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Post and Core- Parallel Currents in Literary Evolution

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ABSTRACT

The endodontic procedures performed shows success due to its good prognosis with predictable results. The restoration after the endodontic treatment has become an integral part in restorative dentistry. The success mainly based on the restoration, its physical and biomechanical properties along with that need to evaluate the periodontal and occlusal condition of the treated teeth. The selection of the restoration material also plays an inevitable role in its success. A thorough understanding of the post is very important for its selection based on the design, fit to the canal, surface characteristics and impression technique. This review mainly comprises the criteria for selection of the post and core, classification, uses of customized cast post, prefabricated cast post and recent advance such as CAD-CAM post.

Keywords

Retention, Custom post, prefabricated post, CAD-CAM post and Digital impression.

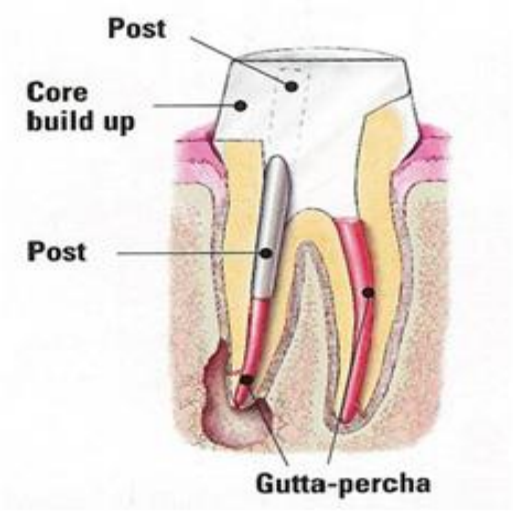
INTRODUCTION

Restoration of extensively damaged anterior teeth is a task for the dentist to conserve and restore the remaining tooth structure. Endodontically treated anterior teeth often have extremely thin coronal tooth structure remaining after root canal therapy and preparation for crown[1]. To preserve the remaining tooth structure, post and core is done with dowel in the root portion along with core build[2]. All ceramic restorations have gained popularity due to their excellent esthetics and biocompatibility[3,4]. The new high strength zirconia ceramics has high mechanical properties along with esthetics and biocompatibility[5-7].

In conventional method of post and core with crown, ideal overjet and overbite must be maintained to decrease the possibility of fracture of the restoration under functional stresses[10]. An alternative to overcome this difficulty, Richmond's crown was introduced which is 'a dowel retained crown made for endodontically treated teeth using a porcelain facing'[9]. Latest advantage is by the usage of computer aided designing and computer aided manufacturing {CAD/CAM} technology for fabrication of zirconia crowns along with post which fulfills functional and esthetic demands [12].

POST AND CORE

According to GPT 10 , Post usually made of metal or fiber-reinforced composite resin that is fitted into a prepared root canal of a natural tooth; yttria – stabilized zirconia is also used as a post material, it provides retention & resistance for an artificial crown; it is also used as a platform for retentive attachment systems & for non-retentive over denture post-coping.



HISTORY

1728 – Pierre Fauchard {Father of Modern Dentistry} introduced the placement of posts in the roots of damaged teeth.

1745 – Claude Mounton , a French Dentist, designed Gold crown with gold post .

1800s – Introduction of wooden posts. The disadvantage is it absorbs fluid leading to expansion of wood and subsequent root fracture.

1839 – Harris – Gold and Platinum were superior to brass, silver and copper which tended to corrode.

1869 - G.V.Black – Porcelain fused to metal crown held in by screw inserted into a canal filled with gold foil.

1878 - Richmond .C.M – American dentist introduced single piece porcelain facing with retained crown that served as bridge retainer , which is known as "Richmond Crown".

1930s – Custom cast and posts and cores were developed that involved the casting of post and core as separate components,which gives better marginal adaptation of the final restoration.

1966 – Prefabricated posts and composite resin cores came into use.

