REVIEW ARTICLE

POSTS - HISTORY AND CONSIDERATIONS

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ABSTRACT : The questions that arise during the restoration of a tooth are not new ones. The replacement of missing tooth structure has been practiced by various cultures for thousands of years. There are numerous references to the importance of healthy teeth in the Old Testament, much of which deals with the period antedating 1000 BC. No wonder than that man has made every effort to restore lost tooth structure. Talmud (AD 352-457) recorded the use of a supporting wire to secure the artificial tooth to the root. Later accounts by the Franks (AD 200-737) described the use of a wooden dowel placed in the root to provide an anchor for the artificial crown.

Keywords: Dowel, Endodontic, Post.

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HISTORY

18th - 19th century: Posts become popular. Various methods of restoring pulpless teeth have been reported for more than 200 years.

In 1747- Pierre Fauchard gave the first documented procedure. He used posts fabricated of gold or silver that was held in place with the heat-softened adhesive called "mastic"[1].

The longevity of restorations made using this technique was attested by Fauchard: "Teeth and artificial dentures, fastened with posts and gold wire, hold better than all others. They sometimes last fifteen to twenty years and even more without displacement. Common thread and silk, used ordinarily to attach all kinds of teeth or artificial pieces, do not last long".

Wooden vs. metal posts: There was much controversy over the type of post to be used. Wooden posts, made of hickory or box tree, were popular as they were self-retentive because they swelled up after water absorption. They also caused less wear to the canal. On the other hand, metal posts retained with cotton or silk thread or with wedges were detrimental to the root. Their intracanal movements caused abrasion of the canal walls. Nevertheless, proponents of metal posts preferred fine gold or platinum that corroded less than copper, brass or silver.

During the next 100 years replacement crowns were made from bone, ivory, animal teeth and sound natural tooth crowns. Gradually the use of these natural substances declined, to be replaced by porcelain.

Porcelain crowns were described in the early 1800s by a well-known dentist of Paris, Dubois de Chemant[1]. A pivot was used inside the root canal to retain the artificial porcelain crown, and the crown-post combination was termed a "pivot crown".

In 1839- Chaplin Harris[2] reported that pivoting of artificial crowns to natural roots, and was the most common method of inserting artificial teeth. Harris in "The Principles and Practice of Dentistry" described the preparation of a natural root for an artificial crown. He recommended removing the remaining portion of the anatomic crown with an excising forceps and the extirpation of the nerve by rapid rotation of a silver wire introduced into the canal. This provided access to the canal space for a pivot (dowel) that would serve as an anchor for an artificial crown. The dowels consisted of well seasoned hickory, which gained retention by absorbing moisture and then swelling. Early 'pivot crowns' failed frequently because they were placed into poorly treated or totally untreated canals.

A device[1] that consisted of a metal tube in the canal and a split metal dowel which was inserted into it was fabricated for retentive purposes. This 'spring loaded' dowel was so designed to allow for the easy drainage of suppuration from within the canal or apical areas.

Later, fine gold and platinum were used. There was decreased corrosion with these posts, compared to brass, copper, silver and even inferior gold.

In 1849- Sir John Tomes[3] presented one of the best representations of a pivoted tooth. Tomes post length and diameter conformed closely to today's principles in fabricating posts to retain both cores and copings.

In 1869- G.V. Black[3] advocated filling the root canal with a gold foil, containing a threaded gold bolt which retained a denture tooth. The Richmond crown was introduced in 1880. It consisted of a threaded tube in the canal, which held a screw placed through the crown. This design was later simplified to eliminate the tube and make an unthreaded dowel, which was by then an integral part of the final part of the restoration.

In 1960- Claude R. Baker[4] defined a dowel crown as a dental coronal substitution that gains its primary retention by means of a fixed adaptation to a metal post or dowel inserted into a prepared root canal for a predetermined portion of its length. The dowel crown has proved itself to be a more useful unit for tooth substitution or fixed partial denture retainer.

