12-1975

The Uses of Pins for Retention in Restorative Dentistry : An Independent Learning Program

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Abstract

THE USES OF PINS FOR RETENTION IN RESTORATIVE DENTISTRY

by Ali M. Asad

Although pins have been used since the 1800's for retention of dental restorations, their widespread use had been limited because supporting techniques such as impression, die materials, better handpieces and drills have only been perfected in the last two decades.

The pin technique allows for greater retention of restorative materials which otherwise might require considerable reduction of sound tooth substance; this is particularly paramount when insufficient coronal tooth structure is present. Also, the placing of pins in divergent directions gives excellent retention. Pin-retained castings reduce the need for deep cavity preparation in some cases.

Pins are useful in stabilizing hypermobile teeth, in that they allow for tooth anchorage otherwise difficult to achieve unless crowns are fabricated and splinted. In cases of placing a post in an endodontically treated tooth, pins may be used to support the post. Malpositioned teeth which in no way would draw in conventional bridge fabrication methods, can be used for abutments by using a variety of pin retention techniques.

Factors which influence any technique are number of pins, length, diameter, surface characteristics, direction, dimensional tolerance, and cementing material; typically, two to four pins are placed in 2-3 mm deep channels.

LOMA LINDA UNIVERSITY

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THE USES OF PINS FOR RETENTION IN RESTORATIVE DENTISTRY

An Independent Learning Program

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December 1975

Each person whose signature appears below certifies that he has read this manuscript and that in his opinion it is adequate, in scope and quality, as a (thesis) for the Degree of Master of Science.

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DEDICATION

To my wife Ihtiram and my two children.

ACKNOWLEDGEMENTS

I wish to express my sincere appreciation to each member of my Guidance Committee for their excellent help so generously given:

To Dr. Elmer Kelln and Dr. William Siebly for their timely counsel and assistance, and for their guidance and technical advice throughout this research project.

To Dr. Robert James and Dr. Douglass Roberts for their valuable technical suggestions in some of the preparation in this project.

To Dr. William Rothgeb for his kind encouragement and help.

To Dr. Lloyd Baum and Dr. Judson Klooster I wish to express my gratitude for their efforts in making this learning possible.

I would like to thank the Kuwaity Government, Kuwait University, for granting me the scholarship to pursue graduate studies.

Last, but not least, to my wife Ihtiram and daughter Reem and son Bashar for their encouragement and patience during my graduate study.

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OBJECTIVES

At the end of this lesson the student will:

1. Be able to identify the two basic clinical applications for using the pin retention technique.

2. Be able to list four reasons why the pin retention technique has now been made expedient.

3. Be able to list the three pin retention systems used since its inception and elaborate on the one which is prevalent today.

4. Be able to list five clinical applications where it is beneficial or essential to use pins for retention.

5. As a result of taking the slide/guide part of this lesson, be able to describe the procedure for selecting and placing self-threading retention pins in a posterior tooth to be used for an amalgam buildup.

TEXT

Increasingly the dentist is called upon to perform extensive and somewhat more heroic restorative procedures. This is largely due to a greater recent application of pin-retention techniques. Pins now may play a major role in the retention of restorations in selected cases. The two basic purposes for using pins are to increase the retention of gold castings and to anchor restorative materials such as amalgam to the tooth structure. In the last ten years the use of multiple retention pins has become commonplace in restorative dentistry.

The utilization of pins for obtaining mechanical anchorage within tooth structure has been used since the turn of the century. Markley and Shooshan are usually recognized for introducing the usage of pins in the present era; Markley introduced the fluted twist drill for preparing a non-tapered pin hole, and Shooshan introduced the nylon bristle technique. These two factors have made the use of pins practical in the two basic clinical applications.