1990 – Duret et al – nonmetallic material for fabrication of posts based on the carbon – fibre reinforcement principle.

2007 – Awad and Marghalani – In CAD- CAM technology, proved technically by making scan of the indirect technique of post and core.

2011 – Sipahi – By using CAD- CAM technology, indirect technique of post an dcore was fabricated proven in invitro.

2019 – Pang – CAD – CAM technology, direct scan has been made without making the pattern resin or cast .

INDICATIONS

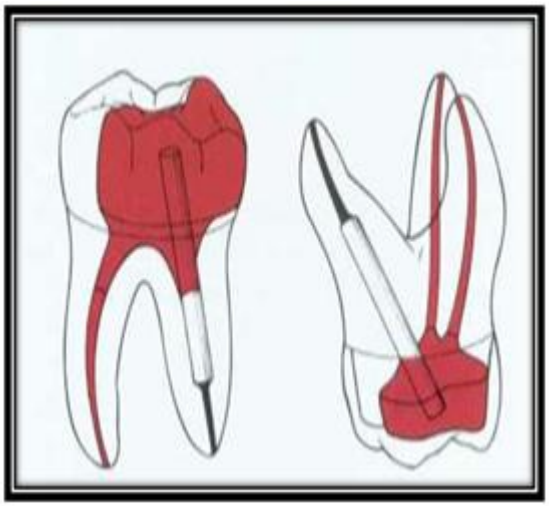
Restoration of endodontically treated teeth are designed to[2,3] :

1. Protect the remaining tooth from fracture.
2. Prevent reinfection of the root canal system.
3. Reconstruct the missing parts of the tooth .
   (Resin composite, Reinforced GICs JPD 1984;51)

Indications	Anteriors	Posteriors
Based on the damage to the structure	< 25 % damage of coronal structure – complete crown	<50 % damage to root structure – core & crown
	>25% damage to tooth structure – post & core	>50 % damage to root structure – post & core is indicated (Molars – largest canal ; Palatal canal – maxillary molar; distal canal – mandibular molar

CONTRAINDICATIONS

1. Severe curvature of root. Eg: Dilacerations of root
2. Persistent periapical lesion.
3. Poor periodontal health
4. Poor crown – root ratio
5. Weak / fragile roots
6. Patient with unusual & occupational habits
7. Economic reasons.



CRITERIA FOR SELECTION

A Precise treatment plan[13] is based on the consideration of differences in endodontically treated teeth from intact vital teeth . The selection of specific materials and technique for restoration of endodontically treated teeth is influenced by the changes that accompany root canal therapy:

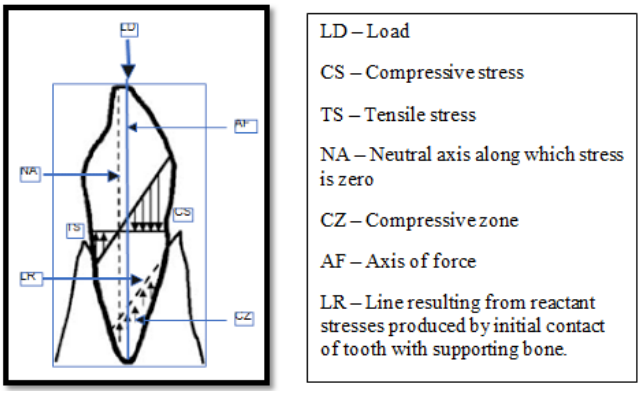
1. Amount of remaining tooth structure.
2. Physical Changes in tooth structure.
3. Anatomic position of tooth.
4. Occlusal forces on the tooth.
5. Restorative requirement of tooth.
6. Esthetic requirements of tooth.

Table 1: Criteria for Selection in Endodontically Treated Teeth.

