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REVIEW ARTICLE

Repair of Extracoronal Direct Retainers

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ABSTRACT

Fractures of the clasp components of removable partial dentures are commonly encountered problems in the dental office. Repair or replacement procedures are therefore, often required and may be preferred over refabrication of the entire prosthesis when it is possible to maintain the denture to serve its purpose of function, esthetics and comfort after repair. This paper reviews various procedures that can be used to repair or replace clasp components in order to produce a clinically acceptable result.

Keywords: Removable partial denture, Direct retainers, Clasp repair.

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INTRODUCTION

The dentist's role does not end with the delivery of a meticulously planned and fabricated removable partial denture. Occasional breakage is inevitable due to various mishaps that may befall the prosthesis, thereby causing loss of retention, instability and discomfort to the patient.

Maintenance of the partial denture is therefore required and involves repair, replacement or modification of the components of the framework.

Among the common types of metal framework repairs associated with cast partial dentures is the repair of clasp components. Though repair procedures can be time consuming and expensive, these are sometimes the most feasible solution to a broken prosthesis. The fit, function and esthetics of the partial denture should be sufficient to warrant a restoration of the clasp assembly rather than fabricating a new prosthesis.[1]

The cause of breakage of a clasp has to be evaluated prior to commencing the repair procedure. If the reason is poor design or construction and inadequate mouth preparation, appropriate corrections have to be made to prevent repeated fracture. If the thickness of metal at the fracture site is less than 1.2 mm, mouth preparation should be accomplished; either by modifying tooth contours or by reducing severe undercuts by accurate survey of the cast.[2]

Repairs of a broken clasp can be grouped as:

- Repair with wrought wire clasp
- Replacement with cast clasp
- Repair with a cast clasp while patient retains the denture
- Repair of broken occlusal rest (which is a part of the clasp assembly)
- Laser welding.

REPAIR WITH WROUGHT WIRE CLASP

This method is commonly used for broken retentive arms of circumferential type of clasps. It is quick and relatively simple but may not yield the best result.

Procedure

A prerequisite for repair is an accurate impression of the prosthesis in its proper position in the mouth, without altering the relationship of the framework to the abutment tooth.

A soft impression material, such as alginate can be used for a pick-up impression after maintaining the partial denture in its ideal relation to the supporting structures. U-shaped paper clips can be attached to the denture base with sticky wax to help lock the denture in the impression.[3] A complete-arch cast is poured with dental stone following the block out of soft tissue undercuts in the denture base with modeling clay and application of a thin coat of petroleum jelly to the exposed metallic portions.[4] A cast of the opposing arch may be required to evaluate occlusal contact during the repair. The cast and the denture are carefully separated and the repair area is evaluated. The contours of the stone abutment tooth are surveyed and a pencil line is used to indicate the exact position of the clasp to ensure correct contour and retention.[3]

A groove is made in the rest—minor connector area adjacent to the repair area.[3] The groove may originate at the remnant of the broken clasp on the buccal aspect of the minor connector (if not contraindicated by occlusal interference) and should pass under the mesioproximal edge of the replacement tooth nearest to the abutment (Fig. 1). The remaining broken wire may be removed with a carborundum disk.[5]

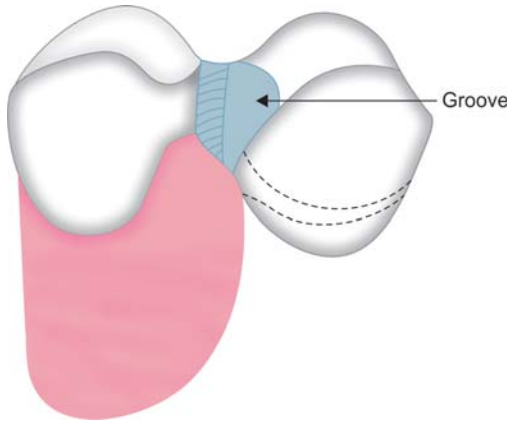

Fig. 1: Groove cut in the rest—minor connector area

Miller[6] suggests making of an opening in the resin of the lingual flange which passes through the base just below the occlusal surface of the denture tooth immediately adjacent to the minor connector (Fig. 2). Wrought wire (18 gauge) is contoured and adapted to the precise line of clasp contact. In case an opening is made to house the wire as mentioned previously, the wire is contoured to enter the opening on the lingual side of the denture and emerge on the buccal aspect.[6]

The wire is secured to the denture base by either of the two methods:[7,8]

- Using autopolymerizing acrylic resin
- Electric soldering.