The history of using pins for retention can be traced back to the Nineteenth Century. Evans described a method used by Littig; here pins were used to fasten a restoration on a tooth. Although pins have been utilized in dentistry since the 1800's, Burgess is considered the first modern clinician who approached pin retention from a scientific point of view; he wrote extensively on the subject in the 1920's. Unfortunately, the technical knowledge of the casting procedure was insufficiently advanced, and the unavailability of carbide or diamond cutting instruments, plus the unavailability of the high-speed handpieces for driving them, limited the potential of pin retention techniques of the day. Moreover, the unavailability of accurate impression and die materials, which are essential for the fabrication of such accurate and delicate procedures, added to the delay in developing these techniques.

In 1940, Karlstrom of Sweden, with his paralleling device, achieved a rather high level of performance with pin-retained castings. It was in the late 1950's or early 1960's that the use of pins became popular subsequent to the development of techniques using Shooshan's nylon bristle technique and the introduction of silicone and mercaptan rubber impression materials. Concurrently, diamond stones, carbide burs, and air rotor handpieces came into use. All of these played a role in setting the stage for the widespread practicality and use of the pin techniques.

As previously cited, the use of pins to retain amalgam restorations was widely used by Markley since 1951. In his early technique a 0.025 inch diameter iridioplatinum pin was cemented into a prepared pin hole made by a 1/2 round bur. In 1955 Markley modified his technique. He cemented threaded stainless steel wire into pin holes prepared with a number 1/2 round bur. In 1958 Markley again varied this technique and used threaded stainless steel pins of 0.025 inch diameter and prepared the pin holes with a 0.027 inch in diameter Spiral-Boher twist drill. One problem was encountered in making small pin holes in the placement of the cementing material, so he used "Lentulo-Spirals" to carry the cement into the holes. More recently, in 1966, Markley used a 0.020 inch diameter pin. This small diameter pin was notable for use in small teeth and large gingival third amalgams.

Goldstein described a technique developed by Baker. In this technique a pin of 0.022 inch diameter was driven into a 0.021 inch diameter hole in the dentin which took advantage of the elasticity of the dentin to retain the pin by friction, thus this became known as the friction lock pin.

Following the introduction of the friction lock pin, the self-threading stainless steel pin (T.M.S.)* was introduced by Weissman. In this technique the pins were screwed into the dentin after preparing a pin hole with a twist drill of a smaller diameter. These pins are available in three different sizes: 0.019, 0.023, and 0.031 inch diameter.

Investigations have been conducted to determine which one of the three types of systems for placing the pin provided the best retention. Dilts in 1968 and Moffa in 1969, who conducted tests on these three designs of pins, concluded and established that the greatest retentive values were obtained with the self-threading pin.

As the use of pins for retention of filling materials became popular, indications for using pins was broadened and are now used for retention in gold foil restorations, acrylic resins, composite restorative materials, repairs, and recently for splinting teeth and impacting

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* Thread Mate Systems, Whaledent Company

castings. The pin cast is now widely used as an aid for retention in many gold cast restorations.

Any aspect of Restorative Dentistry, however, is based on the mechanical as well as the biologic entities. Whether for castings or amalgam retention, pins disclose many new concepts in cavity preparations, impression taking, cementation, etc. The primary purpose of this self-learning program is to bring some new light, or at least to inform clinicians as to their use in cast gold and amalgam restorative procedures.

In summary, although pins have been used since the 1800's for retention of dental restorations, their widespread use had been limited because supporting techniques such as impression, die materials, better handpieces and drills have only been perfected in the last two decades.

The pin technique allows for greater retention of restorative materials which otherwise might require considerable reduction of sound tooth substance; this is particularly paramount when insufficient coronal tooth structure is present. Also, the placing of pins in divergent directions gives excellent retention. Pin-retained castings reduce the need for deep cavity preparation in some cases.

Pins are useful in stabilizing hypermobile teeth, in that they allow for tooth anchorage otherwise difficult to achieve unless crowns are fabricated and splinted. In cases of placing a post in an endodontically treated tooth, pins may be used to support the post. Malpositioned teeth which in no way would draw in conventional bridge fabrication methods, can be used for abutments by using a variety of pin retention techniques.

