervention, wear resistance, overlay, Endocrown

1. INTRODUCTION

Endodontically treated teeth (ETT) needs restoration which can be achieved by various methods because the successful clinical outcome depends upon both the root canal treatment done and the adhesive restoration treatment performed afterwards [1]. Although variety of restoration modality available, selecting a suitable treatment option depending upon the clinical situation is a challenging situation for the dentist because of the structural difference between vital and non-vital root filled teeth and other factors [2, 3].
Restoration following root canal treatment and retreatment are carried out in order to restore form, function and aesthetics, to prevent bacterial micro-leakage into the root canal system, to

protect the residual tooth structure against fracture, to ensure periodontal health and to prevent abrasion of the antagonist teeth [4,5]. Mechanical retention based restoration was conventional method of restoring teeth which are now replaced by adhesion based modern restoration modality [6]. The emergence of adhesive based restoration is purely based on the purpose of minimally invasive dentistry philosophy and also due to development of reliable adhesive systems [7].
Mechanically restored restorations have demonstrated good reliability and predictability as treatment option, where there is a biological cost [8]. Adhesive restoration offers many advantages like conservation of tooth structure by which conservative preparation will reduce periodontal problem and possibility of re-intervention if required [9]. The aim of this review is to assess the literature on various treatments available and used in restoration of teeth treated by endodontic treatment.

2. DIRECT RESTORATION

Direct restoration can be provided by means of Amalgam or Composite restorations. Amalgam restorations are mechanically retained whereas composite restorations are retained micro-mechanically with help of adhesive systems. Amalgam restorations were an economical material able to ensure a stable coronal seal to allow the treatment because of their clinical, practical and ergonomic advantages like optimum marginal seal, wear resistance and compression strength, good polish ability, excellent costs-benefits ratio [10]. Several limitations like rigidity of the material, changes in size caused by thermal expansion coefficient and expansion during the hardening phase which leads to micro-leakage [11].
Direct composite restorations are least invasive option when restoring posterior tooth where conservative access cavity had been prepared which aids in rebuilding the integrity of residual tooth structure. Minimally destructed tooth can be managed by intra coronal composite restoration which has good longevity [12- 13].

3. INDIRECT RESTORATIONS

Indirect restorations are provided in the form of Composite resin based Onlay/overlay, Ceramic Onlay/overlay which is lithium disilicate pressed or cad-cam fabricated, and Gold overlay. Usage of partial indirect adhesive restorations should be preferred in cases of medium sized cavity where conservative approach is followed. These partial indirect adhesive crowns preserve coronal structure by avoiding contamination of the root canal system, reinforcing of residual dental tissues, guarantee optimum form and function and also provides economic undoubtful clinical advantages.
Onlay is an indirect restoration which could be performed if the marginal ridge and cusps are healthy where the presence of one marginal ridge is lost and other two adjacent cusps are compromised. Not indicated in cases where endodontically treated tooth which is heavily compromised.
Overlays involve techniques that require removal of tooth structure by half compared to that of a complete crown preparation. Overlays are advised in cases where the endodontically treated posterior teeth had loss of both marginal ridges as the overlay preparations involves cusp coverage which increases the resistance to fracture of cusps in cases like mesio-occlusal-distal cavities [14].
Onlays and Overlays are adhesive technique which helps the clinician to preserve rather than remove dentin. These restorations require precision during every step in preparation like

build-up, cavity preparation, impression, luting, finishing and polishing where the attention given to minute details can provide basis for the long lasting nature of the restoration [15].
There are different materials available for adhesive overlays such as gold, composite resins and ceramic materials. Compared to all the available materials, gold overlays are minimally invasive indirect restoration, which offer advantage of being biologically conservative nature and also been reported to have a survival rate of 89% over a period of 5 years [16, 17].
Indirect composite overlays provide esthetic and biologically conservative option although its clinical performance in posterior dentition remains a questionable aspect [18]. Studies carried out in the past provide favorable results for using indirect composite overlay, but a failure rate of 21% was noted in posterior restored teeth with patients who had parafunctional habit [19].
Indirect ceramic overlays are considered as an excellent treatment modality when there is high esthetic demand, as it preserves significant amount of tooth structure and have been reported as excellent cusp-replacing restoration [20, 21].

