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THE GEAR OF RETENTION –PIN RETAINED AMALGAM Two Case Reports

Prof. (Dr.) Utpal Kumar Das[1] MDS, Prof. (Dr.) Aditya Mitra[2] MDS,
Dr. Nabanita Bose[3] BDS

[1](HOD, Department of Conservative Dentistry & Endodontics, Guru Nanak institute of Dental Science and Research, India).
[2](Professor, Department of Conservative Dentistry & Endodontics, Guru Nanak institute of Dental Science and Research, India).
[3](PG, Department of Conservative Dentistry & Endodontics, Guru Nanak institute of Dental Science and Research, India).

Abstract: *A pin retained amalgam restoration may be defined as a type of complex amalgam restoration requiring the placement of one or more pins in the dentin to provide adequate resistance and retention forms.Pins are used whenever adequate resistance and retention forms cannot be established with slots, locks, or undercuts only. The pin-retained amalgam is an important adjunct in the restoration of teeth with extensive caries or fractures.Not only the pins help in binding the amalgam to the tooth structure, they also help in binding the weak tooth structure to the amalgam. These case reports present the innovative technique that outlines the reconstruction of severely damaged, posterior teeth with missing functional cusp.*

Keywords: *Dental amalgam; Pin-retained amalgam; Self-threading pin.*

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I. Introduction

Dental amalgam is one of the most versatile restorative materials, which constitutes approximately 75% of all the restorative materials which are used by dentists. The combination of a reliable, long-term performance in load bearing situations, the low technique sensitivity, the self-sealing property and the longevity of dental amalgam is unmatched by those of other dental restorative materials.[1]

Since Markley's first report on the pin retention of amalgam in 1958, much research has been done on this topic.

In 1969, Moffa et al, reported on the retentive properties of three different pin designs in dentin and amalgam. They noted that, 2 mm was the optimal retentive pin-in-dentin/pin-in-amalgam length for the self-threading pins and they concluded that the self-threading pin was the most retentive one in dentin and amalgam.[2,3]

Auxiliary retentive provisions ,in the form of pins are often required for restoration of mutilated and broken tooth, especially in young patient's in which pulp chamber is relatively large,dentinal tubules are comparatively immature and gingival lines are still high.

i.i. Retention of pins in dentin

The main objective of using this pin is to acquire or improve retention of the restoration in dentin.
Self-threading pins will be 5-6 times more retentive than cemented pins.
Friction grips pins will have 2-3 times the retention of a cemented pin.
Pins placed closer than 2mm to each other in one tooth will result in a loss of pin retention in dentin.

i.ii.Proximity of pins to the DEJ

1.5 - 2.0 mm from the DEJ is safe for threaded pins

i.iii.Retention of pins to restorative materials

Threaded pins are 4 times retentive than the friction grip, mainly due to the gnarled and threaded roughness of their surfaces. Restorative materials will occur at a pin length of 1.5mm. A bent pin could complicate the stress pattern.

i.iv.Pin location

The ideal location is gingival, close to the proximo-labial and proximo-lingual corners. The second choice is the middle of a proximal gingival floor or the middle of a labial gingival floor and the third choice is incisal, where there is at least 2 mm or more of dentin between the labial and lingual enamel plates.

i.v.Factors Affecting the Retention of the Pin in Dentin and Amalgam

Type- In the order of retentiveness in the dentin, the self-threading pin is the most retentive the friction locked pin is intermediate, and the cemented pin is the least retentive.

Surface characteristics-The number and depth of the elevations (serrations or threads) on the pin influence retention of the pin in the amalgam restoration. The shape of the self-threading pin gives it the greatest retention value.

Orientation, number, and diameter-Placing pins in a nonparallel manner increases their retention

In general, increasing the number of pins increases the retention in dentin and amalgam.

Other factors for retention of pins are mechanical interlocking of amalgam with undercuts in the pin and resiliency and firmness of dentin

i.vi.Threaded Pin Technique

Indications:

This is the most applicable and feasible of all the techniques for the following indications:

1.It is used for vital teeth.

2.Dentin to engage the pin is primary or secondary dentin properly hydrated.

3.Available pin location is at least 1.5mm from DEJ.