S. No	CRITERIA FOR SELECTION	DETAILS
1	**Amount of remaining tooth structure** One of the most important factor for restoration of endodontically treated teeth	-Sound tooth structure for long term prognosis - Endodontic procedure reduces tooth stiffness i. 5% in access opening ii. 60% in mesio-occluso-distal preparation.
2	**Physical Changes in tooth structure** Changes in collagen cross linking and dehydration of dentin	14% reduction in strength and toughness in endodontically treated molars.
	i. Nature of dentin toughness: Dentine is natural hydrated and mineralized hard tissue that forms the bulk of the tooth. Optimum between stiffness and dynamic toughness is crucial for mechanical stability for a biological structure.	Mature dentine is a composite material. 30% - organic contains collagen 60% - Interdependant inorganic 10% - Water 1. Hydrated manner – as a plasticizer. 2. Dehydrated – Shrinkage of diameter of fibrils.
	ii. Role of moisture: Interaction of water and dentin matrix occurs in a well-defined manner.	It includes creep, stress relaxation and frictional resistance. Stiffness depends on the rate where the load is applied.
	iii.Visco elastic characteristics: Determines the characteristics of dentin. Loss of free water compromises this characteristic.	
3 ,4	**Tooth position and Occlusal forces** 1.Anterior teeth	i.Forces :Flexural and tensile forces primarily on the facial and lingual surface of teeth ii.Lesser force – anterior teeth placed away

	2.Posterior teeth	from the fulcrum line . i.Forces: Compressive forces directed over the tooth. ii.Full coverage restoration is indicated.
5	**Restorative requirements** Based on amount and direction of forces on the tooth. It should provide protection against caries and fracture.	i. Anterior teeth: minimal masticatory forces. ii.Posterior teeth: Compressive forces along with horizontal /tipping forces in case of fixed partial dentures.
6	**Esthetic requirements** It includes tooth-coloured posts, composite resins or ceramic cores, cements and zirconia	Biomechanical considerations: The stress distribution is the key factor in post and core system{fig 1} The factors responsible for dissimilar stress distribution: 1. Greater stiffness. 2. Angulation of post based on occlusal load. 3. Increased flexure of remaining tooth structure.

Fig 1: Force distribution in a tooth



TYPES OF POST AND CORE

The classification of post and core are based on various authors, technique of fabrication, fit of the post , material used and type of esthetic post .This classification[14] is given based on the cumulative effect of the above all and along with recent advances {fig 2 }.

i. Custom – Cast Post and Core

It is a standard method due to its long successful prognosis. This method eliminates the problem of bonding. It requires more chair time with laboratory procedure. The disadvantage of this system it requires temporization.

ii. CAD - CAM Cast Post

This method[15] mainly improves adaptation with

minimum tooth structure reduction and ability to overcome the errors of conventional fabrication methods such as impression, waxing and casting errors. It comes under esthetic post system which resists corrosion from non-noble alloys. The recommended material used is polymer-infiltrated ceramic network {PICN}, Vita Enamic {Vitadent} is used based on their high flexural strength, elastic properties and physical properties which are better than ceramic material.

The preparation outline converts from concave surface to convex surface which deals with the biomechanics of endodontically treated teeth. This CAD-CAM post is mainly used to reduce root fractures. This post mainly increases the retention due to its anatomical adaptation with the canal. The CAD-CAM post and core has improved bond strength and resistance to root canal dentin.

In a study, they have conducted the difference in fabrication of CAD-CAM post in both direct and indirect digital impression technique. The indirect digital impression technique gives a proper customization of the post. The direct digital impression for post and core can be used in cases for upper anteriors especially central incisors for a wide canal. Further studies has to be conducted to evaluate in which cases we can proceed direct digital impression.

