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Selection of post systems for endodontically treated teeth

[1]Dr. Nitin Sharma, MDS Prosthodontics and Crown & Bridge, Himachal Pradesh University, Medical Officer Dental Zonal Hospital Mandi Himachal Pradesh, India

[2]Dr. Tarush Thakur, MDS Orthodontics and Dentofacial Orthopaedics, Himachal Pradesh University, Private Practitioner C/O Arch Dental Hospital 272/13, Sauli Khad, Mandi, Himachal Pradesh, India

[3]Dr. Aprajita Dogra, MDS Orthodontics and Dentofacial Orthopaedics, Himachal Pradesh University, Private Practitioner C/O Arch Dental Hospital 272/13, Sauli Khad, Mandi, Himachal Pradesh, India

Corresponding Author: Dr. Nitin Sharma, MDS Prosthodontics and Crown & Bridge, Himachal Pradesh University, Medical Officer Dental Zonal Hospital Mandi Himachal Pradesh, India

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Abstract

The endodontically treated teeth were found to perform their long term function after using intraradicularly placed devices such as posts. The prognosis of such endodontically treated teeth depends upon quantity and quality of coronally available tooth structure and application of biomechanical principles of restoration of involved teeth efficiently by the operator. The selection of appropriate post is a major factor determining longer survival of teeth which were restored after endodontic treatment. This article is framed after reviewing all the previous studies concerning factors, determining selection of post systems accessible for restoring severely damaged teeth which were endodontically treated. The vast search was carried out for the literature available from the year 1972 to 2017 on various databases such as Science Direct and EBSCOhost regarding various post systems, post materials, mechanical behavior of dental posts and there selection criteria and the knowledge gathered was presented in simplified form in this review article.

Keywords: Endodontic treatment, post, post design, post material, post systems.

Introduction

The restoration of mutilated teeth treated endodontically had always been a challenge to restorative dentist.[1] The most of endodontically treated teeth were found to perform their function when treated with utilization of intraradicularly placed devices such as posts.[2] The various categories of these intraradicular devices include custom made cast post and core and latest introduced single-visit preformed post systems.[3] The various factors involving tooth damage may include trauma, dental caries and previous restorations when extensively involved resulted in loss of substantial tooth structure, which can further be

restored with crown supported by an endodontic post. The purpose of post utilization includes the process of rebuilding of tooth structure before restoring of crown restoration.[4,5,6]

The various studies have been conducted in past for determining the selection criteria of different posts and presently newer materials have been introduced for restoration of pulpless teeth but all prognosis of success of restoration of such teeth mainly depend upon the quantity and quality of the available coronal tooth structure and efficient application of biomechanical principles for restoration of such endodontically involved teeth.[7,8,9] The selection of appropriated post is important for enhancing the long survival of the restored tooth.[10]

Material and method: Present article is framed after reviewing previous studies available for selection criteria of various post systems available for treating the extensively damaged different teeth. The literature available in English language were searched from year 1972 to 2017 from various sources such as Google Scholar, Science Direct, EBSCOhost and even manual search from the references of the articles available on various post systems, post materials, mechanical behavior of dental posts and there selection criteria were searched, for gathering information about the concerned topic which was presented in a simplified manner for better understanding of concerned topic in this review article.

Factors determining the selection of posts:

1. Anatomy of tooth: The different teeth possess different anatomic features such as curvature of root, width i.e. mesial-distal and labial-lingual hence root anatomy plays greater role in the selection of post.[11] The root size and root length such be considered by the dentist as in appropriate post space preparation and utilization of longer post results in lateral or apical perforation of the root. The use of active post can lead to crack propagation in the dentinal wall. The evaluation of proper root anatomy with radiographic aids prior to post space preparation can prevent from catastrophic root damage. The radiographic assessments often may be misleading to the operator because of proximal root concavities and unnecessary magnification which can be prevented with use of grid for accurate determination of length and width of the root.[12]
2. Dimensions of root: The various studies had suggested that on increasing post length, better retention and distribution of stress can be achieved.[13,14,15] In situations where curved or short root are present it is difficult to use the longer posts. The different studies revealed that 3 to 5 mm of apical guttapercha should be remained intact to provide seal in the apical region.[16,17] In case of short roots the use of parallel sided threaded posts had been advocated. The in-vitro studies suggested the use of luting agents as reinforced composites resulted in negotiation of the shorter length factor of the root.[11] The additional post can be inserted in larger molars for enhancing retention.[14]
3. Dimensions of post: The different authors had suggested different approaches concerning selection of post diameter.[18,19] Such approaches were briefed by Lloyd and Palik[20] in 3 sub groups conservationist, preservationist and proportionist approaches. This was recommended by Stern and Hirshfeld[21] that post-width should not be greater than one third of root-width at the narrowest dimension. Pilo and Tamse[22] advocated the conservationist approach of minimum preparation of canal to restrict width of post for conservation of the maximum tooth structure.
4. Design of post: The various posts can be classified on the basis of their shape as tapered, parallel,