4.A minimal number of pins is needed for the restoration.

5.Maximum retention of pin to dentin and restoration is needed for one reason or another. Each pin will have a wrench attachment portion where the driving wrench device can firmly hold it while driving the pin into the pin channel.

Each pin is furnished in one of following designs:

1.The standard design, 7mm in length, should be shortened after seating.

2.The selfshearing design automatically shears off at 4mm from the dentinal end, when this end comes in contact with the pin channel floor.

3.Pins with a disposable latch-head usually have a plastic head to fit a geared-down slow speed contrangle hand-piece. At the point where there is resistance for further threading, i.e., touching the pin channel bottom, the disposable latch-head will separate from the pin.

Procedure:

1.The procedure for using these pins can be expected from describing their designs. The pin channel is prepared as usual.

2.The pin is then engaged with its driving device and the pin is threaded continuously until it offers the resistant initiated by touching the pin channel floor.

3.This resistant may lead to self-shearing or disengagement of the driving device. One can cut the pin by nicking it at the desired length, using a very small bur in a high speed hand piece.

Several clinical studies have demonstrated that high-copper amalgams can provide a satisfactory performance for more than 12 years.[4].Plasmins et al., evaluated the long-term survival of multisurface restorations and found that the extent of amalgam restoration had no influence on the survival rate [5]

II. Case Report

A 28-year-old female patient visited the Department of Conservative Dentistry and Endodontics,with the chief complaint of food lodgement in left lower back teeth region since 2 months.

The medical history of the patient was non-contributory.

On clinical examination, distal wall and partial lingual wall of the tooth was missing.The tooth was asymptomatic and no pain could be elicited. The tooth responded positively to the thermal and electric pulp testing. The involved tooth showed no signs of mobility.(Fig.1)

Her radiographic examination revealed the presence of a carious lesion approaching but not involving the pulp with no signs of apical involvement.(Fig.2)

The patient's informed consent and necessary ethical clearance were obtained.

The procedure was started with the caries excavation and elimination of the weak enamel margins.

Pin channel preparation was done using Fairfax Stabilok custom drill(Fig.3,4).Pin channel made by the Stabilok drill followed by fixation of the pin(Fig.5).After the pins were inserted matrix band adaptation was done , zinc phosphate cement base was placed and the amalgam was condensed layer by layer. Carving was done to get the proper contour of the tooth followed by occlusal adjustment and finishing and polishing.(Fig.6)

III. Case Report

A 32-year-old female patient visited the Department of Conservative Dentistry and Endodontics,with the chief complaint of food lodgement in left lower back teeth region since 4 months.
The medical history of the patient was non-contributory.

On clinical examination, presence of extensive caries involving the buccal surface.The tooth was asymptomatic and no pain could be elicited. The tooth responded positively to the thermal and electric pulp testing. The involved tooth showed no signs of mobility.(Fig.7)
The patient's informed consent and necessary ethical clearance were obtained.
The procedure was started with the caries excavation and elimination of the weak enamel margins.
Pin channel preparation was done using Fairfax Stabilok custom drill.(Fig.8).Pin channel made by the Stabilok drill followed by fixation of the pin(Fig.9).After the pins were inserted matrix band adaptation was done , zinc phosphate cement base was placed and the amalgam was condensed layer by layer. Carving was done to get the proper contour of the tooth followed by occlusal adjustment and finishing and polishing (Fig.10).

IV. Discussion

Traditionally, amalgam has been the material of choice for the restoration of the direct cuspal-coverage of the posterior teeth. Smales et al found a 66.7% survival rate after 10 years for large, cusp-covered amalgam restorations [6].McDaniel et al carried out a survey, which revealed that the leading cause of the failure among the cuspal-coverage amalgam restorations was the tooth fracture. They assumed that the main reason for the failure was a too conservative tooth preparation; they recommended the replacement of the weak cusps with large amalgam restorations [7].