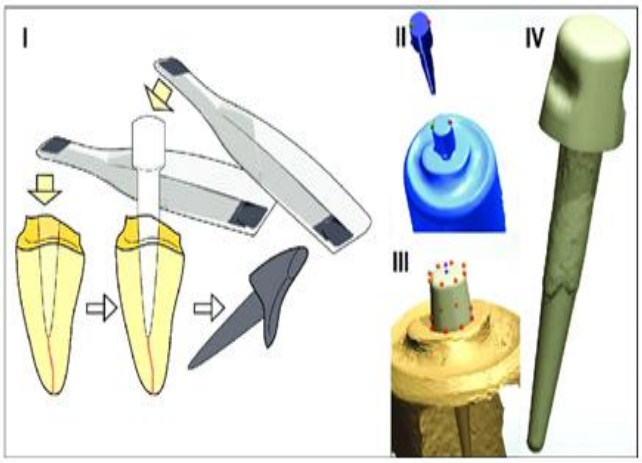


Fig 2: Fabrication of post &core with digital technology -Direct technique

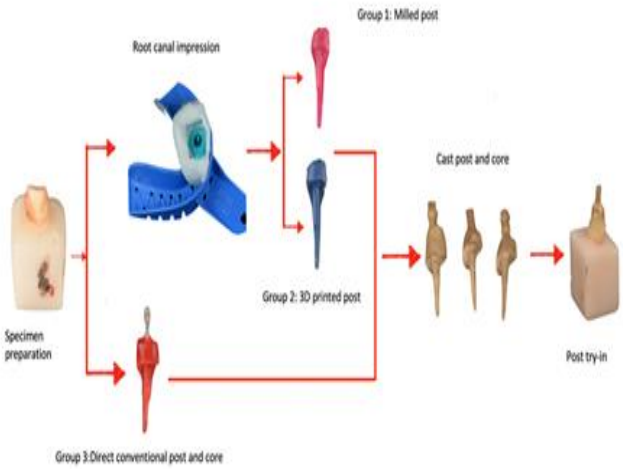


Fig 3: Fabrication of post & core with digital technology – indirect technique.

III. Pre-Fabricated Post and Core

It has been widely used for past 20 years. The parallel posts are more retentive and resistance than other posts. Passive posts are used with greater potential which is preferred for most clinical situations; Carbon fibers are used in initial periods. Esthetic posts such as zirconia are very rigid.

