Review Article

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ENDOCROWNS: AN ALTERNATIVE TO CONVENTIONAL POST AND CORE

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ABSTRACT:

The endocrowns are alternative approach for the restoration of endodontically treated teeth with limited tooth structure. The monolithic restorations, require specific preparation techniques to fulfil the criteria that are primarily biomechanical preparation: a cervical margin in the form of a butt joint and a preparation of the pulp chamber that does not extend into the root canals. Compared to conventional methods, endocrowns have better aesthetics, better mechanical performance, and less chairtime.

Keywords: Endocrowns; post and core; ferrule; bonding

INTRODUCTION:

Extensively damaged endodontically treated teeth are biomechanically deteriorated, so their restoration impact the tooth's long-term prognosis.[1,2] An endodontically treated tooth with substantial coronal tooth loss need a core buildup and a crown. However, in severely damaged teeth with minimum remaining tooth structure, core retention is questionable so an extra retentive feature have to be introduced.[3] Post or dowel is placed to attain adequate retention for the core structure. These posts can be prefabricated ones with a direct core or a one-piece custom-made post and core.[4] Post insertion will increase the retention of the core foundation but unfortunately, intracanal retention weakens the tooth structure and subsequently increases the risk of root fractures.[5,6,7]Moreover,future endodontic re-treatment become strenuous in the presence of post.

With the development of adhesives and effective dentine adhesives was a dynamic point in the restoration of endodontically treated teeth, which made the insertion of a radicular post a less favoured option as long as there is adequate surface area for the adhesion.[8]

Firstly, Pissis in 1995,[9]introduced the monoblock technique which was the ascendant of the endocrown. Bindl and Mormann in 1999 introduced the term endocrown.[10]Several studies showed high success rates of Endocrowns in molars with higher fracture resistance as compared to posts.[11,12,13]

Endo crowns have several advantages over posts and cores and conventional crowns:

- Easy to prepare with less clinical time.
- Esthetic properties are also better.[8]

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- Adhesive restorations can decrease the infiltration of microorganisms leading to less microleakage from the coronal to the apical part thus increase the clinical success of endodontic treatment.[10]
- Short or narrow canals where posts are contraindicated.
- Should be adequate depth of the pulp chamber for better retention.

Objective For Preparation

The main objective is to eliminate metal and achieve an all-ceramic bonded restorations that are minimally invasive, as the use of root canals would be completely eliminated which has been cited as an important factor for weakening of the tooth. Thus, the preparation protocol for endocrowns is different from that for conventional crowns. [14,3]

The endocrown is described as a monolithic (one-piece) ceramic bonded construction[12,15] which is characterized by a supra-cervical[16] butt joint, retaining maximum enamel to improve adhesion. The endocrown preparation involves the pulpal chamber, but not the root canals. Either they can be milled using computer-aided techniques (CAD/CAM) or by molding ceramic materials under pressure[17,18] For better biomechanics a specific preparation and bonding will result in definite result. [19,20]

Occlusal Reduction

A minimum of 2 mm occlusal height reduction in the axial direction should be done. Ideally, the ceramic occlusal thickness should be 3-7 mm. Studies indicated that endocrowns with 5.5 mm thickness have more fracture resistance as compared to ceramic crowns with 1.5 mm occlusal thickness, thus the fracture resistance increases with increase in the occlusal thickness. [21,22]

