Shiraz University of medical Sciences

school of Dental Medicine

THESIS FOR D . M . D DEGREE

Retention Designs For Amalgam Restoration

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Retention designs for amalgam restoration

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Retention Designs For Amalgam Restorations :

- Introduction :

Although amalgam has been used in the restoratione of carious lesions since the 15th century or even earlier , it remains the one material most relative durability and its ease of placement . Reasonably compatible with oral fluids , it is a relatively inexpensive restoration that can be placed in a single be the most important restorative material used by the dentist .

By definition , amalgam is an alloy of two or more metals , one of which is mercury . As will be seen , dental amalgam alloy are composed of three or more metals . The amalgam itself is prepared by combining the alloy with mercury through a process called amalgamation or trituration . The plastic mass is then packed or condensed into the prepared cavity where it hardens by crystalization .

Failure of the amalgam restoration is a major concern for the practitioner .

Amalgam has been characterized as having saved more teeth than any other restorative material . Most failure of dental amalgam are now being observed in large restorations , such as those that are one third and more in width in the intercuspal area and those with inadequate remaining tooth structure to provide the basic reterntion and resistance to dislodgement or fracture of the restoration or tooth structure .

As these failure are encountered the practitioner is faced with a large cavity form for each succeeding restoration replacement with cavity size enlarge , the remaining tooth structure is decreased , affording less resistance and retention form . It is recognized that many initial carious lesions have also destroyed so much of the tooth that the same situation exists .

The most common retentive device has been the undercut (mechanical retention) but , invery extensive cavities with gross tooth loss , the provision of an undercut may not be possible . The development of the dentine pin overcome this problem and much research into the advantage and

disadvantage of various methods of pin retention has been undertaken, however , that the placement of a pin can compromise the pulp , and set up stress in the already weakened tooth structure .

They also should that early microleakage could be considerably by the use of this resin bonding . They compared the system to conventional undercutus in the form of grooves .An alternative to the use of pins is the creation of circumferential slots .

This has been shown to produce amalgam buildups that were as strong as pin reinforced amalgam crown's . Howerer , this procedure is also technically difficult and depends upon the proper condensation of amalgam into narrow slots without any movement of the matrix while the amalgam is undergoing setting reactions.

Slot creation can also reduce the thickness of dentin remaining between the pulp chamber and the preparation , and shown a much greater retention resistance by the bonded amalgam .

Improvements in polymer chemistry have led to the development of several materials that bond to both metals and tooth structure . These have the potential to provide retention of amalgam to dentin even in badly broken-down teeth . some of these materials are excellent dentin bonding agent which penetrate into the superficial 5-10mm of the dentin surface , thereby decreasing permeability of dentin , which would decrease the clinical consequences of any microleakage that might develop between the amalgam and the resin treated dentin.

Part 1

pin - retained restorations :

Retention of amalgam in a cavity preparation can only be provided by mechanical means . Retention is traditionally accomplished by using conventional G . V Black preparation designs . often when the retentive features of the preparation are compromised by loss of tooth structure . auxiliary methods are necessary . (3)

Moser and watson point to the significante of pins in amalgam restorations . The pin-retained amalgam is a vital adjunct to the general practitioner in the restoration of badly decayed or broken teeth .

Placing large pin-retained restorations of amalgam is not a formidable exercise fit only for gifted operators but should lie within the capability of every general practitioner . (37)

- Types of pins :

of the three basic design categories of (1) cemented pin systems . (2) friction - lock pin systems and (3) self - thereading pin systems .

- Cemented pins :

In 1958 Markley described a technique for restoring teeth with amalgam and cemented pins using threaded (or serrated) stainless steel pins cemented in to pinholes prepared 0.001 to 0.002 inch (0.025 to 0.05mm) larger than the diameter of the pin. The cementing medium may be either zinc phosphate or poly-carboxylate cement . The retentiveness of pins cemented with these two materials can be approximately equal , but , depending on the brand and / or size of the pin used , a singificantly higher retentiveness may be obtained with zinc phosphate . The use of zinc phosphate cement can cause pulpal irritation as the acide constituents penetrate the dentinal tubules . This irritation might be minimized or eliminated by placing cavity varnish in the pinhole before cementing the pin . However the application of cavity varnish to the pinhole can reduce the retention of the cemented pin by almost one half .