Factors which influence any technique are number of pins, length, diameter, surface characteristics, direction, dimensional tolerance, and cementing material; typically, two to four pins are placed in 2-3 mm deep channels.

SLIDE/GUIDE STUDY

S-1 Title - The Use of Pins for Added Retention in Restorative Dentistry.

S-2 On final analysis, the purpose of using pins is to anchor restorative material directly to tooth substance. In a typical class II amalgam restoration one depends on tooth structure per se to retain the restorative material. However, loss of a cusp or entire surface of a tooth reduces the role the tooth plays in retaining the restorative material. As seen in this slide, the mesiobuccal cusp has been lost; an extensive amalgam would mean certain failure; however, the placement of two pins in a divergent direction will greatly assist in retaining the alloy.

S-3 This slide shows a freshly placed amalgam. The life of this tooth is now advantaged, since the larger portion of the amalgam has greater retention than meets the eye, due to the two pins. This makes an ideal core for purposes of fabricating a casing.

S-4 The next eight slides demonstrate the technique of placing pins in a bicuspid which has an extensive reduction in natural tooth substance. The steps used in placing an amalgam core and preparing the tooth for a full crown are used. This slide shows the tooth at the onset of the procedure.

S-5 This slide shows the location of the proposed pin holes. Before one begins drilling pin holes, take a sharp lead pencil and "spot" the exact locations where you want the channels drilled. By using a 1/2 or 1/4 round bur, indent the tooth substance to prevent the "slippage" of the spiral drill.

S-6 This shows a 0.027 spiral drill, which will be inserted into the indentations made by the small round bur in the previous slide. Since the pins will be used to anchor amalgam, the pin holes will be divergent.

S-7 A self-threaded TMS pin is now hand-twisted into the pin hole with the wrench supplied for the purpose.

S-8 One now sees the divergent pins placed in the tooth structure before placement of core material. It is usually necessary to reduce the length of the pin to the desired length after insertion.

S-9 The matrix band is placed. The instrument adjacent band is where one normally places the wedge.

S-10 & 11 These two slides show tooth prepared for crown after core has been placed.

S-12 You have now seen a demonstration of the use of pins for one purpose. In this and the next two slides you will see the three basic different types of pins used in similar procedures.

Type one cements into the pinhols and is shown here with a spiral drill. Note the spiral scoring of the pins for locking into cement.

S-13 In this slide you see friction-lock pins by Unitek. These pins are forced into a pin hole which is drilled out .001 smaller than the pin; retention here is not dependent on cement but on friction produced by the elasticity of the dentin.

S-14 The third type of pin shown here is the self-threaded TMS pin. These pins come in three sizes (.017, .021, and .028) and are thus more applicable to variation in the size of the tooth. The flat end fits into the wrench; these pinholes are also drilled smaller, and the threading gets its friction grip due to elasticity of the dentin.

S-15 The TMS pins may be placed three different ways -- by hand turning the wrench, by an adaption for a manual-driven con-trangle handpiece, or by a specially designed driving clutch, as seen here.

S-16 We now will demonstrate the use of pins in placing a composite restoration. Note the fractured mesial angle on the central in this slide. It is essential to place the rubber dam when-ever possible, since one may, through a pinhole, introduce saliva deep within the tooth; indeed, pins have been placed that encroach upon the pulp.

S-17 Here the fracture lines have been squared slightly and the walls made smooth. It is easier to place pins at right angles (a flat plane), hence one often has to square up fractures such as seen here. Also, the labial-lingual thickness enters into the picture for the bulk of material, as well as room for the pins.

S-18 It was determined to place only one pin in this case. This is another form of a self-threading pin, known as the Miniken pin, being placed here. The Miniken pin has a flange or bulb near the head, which helps in retaining restorative material.

S-19 The Miniken pin is now cut off and the bulb is plainly seen. Miniken pins come only in one size. This pin twist off above the bulk when the right amount of resistance to torque is met.

S-20 This is the final slide showing the finished composite restoration from a lingual view.