1870s - Richmond Crown (integrated dowel crown) given by T.W. Richmond persisted for number of years. This originally consisted of a threaded tube in the canal that held the screw (dowel) placed through the porcelain crown. Later, with the advent of cements, this design was simplified to eliminate the

Fig. 1 Mastic

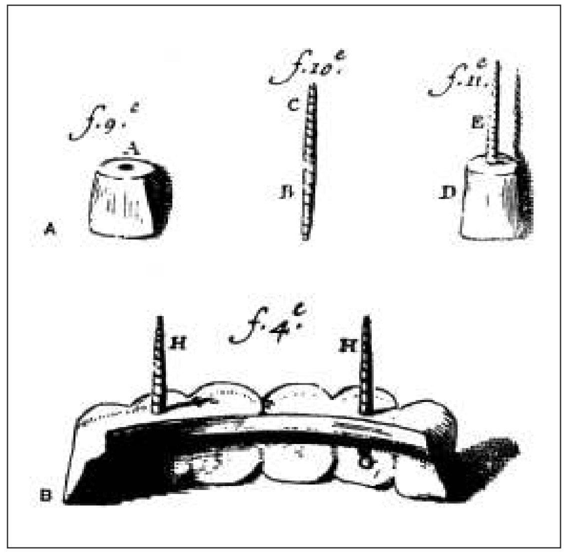

Fig. 2 Pivot crowns

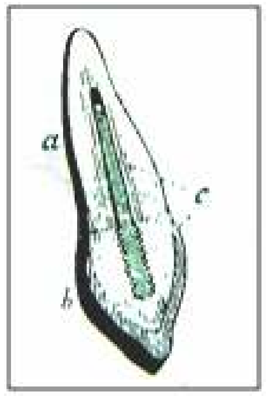

Fig. 3 Metal tube and split metal dowel

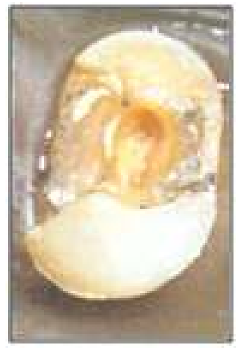

Fig. 4 Loss of tooth structure.

Fig. 5 Change in collagen cross linking.

Fig 6 Discoloration of non vital tooth

tube and make the dowel, by then unthreaded and integral part of the final gold-porcelain restoration.

Logan Crown was a variation of the Richmond crown and had an all porcelain crown instead.

Davis Crown (detached dowel crown) designed by W.C. Davis was an all porcelain crown with a post that could be detached (separated) and could be fixed into the prepared root end by cementation of the post to the root and crown. There was, however, no core design. Practitioners preferred this crown to the Richmond crown because of ease of construction and that it allowed alignment with other teeth.

During this period, the treatment of pulpally involved teeth was generally limited to single rooted teeth. Proper endodontic treatment was severely neglected with little emphasis given to cleaning and obturating canals.

James L. Gutmann[5] insisted that certain guidelines need to be followed in the preparation of root of endodontically treated teeth. With the recent advances in achieving successful endodontic therapy, there is an increased use of the dowel crown.

Considerations

The restoration of endodontically treated teeth has been the focus of considerable controversy and empiricism. Time-tested methods have been highly successful in some respects, but failure is still apparent. Regardless of the system there should be a thorough understanding of the anatomy, and biology of dentin and root supporting the restoration on the part of the practitioner to support the contention that endodontically treated teeth have special needs that exceed the requirements of teeth with vital pulp. These unique aspects include,

A. Effect of endodontic treatment on teeth and

B. Anatomic and biologic considerations.

A. EFFECTS OF ENDODONTIC TREATMENT ON TEETH

Endodontically treated teeth have special needs that exceed the requirements of teeth with viable pulps. The tooth structure that remains after endodontic treatment has been weakened and undermined by caries, fracture, tooth preparation and restoration. Endodontic procedures further remove important intra-coronal and intra-radicular dentin. Also, endodontic treatment changes the actual composition of dentin.

The combined result of these changes is increased fracture susceptibility and decreased translucency in non-vital teeth. Because restorations for endodontically treated, are designed to compensate for these changes, it is important to understand the effects of endodontics on the tooth and the significance of each factor.

The major changes in these teeth[6,1,7,8] include:

1. Loss of tooth structure
2. Altered physical characteristics
3. Altered esthetic characteristics

1. Loss of tooth structure

The decreased strength seen in endodontically treated teeth is primarily caused by the loss of coronal tooth structure and is not a direct result of the endodontic treatment. Endodontic access into the pulp chamber destroys the structural integrity provided by the coronal dentin of the pulpal roof and allows greater flexing of the tooth under function. In cases with significantly reduced remaining tooth structure, normal functional forces may fracture undermined cusps or fracture the tooth in the area of the smallest circumference, frequently at the cementoenamel junction. The decreased volumes of tooth structure from the combined effect of prior dental procedures create a significant potential for fracture of the endodontically treated tooth.