According to Chan and Svare , cemented pins have a greater degree of leakege than noncemented pins , those cemented with zinc phosphate cement have a greater degree of leakage than those cemented with polycarboxylate cement .

Microlekage around pins may not be clinically significant if leakage at the margins of the restoration can be eliminated .

The depth of the hole for the cemented pins should be 3to 4mm for maximal retention . Because the cemented pin dose not produce internal stress and crazelines in the dentin , it is the pin of choice for use in the restortion of root canal treated teeth . Although the cemeted pin is the least retentive of the three types of pins , it will provide adequate retention if correctly placed in sufficient numbers .

- Friction - locked pins :

In 1966 Goldstein described a technique for the friction - locked

pin in which the diameter of the prepared pinhole is 0.001 inch (0.025mm) smaller than the diameter of the pin . The pins are tapped to place , retained by the resiliency of the dentin , and are two to three times more retentive than cemented pins. Stresses are created in the dentin when the pin is tapped to place and may result in lateral cracks perpendicular to the axis of the pin , also , a shearing of the dentin occurs apical to the leading edge of the pin . pulpal stress is maximal when the lateral surface of the

friction - locked pin is adjacent to the pulp . Microleakage occure to a greater degree around friction - locked pins than around the Thread - mate system self - threading pins . cavity varnish applied to the pin hole does not significantly reduce the retentive ability of the friction - locked pin .

The pinhole should be 2to 4mm deep . Major disadvantages with this system are the difficulty in placement of these pins in posterior teeth , patient apprehension during pin placement , and minimal retentive qualities of the inserted pins.(19)

Self - threading pins :

The pin-retained amalgam restoration using self - threading pins was described by Going in 1966 . The diameter of the prepared pinhole is 0.0015inch to 0.004 inch (0.38to 0.1mm) smaller than the diameter of the pin . The pin is retained by the threads engaging the resilient dentin as it is inserted .

The compression of the dentinal tubules that has been observed during insertion of threaded pins may be evidence , although speculative , of the elastic factor that accommodates insertion of a threaded pin into a hole of smaller diameter .

Although the threads of self - threading pins do not engage the dentin for their entire width , the self - threading pin is the most retentive of the three types of pins . It is five to six times more retentive than the cemented pin . lateral and apical stresses can be generated in the dentin when a self - threading pin inserted . Although some studies have shown that insertion of self - threading pins produces more dentinal craze lines than in sertion of either of the other two types .

pameijer and stallard have shown that self - threading pins do not create dentinal crazing and that the crazing demonstrated in other studies may be caused by the technique used for preparation of the specimen .

Pulpal stress is maximal when the self - threading pin is inserted perpendicular to the pulp . As with the friction - locked pin , use of cavity varnish in the pinhole does not reduce the retentive ability of the self - threading pin . The depth of the pinhole varies from1.3to2mm depending on the diameter the pin used . several styles of self-threading pins are available . Because of its versatility , wide range of pin sizes , color - coding system , greater retentiveness , and gold - plated pins (which may

eliminate the possibility of corrosion) , the thread mate system (TMS) is the most widely used self - threading pin . In addition , the TMS minim pin (0.024 inch or 0.61mm) cemented with Zinc phosphate in a pinhole that is 0.025 inch (0.63 mm) in diameter is one of the most retentive cemented pins . chan and svave have demonstrated that the TMS pin exhibits less microleakage than the friction - locked or cemented pin .(37)