Polymerization shrinkage is a major concern during the placement of the direct, posterior, Resin Based Composite (RBC) restorations. As compared to the similar amalgam restorations, the placement of a direct RBC restoration takes 2.5 times longer due to the complex sequence which is included in the incremental techniques (Roulet, 1997). Patients with para-functional habits are not the ideal candidates for similar treatments. If a conventional, continuous, fast-curing technique is adopted, the bonding interface may remain intact, but microcracks may develop just outside the cavosurface margins due to the stress of polymerization shrinkage [8]. Conversely, alternative, indirect methods for restoring the severely destroyed molars and the premolars with tooth coloured and cast metal restorations are also available, but, the operative procedures for these are more complex and time consuming and they come at higher costs [9].

The cardinal principles for the cavity preparation for a pin-retained amalgam restoration are, firstly, the conservation of the remaining tooth structure and secondly, the removal of all carious / weakened tooth structures. Pins do not obviate the need for the cavity preparation, but they rather complement the features of the cavity design. Pins by themselves incorporate stresses in the tooth structure. Hence, a judicious blend of minimal pins and cavity features are ideal, to have the maximum of the retention and the resistance features. For an ideal retention, the existing facial and lingual walls should be parallel rather than converging occlusally [10]. The approximal areas of the tooth should contain boxes with retention grooves, whenever practical. Additional retention may be provided by placing slots and dovetails in the remaining tooth structure [11]. The area that has to receive a vertical pin should be flat and perpendicular to the long axis of the tooth, and it should present a zone of dentin which is sufficiently wide for the placement of a pin. In general, any area which is designed to receive a pin should be reduced enough to allow a pin length of 2.0 mm and an amalgam covering of at least 0.5 mm around the pin and 2.0 mm occlusal to the pin.

The position of a pin depends on several factors, first of which is the internal morphology of the cavity. Secondly, the external morphology of the tooth must be considered. Thirdly, the anticipated bulk of the amalgam must be considered, since the pins which are placed in areas of greater bulk are less likely to weaken the amalgam. Finally, the anticipated points of the occlusal load must be considered, since a vertical pin which is positioned directly below an occlusal load weakens the amalgam significantly (Cecconi and Asgar, 1971) [11].

The prediction that the amalgam would not last until the end of the 20th century was wrong. Conversely, recent studies have concluded that the combined amalgam-composite cusp coverage restoration showed acceptable clinical performance over a period of time [12,13]. Yet, amalgam continues to be the best bargain in the restorative armamentarium because of its durability and technique insensitivity. Amalgam will probably disappear eventually, but its disappearance will be brought about by a better and more aesthetic material, rather

than by concerns over health hazards. When it will disappear, it will have served dentistry and patients well for more than 200 years.

V. Conclusion

Amalgam restorations have served the dentistry profession well and they will continue to do so in the years to come. In terms of longevity, they are probably superior to composite resins, especially when they are used for large restorations and cusp capping. The newer high copper single composition alloys offer superior properties, but they may not offer a good seal as the older amalgams. Amalgam can be continued to be used as a material of choice if aesthetics is not a concern.

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Pictures

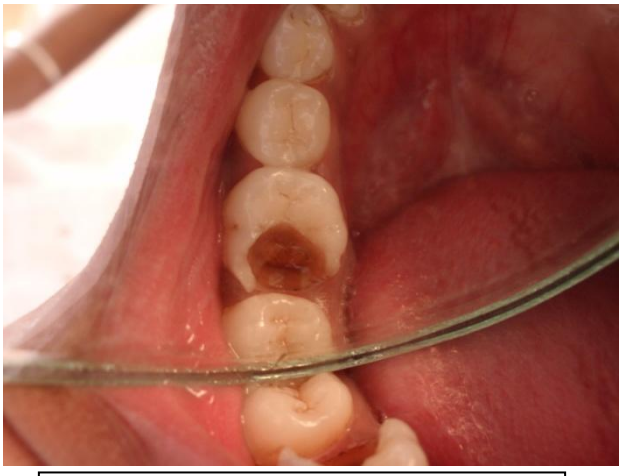

Fig.1 Pre- operative view

Fig. 2 Pre-operative IOPAR

Fig.3 Pin channel preparation made by custom drill

Fig. 4 Custom drill

Fig.5 Fixation of pin

Fig. 6 Post operative view

Fig.7 Pre operative view

Fig.8 Pin channel made by custom drill

Fig.9 Fixation of pin

Fig.10 Post operative view