2. Altered physical characteristics

The tooth structure remaining after endodontic therapy exhibits irreversibly altered physical properties. Calcified tissues of pulpless teeth have 9% less moisture content than in vital teeth (Helfer et al, 1972). The collagen too has fewer mature and more immature cross links (Rivera et al, 1988).

Changes in collagen cross linking and dehydration of the dentin result in 14% reduction in strength and toughness of endodontically treated molars, with maxillary teeth shown to be stronger than mandibular teeth and mandibular incisors to be the weakest[9].

The combined loss of structural integrity, loss of moisture and loss of dentin toughness compromises these teeth and necessitates special care in their restoration.

3. Altered esthetic characteristics

Esthetic changes also occur in endodontically treated teeth. Biochemically altered dentin modifies light refraction through the tooth and modifies its appearance.

Inadequate endodontic cleaning and shaping of the coronal area also contributes to this discoloration by staining the dentin from degradation of vital tissue left in the pulp horns. Medicaments used in dental treatment and remnants of root canal filling material can affect the appearance of endodontically treated teeth. Endodontic treatment and restoration of teeth in the esthetic zone require careful control of procedures and materials to retain a translucent, natural appearance.

A. ANATOMIC & BIOLOGIC CONSIDERATIONS

For restoring endodontically treated teeth with post and core restorations careful attention to root anatomy should be paid in order to select the appropriate post design in terms of length and shape and its method of placement. To achieve this end, a thorough knowledge of root anatomy is important along with periapical radiographs at different angulations to determine the number of roots, their structure and curvatures. However, different teeth pose certain problems unique to their anatomy.

MAXILLARY TEETH

Central and lateral incisors – Normally, their bulky roots easily accommodate a post. But excessive post lengths are to be avoided in roots that taper rapidly to the apex because the thinned out root walls at the apical extent of the post increase chances of root fracture.

Canines - Being wide facio-lingually custom cast posts may be desired for better adaptation. Proximal invaginations may be present; hence thicker posts should not be used in order to avoid root perforation.

Premolars - The first premolar presents many challenging problems. It has thin root walls that are further weakened after removal of dentin. Roots taper rapidly to the apex, especially when two roots are present. Proximal invaginations and canal splitting are common. Facial curvature of palatal root and distal curvature of the roots may result in perforation during preparation or cementation.

The second premolar poses similar problems but due to greater bulk of the root shows fewer complications.

Molars - Only palatal root is suitable for post placement as it has the largest canal. In 85% of cases this root is facially curved. Invaginations may be present

on palatal and facial surfaces of this root, as a result of which, weakening or perforation of the root may occur during placement of long thick posts that, may not be disclosed on the radiograph. First molars have deep concavities on the furcal surface of 94% of the mesiobuccal roots, 31% of disto-buccal roots and 17% of palatal roots. Placement of post in the narrow mesiobuccal or disto buccal canal is generally contraindicated.

MANDIBULAR TEETH

Incisors and canines - These teeth are difficult to treat. In fact, success rate has been shown to be higher without a post. They have thin root walls, proximal invaginations and often multiple canals, which complicate post placement. Additionally, significant bone loss may be present which contraindicates post and core restoration.

Premolars - These teeth have sufficient root bulk for post placement, though occasionally multiple canals may be present. In the first premolar the angle of the crown to the root is an important consideration. Perforation may occur on the facial surface of the lingually inclined root if preparation is made perpendicular to the occlusal surface.

Molars – Proximal invaginations are common. First molars have root concavities on the furcal surface of 100% of mesial roots and 99% of distal roots. Perforations may not be seen on radiographs. Their canals are narrow mesio distally and wide facio-lingually and may become considerably weakened if prepared for large, circular prefabricated posts. Distal canal is preferred for post placement as it is the largest. Fractures may occur during cementation or mastication. These fractures are termed 'odontiatrogenic' in origin and may appear radiographically as furcal bone loss or proximal angular defects.[9]

CONCLUSION

However, in the past 30 years, there has been a dramatic improvement in post endodontic procedures being performed and their effectiveness and predictability. Today, the endodontic and Prosthodontic aspects of treatment have advanced significantly; new materials and techniques have been developed, and a substantial body of scientific knowledge is available on which clinical procedures and treatment decisions are based.

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