A box-like preparation can be made in the resin of the lingual flange to house an anchorage for the new clasp arm and the wire can then be anchored within the resin[6] (Fig. 3). The wire can be held in place with sticky wax while the resin is applied.[5] Curing of the resin should take place in a heated pressure pot or in a closed container for best results.[7]

The new clasp arm can also be secured to the denture by soldering it to the junction of the rest and minor connector.[3,7] If the clasp is to be soldered to the frame, a precious metal high fusing wire (about 18 gauge) should be used. The clasp is extended 3 to 4 mm lingual to the minor connector. Soldering should be done electrically to prevent overheating of the wire. A low fusing triple thick gold solder should be used.[8] The soldering tip should remain in position for 1 to 2 seconds.[3] The soldered joint should then be finished and polished.

Fig. 2: Opening made in the resin of the lingual flange which passes through the base just below the occlusal surface of the denture tooth immediately adjacent to the minor connector

Fig. 3: Box-like preparation made in the resin of the lingual flange to anchor the clasp with autopolymerizing resin

Infrabulge clasps can also be repaired using wrought wire and are always retained in resin. A trough can be cut in the buccolabial flange to accept the base of the wire. To provide retention against rotation within the resin, a bend can be incorporated at the distal end.[9]

REPAIR WITH CAST CLASP

In this technique, a pattern for the replacement clasp is fabricated either in wax or autopolymerizing acrylic resin directly on the stone cast and then reproduced either in chrome-cobalt alloy. It is a more definitive method of repairing broken clasps and is useful in cases where rigidity is needed due to fracture of an occlusal rest or other type of supporting area.[4] Embrasure clasps and clasps associated with single tooth replacements can be replaced more conveniently in this manner than by forming them in wrought wire.[4,9]

Brudvik[2] recommends replacing a broken circumferential clasp with an infrabulge clasp since the replacement clasp will be contained entirely in the resin of the denture base and not involve occlusal surfaces (Fig. 4). If the adjacent acrylic flange is not of suitable proportion to allow I-bar placement, the repair requires a circumferential clasp. Reciprocal clasp arms, if broken, require refabrication of the entire clasp.[6]

Procedure

The partial denture is positioned so that the exact frame-to-tooth relationship is reproduced on the repair cast. A pick-up impression is made with irreversible hydrocolloid. Undercuts in the denture base are blocked out with modeling clay and exposed metallic portions are lubricated with petroleum jelly.[4] A complete-arch cast is poured to allow reseating of the denture and survey of the cast for modifications. A cast of the opposing arch is helpful for evaluation of occlusion. The partial denture and cast are separated and the clasp design is determined. The denture is reseated on the repair cast and evaluated.

A lingual keyway is cut in the major connector where the clasp is fractured[4] (Figs 5 and 6). Miller[6] suggests the use of a buccal matrix made on the denture base area on the side to be repaired to aid in repositioning of the teeth after

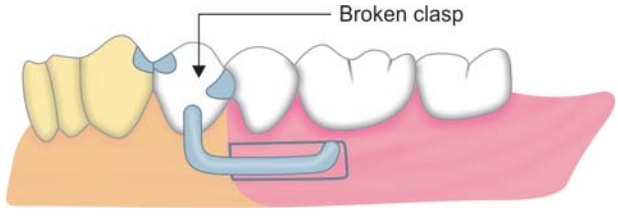

Fig. 4: Replacement of a broken circumferential clasp with I-bar. Trough is created in the buccolabial flange for the base of the wire