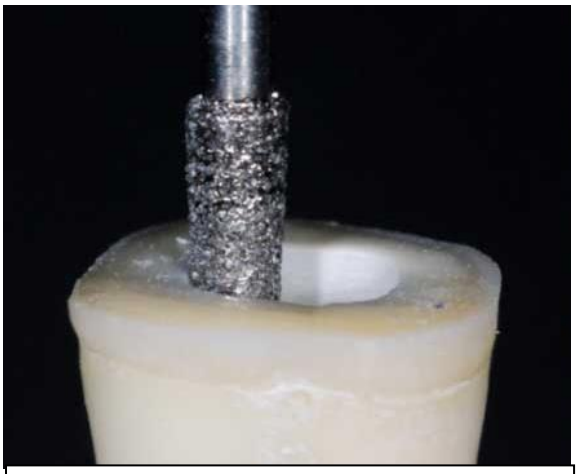
In 2mm depth orientation grooves are made on the occlusion surface, followed with a coarse grit wheel diamond. The preparation should be parallel to the occlusal surface such as to direct the stress resistance along the long axis of the tooth.[23,24] The diamond is directed along the long axis of the tooth, parallel to the occlusal plane. The diamond shape ensures the proper reduction and desired flat surface, wherein the cervical margin or cervical sidewalk is determined. Ideally, the margins should be kept supragingival on the tooth surface as they are easy to maintain by the patient. Any undermined enamel with less than 2 mm thickness should be eliminated. [23,24]

The cervical sidewalk is the premise of the restoration, the main objective is to attain a wide, uniform, steady surface resistant to any compressive stress. [25]

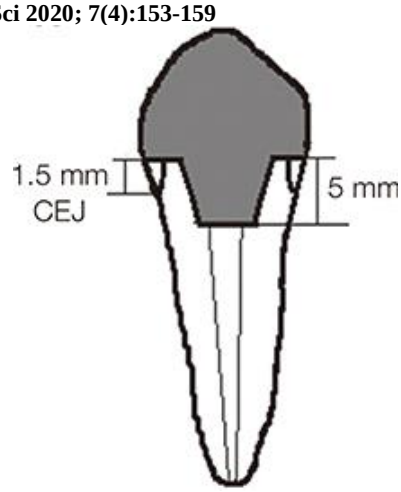
Cervical sidewalk is being prepared with coarse grit wheel diamond.

Axial Reduction

A cylindrical-conical course grit diamond with an occlusal taper of 7 degrees is used to remove the undercuts in the access cavity being prepared such as to make the pulp chamber and endodontic access cavity continuous. Diamond should be held parallel to the long axis of the tooth, to avoid excess pressure and pulpal floor should be kept untouched. The walls of the pulp chamber should not be reduced deliberately as it will reduce the width of remaining enamel leading to more chances of tooth fracture. The recommended endocrown measurements are 3 mm diameter and 5 mm depth for the first upper premolars and a 5 mm diameter and a 5 mm depth for molars.[23] So, the minimum cavity depth should be 3 mm.[23,24]



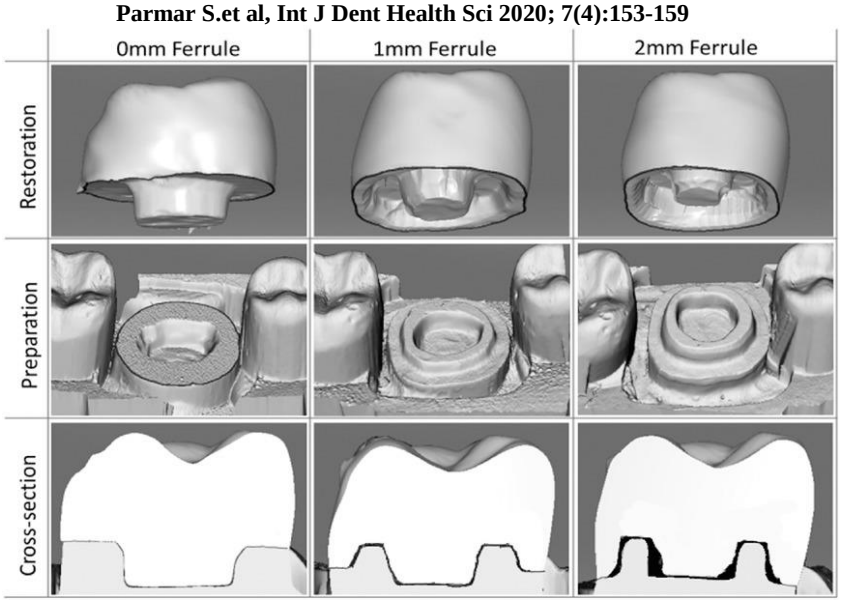
A cylindrical-conical course grit diamond is used to prepare the pulp chamber.



