Use of spring-loaded attachments for retention of removable partial dentures

Susan M. Wright, M.D.S., F.D.S., R.C.S.(Eng)*
Royal Dental Hospital, School of Dental Surgery, London, England

Precision attachments provide an esthetic alternative to clasps for anterior retainers. However, they require the placement of restorations on the natural teeth that may not be indicated on clinical grounds and they are expensive.

Another esthetic method of attaining direct retention is by means of a spring-loaded plunger that engages an undercut on the proximal surface of the abutment tooth adjacent to the edentulous ridge. When the prosthesis is inserted, the plunger is depressed against the spring, which allows it to pass over the maximum circumference of the tooth. The plunger then springs back, and its tip engages the undercut when the prosthesis is fully seated. The retentive force against subsequent dislodgement of the prosthesis is provided by the resistance of the spring, which controls the displacement of the plunger. Such attachments have been available for many years, but little has been written about the indications and contraindications for their placement or the problems that may arise from their use.

This article discusses the difficulties that may be encountered when this type of attachment is used.

SPRING-LOADED ATTACHMENTS

Spring-loaded plungers have been recommended for the retention of telescopic crowns, bar dentures, and removable partial dentures. Attachments for use in telescopic crowns are usually in precious metal and are essentially small, for example, the Mini Pressomatic (Ultratek Attachment and Technology, Inc., Concord, Calif.). Those for use with fixed bars are usually housed within a metal sleeve in the denture, for example, the Pressomatic (Ultratek Attachment and Technology, Inc.) and the Ipsoclip (Cendres et Metaux S.A., Biel-Bienne, Switzerland). These attachments contain a plunger to which pressure is applied usually by means of a coiled spring, although the Pressomatic units use a plastic resin cartridge to activate the plunger. In the C and L attachment (counterpoise interlock and L-spring; Prosthetic Development Corp., New York, N.Y.), a leaf spring is used to provide pressure through the plunger. This attachment is...
Fig. 3. Diagram of Tach-E-Z attachment with smooth outer housing (H) except for circumferential groove (G). Inner surface of housing is threaded to engage threaded inner housing, which has a fixed collar (C) that limits projection of plunger (P), which is loaded by coiled spring (S).

Fig. 4. Two angle-headed screwdrivers. Left, Plane-edged blade for use with blank plug. Right, Central notch to clear plunger on Z A anchor.

designed for use in removable partial dentures in conjunction with a cast crown on the abutment tooth.

Cylindrical spring-loaded attachments such as the Tach-E-Z (Whaledent International, New York, N.Y.) and the Z A anchor (Metrodent Ltd., Huddersfield, England) (Fig. 1) are available for the retention of removable partial dentures.

The Z A anchor and Tach-E-Z attachments

These attachments are constructed of materials that are compatible with the oral fluids. The Tach-E-Z attachment is available with either a precious metal or a stainless steel housing, and the Z A anchor is in stainless steel.

Although the two attachments work on the same principle, their individual construction differs slightly. Both have an outer housing that encases a spring, a plunger, and a collar that limits the projection of the tip of the plunger beyond the housing. In the Z A anchor the housing is threaded on its outer surface to retain the attachment and to allow it to be screwed into the acrylic resin of the denture base (Fig. 2). It also enables the dentist to adjust the horizontal position of the whole attachment and hence the tip of the plunger. In the Tach-E-Z attachment the external surface of the outer housing is smooth except for a single circumferential groove at its distal end (Fig. 3). The position of the housing is fixed in relation to the removable partial denture. The proximal part of the internal surface of the outer housing of the Tach-E-Z attachment is threaded. Inside is an inner housing that contains the attachment. This is partly threaded to allow alteration of its position in the fixed outer housing, and hence the horizontal position of the tip of the plunger may be adjusted.

The method of fixation of the attachments to the denture base is different. For the Tach-E-Z a vertical post is waxed-up on the denture framework 7 mm from the abutment tooth; the attachment is disassembled, and the empty housing is soldered to this part of the casting. Before the acrylic resin base is processed, a screw plug is inserted to prevent foreign material from entering the housing during processing.

The Z A anchor is not soldered to the framework but is eventually fixed into the acrylic resin of the denture base. After the denture is processed, a hole approximately 3 mm in diameter is drilled in the acrylic resin. Autopolymerizing acrylic resin is used to fix the lightly lubricated blank plug in the future position of the anchor. When the acrylic resin has polymerized, the plug is unscrewed, which leaves a threaded hole. The anchor is then screwed the required distance into the hole with the special screwdriver provided for the
**SPRING-LOADED ATTACHMENTS FOR RPD RETENTION**

![Diagram showing correct position of attachment in relation to undercut zone of abutment tooth.](image)

**Fig. 6.** Diagram showing correct position of attachment in relation to undercut zone of abutment tooth. Plunger ($P$) should be in passive contact with tooth surface.