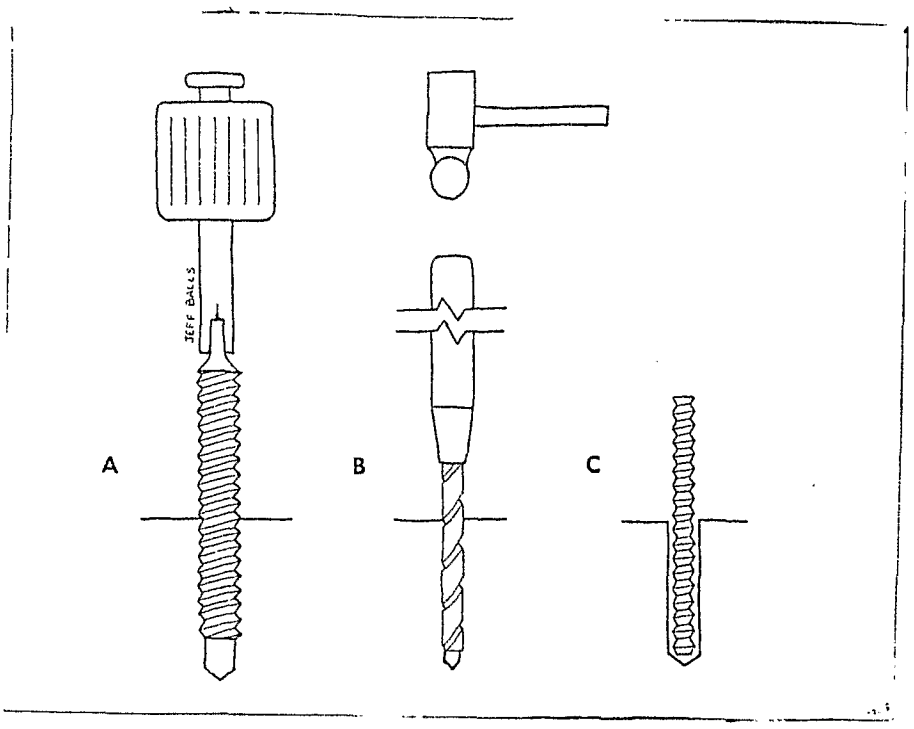

Fig 2-1 : The three basic types of pins . A, TMS systme using oversized pins that are self-threading when twisted to place in undersized pin channel . B, oversized friction-lock pin that is tapped into undersized pin channel . C, cemented pin placed in oversized pin channel .

Table 1-1 : TMS pins

Name	Color code	pin diameter (in/mm*)	Drill diameter (in/mm)	Total pin length (mm)	Pin length extending from dentin (mm)
Regular (Standard)	Gold	0.031/0.78	0.027/0.68	7.1	5.1
Regular (Self-Sheaning)	Gold	0.31/0.78	0.027/0.68	8.2	3.2
Regular (two-in-one)	Gold	0.31/0.78	0.027/0.68	9.5	2.8
Minim (standard)	Lilver	0.024/0.61	0.021/0.53	6.7	4.7
Minim (two-in-one)	Silver	0.024/0.61	0.021/0.53	9.5	2.8
Minikin (self-shearing)	Red	0.019/0.48	0.017/0.43	7.1	1.5
Minuta (self-shearing)	Pink	0.015/0.38	0.0135/0.34	6.2	1.0

* 1 mm = 0.03937 in

-Factors to consider in the use of pins :

1- Retention form :

When insufficient tooth structure remains for the provision of adequate retention form by means of slots or grooves , the placement of a pin or pins is recommended . The number of pins used depends on the amount of tooth structure remaining and the tooth being restored .

As a general rule , one pin for each missing wall will be adequate.

2- Resistance form :

In a severely involved posterior tooth any weakened tooth

structure that may be subject to fracture must be removed and restored .

Ideally a weakened tooth is best restored with a properly designed cast restoration that will prevent tooth fracture caused by the forces of mastication . However , in selected cases pins judiciously placed before placement of an amalgam restoration can function to improve that resistance form .

3- Status and prognosis of the tooth :

Teeth that are sensitive or symptomatic preoperatively should be treated first with a control restoration without the use of pins .

The placement of pins may increase and /or prolong the sensitivity .

If possible , the placement of noncemented pins in root canal treated teeth should be avoided , however , if self threading pins are to be used , a threaded pin larger than the Minikin should never be used .

The treatment of choice for multirooted posterior teeth that have had root canal therapy is to insert an amalgamcore or foundation, which is anchored in the canals and chamber , and then to place