Endocrown measurements for premolar with 5mm depth and prepared 1.5 mm above CEJ.

Ferrule

In full coverage crowns supported by post and core the presence of ferrule was thoroughly investigated and well documented to increase the fracture resistance and fatigue cycles to failure.[26,27,28]Einhorn et al. [29]studied the consequence of ferrule integration, on molar endocrown failure resistance. According to the study, ferrule effect in tooth preparation has increased the dentin surface area for bonding. However, it was reported that additional features incorporated in the preparation design like ferrule might lead to discrepancy in endocrown adaptation. They also concluded that ferrule effect in endocrown preparations revealed significantly failure loads than regular endocrown restorations. Moreover, less occurrences of failure were detected with the endocrown preparations containing 1 mm of preparation ferrule design.



Three preparation design with no ferrule, 1 mm ferrule, 2 mm ferrule.

Bonding

Adhesives such as self-adhesive RelyX Unicem (3M, St. Paul, Minn.) or composites such as Multilink (Ivoclar, Schaan,) are used for bonding the endocrown to the prepared tooth.

Clinical Performance of Endocrowns

Endocrowns had fewer disastrous failures than crowns (with or without post retained restoration), documented only 6% of root fractures and 29% for crowns. Most failures found in endocrowns were due to crown loosening (71%). This lead to the importance of respecting the adhesion protocol, thus ensuring the sustainability of the restoration. The adhesive technique if followed properly reduce the microleakage and invasion of microorganisms from the crown to root apex, thus contributing to the clinical success of the endodontic treatment.[10] In clinical studies, the bonding system failure was observed at the dentin interface while retention was adequate on the intaglio surface of the tooth.[10,31]

Several factors that account for this situation. Firstly, the presence of sclerotic dentin in the pulp chamber that can result in poor adhesion than with sound dentin.[30] And high elastic modulus of some materials, such as ceramic, they transmit stresses at the tooth-to-material interface.[31] The residual height of the walls is low (less than 2 mm), this could also have a negative impact.

Study showed an increase in fracture resistance in restored premolars when length of endocrown is extended in the pulp chamber,[31] but the pulp chamber should not be extended at the expense of the pulpal floor. Thus to limit the risks of displacement maximum depth of pulp chamber should be utilised providing increase in surface area to attain maximum bond strength. The pulpal chamber cavity ensures retention and stability. Its shape should be trapezoidal in mandibular molars and triangular in maxillary molars which enhances the restoration stability.

The saddle form of the pulpal floor and adhesive bonding technique enhances

stability.Therefore, intracanal extensions should be avoided as it results in a decrease in the marginal and internal adaptation of the endocrowns.[32]

The choice of materials used for endocrown fabrication are nanofill composite resins as their modulus of elasticity to be quite similar to that of dentin and thus limits the fractures, while retaining a high fracture resistance. As documented the risk of debonding has been shown to be greater than the risk of fracture, materials such as lithium disilicate, are the best choice due to their greatest adhesive properties.

CONCLUSION:

Based on the findings, the following conclusions were drawn:

1. Restoration of endodontically treated molars with extensive tooth structure loss, restored with endocrowns have shown quite promising results.
2. Clinical indication for restoring anterior teeth with endocrowns cannot be stated yet due to lack of evident data on incisor endocrowns.
3. A successful endocrown restoration requires a good preparation design and bonding techniques to limit failures due to displacement.
4. The nanocomposite resins and lithium disilicate seem to have excellent properties in the fabrication of endocrowns.

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