S-21 This slide shows the use of a 2 Miniken pins in a class IV cavity preparation setting.

S-22 Same tooth as in previous slide to show relationship of pin diameter to tooth thickness.

S-23 Same tooth as seen in previous two slides to demonstrate relationship of pin to incisal and distal surface of tooth and/ or final restoration.

S-24 Another good place to use pins is in a class V cavity preparation. One frequently is unable or unwilling to deepen a cavity preparation in a class V area, so retention pins assist in the restoration. Here one sees 4 Miniken pins in place.

S-25 In the next six slides you will observe the use of regular TMS pins in placement of a class V foil; this procedure may indicate in large extensive foils. In this slide you see an extensive cavity preparation with 2 pinholes. Basic cavity preparation principles are never sacrificed when one opts to use pins.

S-26 This slide shows the placement of 2 TMS pins. It is obvious here that one could not condense foil around the bulb if Miniken pins had been used here.

S-27 Another case to show placement of pins. Note that the operator elected to place the pins in a more coronal position.

S-28 & 29 These two slides show the condensing of the foil (Loma Linda cohesive gold foil used here) around the pins.

S-30 Finished product of the previous two slides.

S-31 & 32 Another good restorative application for pin retention is in reconstructing crowns in teeth with greatly reduced crowns, much like in the introductory slides S-4 to S-11, but more extensive. Many such teeth will have been endodontically treated. Models in these two slides show a final crown cemented on an amalgam core containing a post which was anchored by 4 TMS pins.

S-33 This slide shows a diagram of how pins could be used to anchor a crown without the use of a post, as would be the case in a non-endodontically treated tooth.

S-34 Pins may be used over and beyond the typical cases seen so far. In this case a facing of a bridge is lost and pins are placed into the cast pontic. You can readily see its use in replacing a facing. Materials such as acrylics and synthetics can now be placed and substituted for the original facing.

S-35 This next series of 7 slides will demonstrate the use of pins in a variety of splinting techniques. The range of splinting by pins is useful in treating teeth periodontally involved to cases where teeth diverge and too much tooth structure would have to be sacrificed for preparing teeth for conventional crowns. This slide shows 6 steps in fabricating a mandibular anterior 3-tooth bridge. "A" shows the initial problem of a divergent tooth. "B" shows nylon or plastic bristles in pin-holes; these bristles will not be cast but preserve a hole in the casting for threading in the TMS pin. "C" shows the casting and the TMS pins in casting. "D" shows another view of "C". In "E" you see the bridge cemented into place, and "F" shows the finished product. Here the bristle simply was used to line up the hole in the casting with the hole in the tooth.

S-36 Here a lower bridge is placed using the same technique as in the previous case.

S-37 This is a diagram of the use of pins in stabilizing mobile teeth. The pins are illustrated extra long here to show relationship to dotted line.

S-38 These steps show a similar technique, but now the pins will be placed horizontally (through casting into body of tooth) and non-parallel.

S-39 & 40 Here you see a horizontal, non-parallel pin being placed. The pin enters from labial through the crown and casting. The labial entrance is then sealed with a composite. This is particularly useful in cases of stabilizing mobile teeth.

S-41 Another use of pins in restorative dentistry is in the pinlay technique of making castings. Here pins are part of the casting and the pins are cemented into pinholes prepared in the tooth.

S-42 The remainder of this lesson demonstrates the technique and shows some applications. Here the pinlay stands on its own and we do not make any use of previous techniques for locking in the casting. As you can see, there are advantages and disadvantages and when you decide to use this technique and/or such procedures, it must be done from the advantage points.

S-43 Here you see a 3-tooth bridge with pinlay abutments. In cases where teeth diverge and one would be required to reduce a crown extensively to get draw by using conventional techniques, the use of pinlays enables a conservative approach.

S-44 In order for pins to be effective, they must extend 3 mm deep into the dentin when possible. Here you see 3 twist drills lined up parallel; the center one will only be 1-1/2 mm deep due to proximity of pulp chamber. Note that drills are parallel to labial surface and also note lingual reduction; enamel should all be removed.