4. ENDOCROWNS AND FULL CROWNS

In cases of tooth which is severely destructed, there is a requirement of some sort of intra-radicular retention that helps in retaining restoration which can be achieved with the help of metal post, core and full coverage crowns [22].
Much conventional and advanced technique had been practiced over the years in order to provide a restoration of a root canal treated teeth by means of various crown placement modalities. A new technique invented by Nayyar et al, wherein the restorative core material fills the pulp chamber and extends into the coronal root canals followed by full coverage crowns can be utilized for better longevity and predictability [23].
Full crowns have fewer indications due to advancements of restoration of endodontically treated teeth and due to the concept of minimally invasive restoration. Full crowns are advised when there is loss of crown structure with extension into cervical third, as a component of fixed prosthesis or in cases where perio-prosthesis is indicated. These crowns are provided in various materials like metal, metal fused to porcelain, ceramic crowns e.t.c.
Endocrowns was originally referred to as mono-block porcelain technique by Pissis [24]. Later it was the term Endocrown was introduced by Bindl and Mörmann [25]. It is basically a type of restoration that consists of a core and a crown as a single unit which extends into the pulp chamber [26]. Retention of endocrown is achieved by the adhesive resin cement which aids in micro-mechanical retention and pulp chamber's axial walls acts as macro-mechanical retention. It reduces the need for a post, which would reduce the risk of vertical root fracture and incidental root perforations. It mainly consists of acentral retention cavity and circular butt-join margin inside the pulp chamber. Endocrown does not have inter radicular anchorage [27].
Posts are indicated in teeth which require mechanical support to withstand the crown in cases where there is maximum or severe destruction of tooth structure due to caries or fracture of enamel. Placement of post depends upon factors like [28]

1. Post length: Length of post should reach two-thirds of entire root length. An ideal ration of crown length to post length should be at least 1:1.
2. Post diameter: A minimum dentin thickness of 1 mm around the post should be provided.
3. Post fixation: Posts which were adhesively cemented are more fracture resistant.

4. Post design: Parallel-side posts surrounded by large amounts of cements has lower fracture rates when compared to tapered posts with maximal adaptation in root canal which has high fracture rate.
5. Post and core material: Post and core material should be selected similar.

Although endodontic posts are necessary in order to provide retention and strength to remaining tooth structure it is assessed and avoided in cases where

1) Preparation of an endodontic post requires the removal of healthy dental tissue at the root which increases the probability of root fracture [29].
2) Presence of posts is seen to be associated with increased incidence of endodontic lesions [30].
3) In cases of retreatment, the post acts as an obstacle which leads to removal of radicular dentin and also the risk of perforation [31].

5. CONCLUSION

Long term success of endodontically treated teeth depends upon the operative choices opted by clinician keeping in mind about the individual clinical case, to restore with direct or indirect restorations, overlays or full crown, using or not posts and the materials and principles utilized for restoration preparation. The treatment plan is purely based on the amount of remaining coronal structure and functional requirement of the tooth which is root canal treated. This review was carried out in order to update a current literature about various post endodontic restoration modalities available regarding which further studies should be carried out to provide an insight into better treatment option based on the condition of the tooth portion remaining.

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6. REFERENCES

[1] Gillen BM, et al. Impact of the quality of coronal restoration versus the quality of root canal fillings on success of root canal treatment: a systematic review and meta-analysis. J Endod 2011; 37(7): 895-902.
[2] Rocca GT, Krejci I. Crown and post‐free adhesive restorations for endodontically treated posterior teeth: From direct composite to endocrowns. Eur J Esthet Dent 2013;8(2):156‐179.
[3] Zarow M, Devoto W, Saracinelli M. Reconstruction of Endodontically treated posterior teeth – With or without post? Guidelines for the dental practitioner. Eur J Esthet Dent 2009;4(4):312‐327.
[4] Ray HA, Trope M. Periapical status of endodontically treated teeth in relation to the technical quality of the root filling and the coronal restoration. Int Endod J 1995;28(1): 12-18.
[5] Mannocci F, Bhuva B, Stern S. Restoring teeth following root canal re-treatment. Endod Topics 2011;19(1):125-152.

