

The Ferrule Effect : A Review Article

Dr. Anupama Vyas
Private Practitioner
Jaipur

Dr. Himanshu Vyas
Private Practitioner
Jaipur

Abstract

Course to an endodontically treated tooth is either fracture of roots or de-bonding of post and core assembly. Successful restoration of endodontically treated teeth requires effective coronal seal, protection of the remaining tooth, restored function and acceptable esthetics. The rate of fracture and de bonding is lesser with the latest advancements in bonded dentistry. A ferrule effect is the envelopment of the tooth structure by a crown. According to recent studies 1.5 mm of tooth structure is sufficient to ensure the transmission of forces of mastication to both the post and the tooth.

A ferrule is a metal ring or cap used to strengthen the end of a stick or tube use of ferrule as a part of core reinforces root canal treated teeth.

Preserving intact coronal and radicular tooth structure and maintaining cervical tissue to create a ferrule effect are considered to be crucial to optimize the biomechanical behavior of restored tooth.^{1,2} A ferrule effect is defined as a “360 degree metal collar of the crown surrounding the parallel walls of the dentine extending coronal to the shoulder of the preparation. The result is an elevation in resistance form of the crown from the extension of dentinal tooth structure”.³ More precisely, parallel walls of dentine extending coronally from the crown margin provide a “ferrule”, which after being encircled by a crown provides a protective effect by reducing stresses within a tooth called the “ferrule effect”.⁴



Introduction

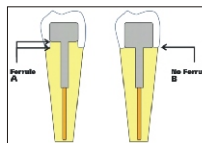
A ferrule as defined by “The Glossary of Prosthodontic Terms”⁵ is a metal band or ring used to fit the root or crown of a tooth. One way to visualize this effect is when observing a wine barrel the metal bands or hoops, which encompass the wooden barrel, give support when barrel is full. Ferrule is a latin word which means “small bracelet” under the influence of ferrum “iron”. The metal ring crimped to hold eraser in place on pencils with attached erasers is an example of “ferrule effect”. In fishing, the circular eyelets that fishing line passes through on the fishing rod is another example.

Ferrule is a vertical band of tooth structure at gingival aspect of crown preparation. In some cases in anterior teeth, it is necessary to perform crown

lengthening or orthodontic eruption of tooth to provide adequate ferrule.

Importance

- Reduces fracture incidences by reinforcing it.
- Resists lateral forces from posts.
- Resistance to fracture increases on using a longer ferrule.



Requirements

- 1.5-2 mm of buccal and lingual sub gingival tooth structure.
- 1 mm of tooth thickness after adequate preparation.
- 4 mm of suprabony tooth structure.

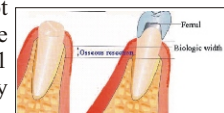
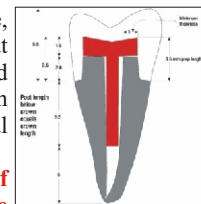
Ferrule Height/Ferrule Design

The importance of ferrule, its design and execution cannot be ignored. When crowned bovine teeth were subjected to cycling loading until the crown or the post or root fractured, the resistance increased with increasing ferrule height.⁶ The number of load cycles required to induce failure in cement layer was higher for human teeth with higher ferrule.^{7,8} Teeth with no ferrule survived only few fatigue cycles and 0.5 mm and 1mm ferrule groups showed a significantly higher number of cycles before failure.⁷ Ferrule heights required to significantly improve fracture resistance when exposed to static loading were 2 mm^{9,10} and 3 mm.¹¹ Additionally, during chewing simulation, teeth with a 1 mm ferrule had a higher percentage of preliminary failure and lower ultimate load before fracture when compared with a 2 mm high design.¹² The mode of fracture was highly dependent on the ferrule height: for restorations with a ferrule height of a 1 mm post/core/crown complex was usually decemented, whereas for teeth with 2 mm ferrule fractures starting on the remote side were most common.¹² A ferrule of non uniform height, varying between 0.5 mm proximal and 2 mm buccal and lingual, was less effective in preventing failure under static loading than a uniform 2 mm.¹³ Similarly, differences in resistance after thermo-mechanical loading were present when a 360 degree circumferential 2 mm ferrule was compared with a 2 mm ferrule present just on the palatal or facial aspect or with the ferrule interrupted by biproximal cavitation.¹⁴ Yet, one study reported no change in resistance between teeth with a uniform ferrule and a ferrule that incorporated only the buccal and/ or lingual wall.¹⁵ Nonetheless, teeth with a non uniform ferrule length were still more fracture resistant than teeth without a

ferrule^{13,15} & therefore, it was suggested that a 2 mm ferrule should be provided atleast on the buccal and lingual wall.

Techniques of Obtaining Ferrule Effect for Tooth Fractured At Gingival Level Surgical Approach

- a. Gingivectomy :** Removal of marginal gingival for a sulcus depth greater than 1 mm in a healthy periodontium with a band of keratinized gingival greater than 3 mm.
- b. Osteotomy :** Removal of supporting bone for lengthening of clinical crown. The crown root ratio should be greater than 1:1 after the surgery is complete. Care should be taken to not to expose furcation in multirrooted teeth.



Orthodontic Extrusion

It is done with the help of J loop and elastics.

Conclusion

Based on the evidence from in vitro and in vivo studies reviewed, the presence of ferrule has a positive effect on fracture resistance of endodontically treated teeth. More successful prognosis could be expected if healthy dentine extending 1.5 to 2 mm coronal to the margin of the crown is provided circumferentially. If the clinical situation does not permit a 360 degree circumferential ferrule because of extensive caries lesions, previous restorations or fractures, an incomplete ferrule is still considered a better option than complete absence of a ferrule. Moreover, including a ferrule in the preparation design could possibly lead to more favorable fracture patterns. With regard to the effect of different restorative procedures on tooth resistance, literature data are often controversial, probably because of the different methodologies and study designs used. However it could be generally concluded that providing an adequate ferrule lowers the impact of the post and core system, luting agents and the final restoration on the performance of endodontically restored teeth.

References : For a complete list of references are available on request, please mail us editor@healtalkht.com

Address for Correspondence :
Dr. Anupama Vyas, Private Practitioner, Jaipur,
243, Ghora Nikaas Road, Ramganj-302003 Jaipur (Raj.)
dr.anupamapurohit@gmail.com