PROCEDURE FOR POST PREPARATION

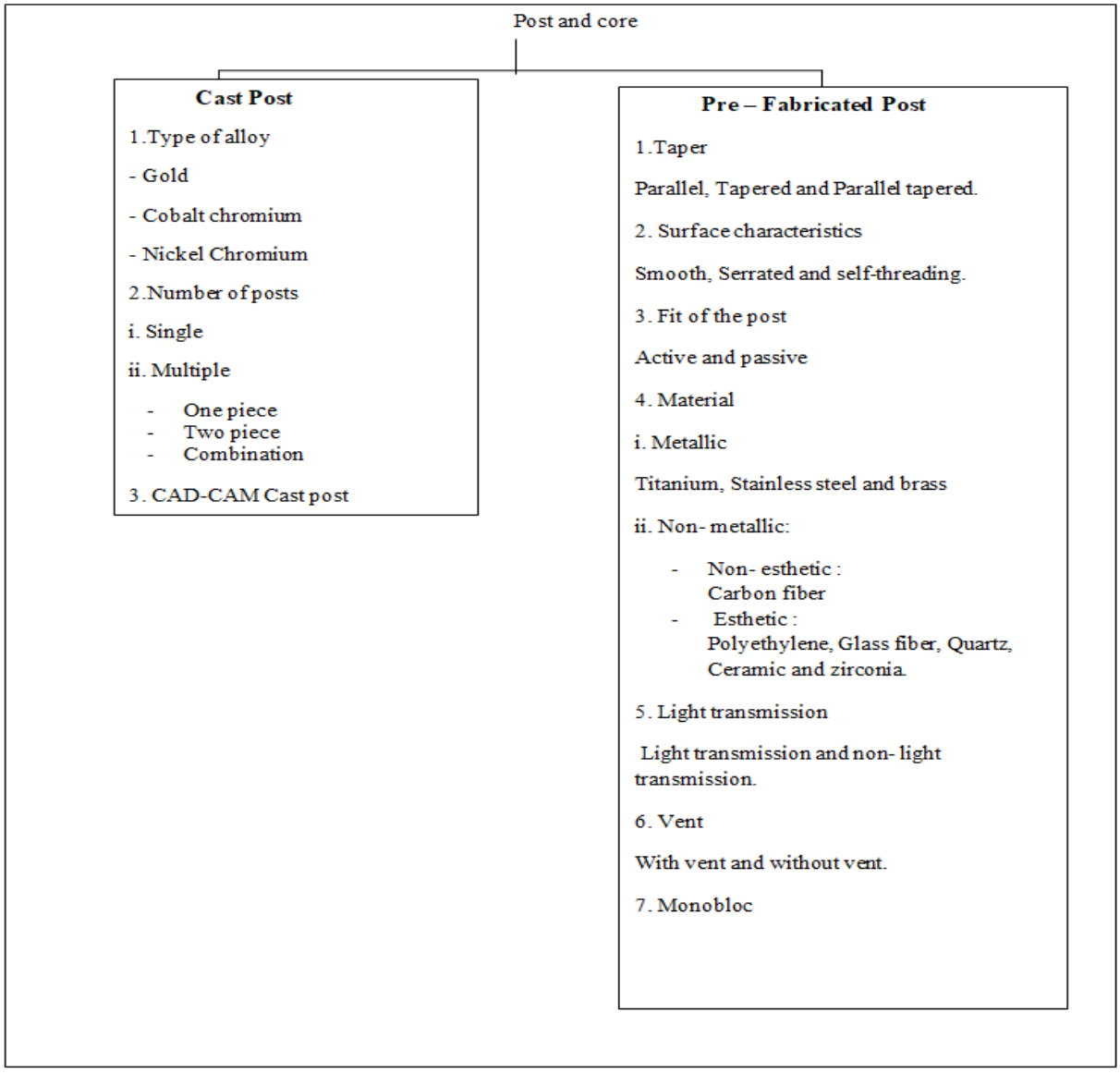
1. Extension of axial wall of the crown apical to the missing tooth structure is known as ferrule and helps to bind the remaining tooth structure together by preventing root fracture during function.

2. Adequate height is 1.5-2mm of sound tooth structure.

3. Rosen in 1961 suggested the hugging action

4. Eissman & Radke used the term ferrule effect effect as "360 degree ring of cast metal & recommended extension of the definitive cast restoration at least 2mm apical to junction of the core & remaining tooth structure.

Fig 4: Schematic representation of classification of post and core



RETRIEVABILITY OF POSTS AND CORE:

Posts and core had an average absolute failure rate of 9%[13] .The most common cause of the failure are post loosening and tooth fracture. The other reasons are apical abscesses and carious lesions while the others are recurrent caries, endodontic failure, periodontal disease, post dislodgement , cement failure, post-core separation, core separation , post fracture , loss of crown retention and root fracture.

The retrieval post can be done to retreat the issue. The fiber posts , custom cast – post can be retrieved without damaging the remaining tooth structure. While the other posts like zirconium posts are impossible to retrieve due to virtually impossible to locate. The techniques and instruments currently available to removal of post and core include masserann technique. The Little Giant post puller Kanematsu dowel removing pliers, S.S. White post extractor , Post puller, Gonon post removing system and many other ultrasonic and drilling systems.

CONCLUSION

The restoration of endodontically treated teeth should be selected based on periodontal, endodontic principles. The understanding of the post and core should be done before selecting the post and the restoration of the core. The selection of the post should be based on the retention because there are lot of advances done to restore the post by using different materials, design and manufacturing. The CAD-CAM post and core is the recent advance which gives minimum chair side and laboratory side time consumption when compared to others. The modifications are done to overcome its limitations.

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