[6] Tjan AH, Munoz Viveros CA, Valencia Rave GM. Tensile dislodgement of composite/amalgam cores: Dentin adhesives vs. mechanical retention. J Dent Res 1997;76:1355.
[7] Van Meerbeek B, Vargas M, Inoue S, Yoshida Y, Peumans M, Lambrechts P, *et al*. Adhesives and cements to promote preservation dentistry. Oper Dent 2001;26:119‐144.
[8] Aquilino SA, Caplan DJ. Relationship between crown placement and the survival of endodontically treated teeth. J Prosthet Dent 2002;87(3):256‐263.
[9] Carvalho MA, Lazari PC, Gresnigt M, Del Bel Cury AA, Magne P. Current options concerning the endodontically‐treated teeth restoration with the adhesive approach. Braz Oral Res 2018;32(1):74-82.
[10] Naumann M, Kiessling S, Seemann R. Treatment concepts for restoration of endodontically treated teeth: A nationwide survey of dentists in Germany. The Journal of prosthetic dentistry. 2006;96(5):332-338.
[11] Malarvizhi D, Karthick A, Mary NS, Venkatesh A. Shrinkage in composites: An enigma. Journal of International Oral Health. 2019 Sep 1;11(5):244-248.
[12] Nagasiri R, Chitmongkolsuk S. Long‐term survival of Endodontically treated molars without crown coverage: A retrospective cohort study. J Prosthet Dent 2005;93(2):164‐70.
[13] Mannocci F, Bertelli E, Sherriff M, Watson TF, Ford TR. Three‐year clinical comparison of survival of endodontically treated teeth restored with either full cast coverage or with direct composite restoration. J Prosthet Dent 2002;88(3):297‐301.
[14] Edelhoff D, Sorensen JA. Tooth structure removal associated with various preparation designs for posterior teeth. Int J Period Restorative Dent 2002;87(5):503-509.
[15] Hansen EK, Asmussen E, Christiansen NC. In vivo fractures of endodontically treated posterior teeth restored with amalgam. Endod Dental Traumatol 1990;6(2):49-55.
[16] Banerji S, Mehta SB, Millar BJ. Cracked tooth syndrome. Part 2: Restorative options for the management of cracked tooth syndrome. Br Dent J 2010;208(11):503‐14.
[17] Chana H, Kelleher M, Briggs P, Hooper R. Clinical evaluation of resin‐bonded gold alloy veneers. J Prosthet Dent 2000; 83(3):294‐300.
[18] Bartlett D, Sundaram G. An up to 3‐year randomized clinical study comparing indirect and direct resin composites used to restore worn posterior teeth. Int J Prosthodont 2006;19(6):613‐617.
[19] Magne P, Knezevic A. Simulated fatigue resistance of composite resin versus porcelain CAD/CAM overlay restorations on endodontically treated molars. Quintessence Int 2009;40(2):125‐133.
[20] Otto T, De Nisco S. Computer‐aided direct ceramic restorations: A 10‐year prospective clinical study of cerec CAD/CAM inlays and onlays. Int J Prosthodont 2002;15(2):122‐128.
[21] Archibald JJ, Santos GC Jr., Moraes Coelho Santos MJ. Retrospective clinical evaluation of ceramic onlays placed by dental students. J Prosthet Dent 2018;119(5):743‐780.
[22] Afrashtehfar KI, Ahmadi M, Emami E, Abi‐Nader S, Tamimi F. Failure of single‐unit restorations on root filled posterior teeth: A systematic review. Int Endod J 2017;50(10):951‐966.

[23] Nayyar A, Walton RE, Leonard LA. An amalgam coronal‐radicular dowel and core technique for endodontically treated posterior teeth. J Prosthet Dent 1980;43(6):511‐5.
[24] Pissis P. Fabrication of a metal‐free ceramic restoration utilizing the monobloc technique. Pract Periodontics Aesthet Dent 1995;7(5):83‐94.
[25] Bindl A, Mörmann WH. Clinical evaluation of adhesively placed cerec endo‐crowns after 2 years – Preliminary results. J Adhes Dent 1999;1(3):255‐65.
[26] Belleflamme MM, Geerts SO, Louwette MM, Grenade CF, Vanheusden AJ, Mainjot AK. No post‐no core approach to restore severely damaged posterior teeth: An up to 10‐year retrospective study of documented endocrown cases. J Dent 2017;63(8):1‐7.
[27] Lander E, Dietschi D. Endocrowns: A clinical report. Quintessence Int2008;39(2):99-106.
[28] Peroz I, Blankenstein F, Lange KP, Naumann M. Restoring endodontically treated teeth with posts and cores - A review Quintessence Int2005; 36(9):737–746.
[29] Heydecke G, Butz F, Strub JR. Fracture strength and survival rate of endodontically treated maxillary incisors with approximal cavities after restoration with different post and core systems: an in-vitro study. J Dent 2001;29(6):427-33.
[30] Sorensen JA, Engelman MJ. Ferrule design and fracture resistance of endodontically treated teeth. J ProsthetDent. 1990;63(5):529-36.
[31] Schwartz R, Robbins JW. Post placement and restoration of endodontically treated teeth: a literature review. J Endod 2004;30(5):289-301.