combination of tapered and parallel. As per characteristic features of surface the post can be classified as active post and passive post.[23] Active posts are mechanically engaged with dentin via threads and passive post rely upon the cement and there adaptation with canal for retention. The tapered post design provides conservation of tooth structure due to resemblance to the root pattern, although this design leads to production of wedging effect and concentration of stress at coronal region of tooth, which results in low retentive strength of the post restoration.[24,25,26] The parallel-tapered design of post results in conservation of adequate dentin in the apical region and sufficient retention can be obtained due to favorable parallel pattern of the post.[27]

5. Configuration of root canal and adaptability of post: The selection of custom- designed or preformed post depend upon the configuration of root canal.[28] In case of funnel shaped canal parallel post can be used but retention mainly depend upon the cement whereas in case of extensively prepared post space a well adapted cast post and core should be fabricated as preformed post do not match the available space of the canal.[29]
6. Surface characteristics of post: The post possessing rough surface show higher bond strength as compared with non treated post surfaces due to availability of greater surface for bonding. The Balbosh Aet al[30] and Nergiz et al[31] stated that retentive values of round parallel sided dowels with sanblated surfaces were found to be higher than those with non sandblasted surfaces. D' Aracangelo C et al[32] suggested that after surface treatment of fiber post with silanization, acid etching using hydrofluoric acid and finally sandblasting it was found via SEM analysis that microretentive surface changes with increased retentive properties and decreased flexural properties.
7. Material of post: The choice of material for post should be such that the material possesses physical properties similar to dentin, easily bondable with tooth and should be biocompatible in oral cavity.[33] The ideal post should absorb all the stress induced and transfer minimum to the surrounding structure of tooth.[34] The limitations of the different physical properties of the materials of post, dentin and luting cement is challenge to the dentists as they undergo variant fatigue behavior.[35]

Previously introduced metallic posts have limitations of rigidity, and studies reveled that such post resisted grater forces without deforming.[36,37] Presently the use of different post such as carbon fiber post with physical properties similar to that of tooth has been advocated.[38] Although these carbon fiber post have lower strength in comparison to metallic post but they absorb more stress and disburse less stress to the tooth structure due to presence of parallel carbon-resin fibers in their microstructure.[38,39,40]

The recently introduced Zirconium ceramic as material for post fabrication possess limitation of high modulus of elasticity, results in transmission of forces directly to the tooth structure without intermittent absorption leading to root fracture.[38]

8. Bonding ability of posts: The success of post depends upon its bonding with the surrounding tooth structure. The studies have revealed that resin luting cements showed greater bonding to the carbon fiber post and glass fiber post materials. The surface treatment are more helpful for bonding of ceramic posts as compared with fiber post, however even after creation of retentive features on the post the adhesion between the post and resin cement is not found to be uniform.[41]
9. Retrievability of post: The endodontic treatment of the damaged tooth is highly successful treatment but

some authors have suggested failure rates sometimes.[42] The retrievability of post is needed in such failure of endodontic treatments. The fiber and metal-alloy posts are easier in retrieving from corresponding tooth in comparison to ceramic or zirconium post in which retrieving is difficult or almost impossible from the tooth.[43,44]

10. Esthetics: The metal ceramic crown allows operator to use any post and core material.[45] in case of All–ceramic restorations translucency of crown will permit metal of post to show through. The non metal carbon fiber post and zirconium post results in achieving more esthetics in case of All-ceramic restorations.[46] The opaque-porcelain fused with post-core can be utilized for masking gray discoloration effect of metal post.[47]

Conclusion

The treatment of an endodontically treated tooth is most successful in those situations where loss of coronal structure of tooth is limited and choice of post should be such that the mechanical properties of post material should be in similarity with natural tooth dentine. The most of studies conducted in past times had revealed that use of metallic post resulted in fracture or failure of tooth, resulting from greater stress concentrations; hence the use of newer non-metallic post was promoted globally.

This review article focused on the selection criteria of the post which is of importance for every clinician for selecting appropriate post in their routine practice.

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