![Diagram showing lack of contact between plunger of the attachment ($A$) and tooth ($T$) surface.](image)

**Fig. 7.** Lack of contact between plunger of the attachment ($A$) and tooth ($T$) surface allows removable partial denture (RPD) to displace vertically.

![Diagram showing outward adjustment of plunger attachment ($A$) is limited by projection of housing or inner housing which prevents removable partial denture (RPD) from being seated.](image)

**Fig. 9.** Outward adjustment of plunger attachment ($A$) is limited by projection of housing or inner housing which prevents removable partial denture (RPD) from being seated. $T =$ Tooth.

**Location of the attachments**

Proper placement of the Z A anchor and Tach-E-Z attachments is important if they are to function correctly. To ensure that adequate space is available, either the attachment, or, in the Z A anchor, the blank plug should be positioned when the metal framework is waxed. There should be at least 1.5 mm of acrylic resin covering the attachment occlusally to prevent subsequent breakdown of the acrylic resin during use. Short clinical crowns (less than 6 mm) may preclude use of the attachments.

Correct placement of the attachments in relation to the undercut zone is essential for retention to be effective (Fig. 6). The attachments should lie parallel to the residual ridge or at a slight angle (5 degrees) to it with the distal end closer to the ridge than the mesial end. When the denture is in position, the plunger of the attachment must contact the tooth passively. If a space is left, the denture will be loose and will move vertically until the spring-loaded plunger contacts the tooth, and the attachment can act to resist further displacement (Fig. 7).

In both attachments the position of the tip of the plunger in relation to the adjacent tooth may be...
Fig. 10. Abrasion of cementum that resulted from metal plunger of spring-loaded attachment.

Fig. 11. Wear of nylon plunger that necessitated replacement of Z A anchor.

Fig. 12. New anchor in position.

Fig. 13. Distal-extension base is pushed distally (arrows) by spring-loaded attachment where there is an inadequate bracing component.

adjusted. In the Z A anchor this is achieved by screwing the entire attachment either into or out of the threaded hole in the acrylic resin base with the special screwdriver. In the Tach-E-Z attachment horizontal adjustment of the plunger position is made with the special wrench (Fig. 8) to alter the position of the inner housing, and hence of the plunger itself. In both attachments outward adjustment is limited, since, if the rigid housing of the Z A anchor or the inner housing of the Tach-E-Z attachment project beyond the surface of the denture, they will contact the tooth above the height of contour and prevent the prosthesis from being inserted past this point (Fig. 9).

Limitations of the attachments

Both attachments have a metal plunger that is suitable for use against porcelain, gold, and other restorative materials. However, if it is positioned against cementum or dentin, abrasion may result (Fig. 10). The Z A anchor is also available with a soft nylon plunger, which will wear down instead of abrading the tooth surface (Fig. 11). This means that the position of the anchor must be adjusted periodically to maintain contact with the tooth. Ultimately, the whole Z A anchor must be replaced entirely (Fig. 12). This may be performed readily in the dental office.

The attachments may be used when distal-extension ridges are present. Careful denture design is necessary to ensure that there is adequate bracing to resist distal movement of the removable partial denture. This is usually provided in the form of a rigid lingual bracing arm combined with a deep rest on the mesial surface of the abutment tooth. In addition, an interdental spur may also be indicated. If such resistance to
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Fig. 14. Upper first premolars have moved buccally (arrows) after use of a spring-loaded attachment with inadequate bracing components in a young adult.

distal movement is not provided, the spring-loaded plunger of the attachment is ineffective for retention, because it merely pushes the denture distally as it moves vertically out of position (Fig. 13).

Similar to any clasping system, the position of the attachment must be maintained by means of a rest and a rigid bracing component to prevent tooth movement. The rest, the rigid lingual stabilizing arm or plate, and the plunger of the attachment should encompass more than 180 degrees of the tooth circumference. This is especially important in young patients, to prevent tooth movement that will occur rapidly (Fig. 14).

Proper shaping of the occlusal surface of the abutment tooth is necessary to facilitate depression of the plunger of the attachment and ease of insertion of the prosthesis. A flat occlusal surface will not allow the plunger to depress (Fig. 15). In teeth with attrition, recontouring of the junction between the occlusal and proximal surfaces to provide a short bevel is recommended to aid depression of the plunger (Fig. 16). Similarly, the design of a cast abutment crown should make provision for depression of the plunger during placement of the removable partial denture.

SUMMARY

Where conventional clasping will result in poor esthetics, a simple alternative means of retention is available in the form of an attachment with a spring-loaded plunger. Careful placement of the attachment is important to provide effective retention and to prevent tooth movement.

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Reprint requests to:
Miss Susan M. Wright
Kings College Hospital
Dental School
Denmark Hill
London SE5 8RX
England

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