S-45 This slide shows that .002" clearance is allowed between drill and final pinlay before cementation.

S-46 In this technique, nylon bristles are used and inserted into pinholes before impression is made. Here one sees a container made available with a variety of bristles, plastic pins and twist drills.

S-47 If more than 2 pinholes are made in 1 tooth, or pinholes are placed in several teeth and draw is needed, a paralleling instrument must be used. The drill fits into the sleeve on a sliding plate in a jig and this can be moved in all directions so multiple pinholes, even on multiple teeth, are all parallel.

S-48 Here the drill is in a contrangle and sleeve on the sliding plate of the paralleling instrument.

S-49 This demonstrates how the paralleling instrument is anchored by compound to an acrylic base which is stabilized (much as an occlusal splint) to structures such as teeth, palatal template, or occlusal surface. All pinholes drilled in this setting will be parallel.

S-50 This slide shows the ideal range of angulation of the drills.

S-51 One must measure depth of pinholes. This instrument is designed to do so, and this may be done without disturbing the paralleling instrument.

S-52 After holes are drilled, a broach should be forced into the pinhole to detect any pulpal exposures; if the pinhole exposes the pulp, you must cap the exposure, fill the hole, and relocate the pinhole.

S-53 Here one sees "skidding" effect when one does not approach site of pinhole at somewhat of a perpendicular approach to tooth surface.

S-54 This shows that pinhole drilling requires careful selection of drill. At the left you can see shank of drill riding on incisal edge of tooth.

S-55 In the next three slides you will see demonstrations of three basically different preparations. This first slide primarily applies to the single tooth preparation; note coronal region is reduced to a near flat plane and six parallel holes are drilled.

S-56 In this slide you see a combination of pins of the mesial and a more conventional design on the distal. This will reduce the display of mesial gold. A preparation such as this may be used for a bridge abutment.

S-57 In this slide you see a proximal slice, as can be used when desirable for caries reduction.

S-58 Here you see the impression with bristle pulled out of impression material on three teeth. Although all teeth will be covered with pinlays, one only works on alternate teeth during a procedure for ease of making dies and castings.

S-59 This is a divestment die. The bristles were placed into impression and came out on this model.

S-60 The bristles are now removed. Note pinholes in three dies. These will be waxed over and gold will flow into pinholes during casting, since divestment is used here.

S-61 Here you see the alternate teeth cut off and separating media placed on die to insure smoothness of casting to the tooth surface.

S-62 This slide shows two wax-ups; one has been cut off and sprued.

S-63 This slide shows an actual case, but dies are of stone. Now plastic pins or bristles must be placed in pinholes before wax-up.

S-64 This slide shows wax-up of previous case.

S-65 This slide shows castings cemented into place.

S-66 In order to get cement into the fine pinhole, a lentulospiral is used to draw cement into pinhole.

S-67 The remainder of the slides show the application of the pin-lay technique in the fabrication of an anterior bridge. It was determined that the central was not acceptable as an abutment tooth so a palatal-loop bridge was made, and you will observe a 4-tooth bridge being fabricated using canine teeth for abutments.

S-68 Note that both cuspids have 3/4 crown preparations with 2 pinholes each.

S-69 This shows a hand drill for placing holes in porcelain facing. The facing is anchored to the shellac and contained and then pinholes are drilled in facing.

S-70 This slide shows lingual view of wax-up on divestment.

S-71 This slide shows labial view of wax-up with porcelain facings in place.

S-72 Facings are now removed showing plastic pins on the two pontics which will hold facing.

S-73 Divestment is now flowed over pins after case is sprued.

S-74 This slide shows rough casting with 2 pins in each cuspid 3/4 crown.

S-75 Finished casting with facings in place before seating.

S-76 Another view to show appliance.

S-77 Palatal view of cemented appliance.

S-78 Front view of completed case.

S-79 The End.

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