Fig. 5: Broken embrasure clasp

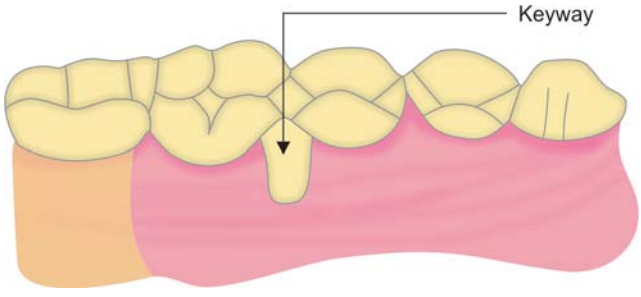

Fig. 6: Keyway cut in the major connector lingually

casting of the clasp and soldering in case the teeth and base need to be removed prior to the repair. Clasp addition can be waxed and sprued on the repair cast in certain situations. A small amount of investment suitable for the alloy to be used is painted on the wax to strengthen the repair segment before removing it from the cast.[7] The repair cast could otherwise be duplicated to form a refractory cast on which the wax repair components are added. The completed wax-up can be sprued in a nonfunctioning area and added to a routine framework casting as a 'rider'.[9]

Smith[4] has suggested a technique using cold cure resin to form a clasp pattern. Here, a tin foil substitute is applied on the cast surface. Using the brush technique, the desired clasp pattern is painted on with cold curing acrylic resin. (Fig. 7). When the resin has hardened, the acrylic clasp is removed and refined. The fit is verified by replacing on the cast. The pattern is then removed from the cast, sprued and cast with an appropriate metal alloy. The cast clasp is then returned to position (Figs 8 and 9) and attached to the major connector with an electric soldering apparatus and polished. The solder joint between the clasp and framework must be placed such that the joint is not involved in clasp flexure.

Livaditis has also reported an etched metal to etched metal connection with composite resin. Adhesive resins like 4-META have been described for use in metal-metal connections. This technique requires a broader interface between components and is more technique sensitive.[1]

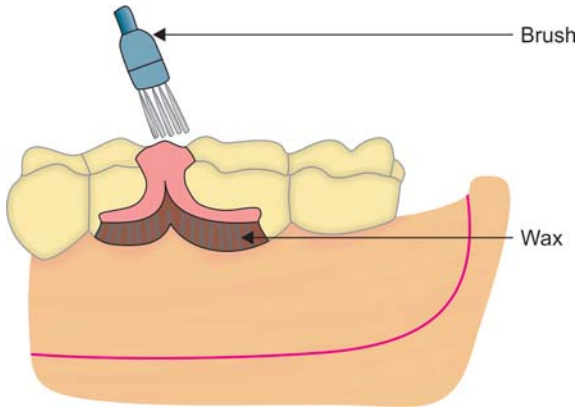

Fig. 7: Acrylic clasp pattern painted on the cast using brush technique. Undercuts blocked out with wax (denoted in red)

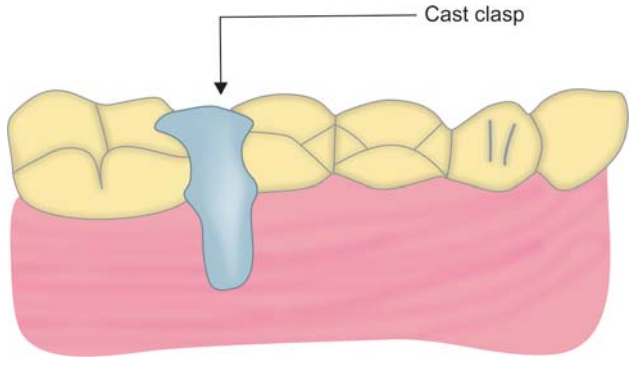

Fig. 8: Cast clasp fits in the keyway

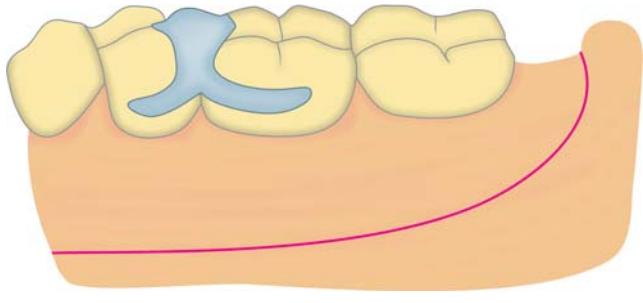

Fig. 9: Buccal view of the casting positioned on the cast

REPAIR WITH SURVEYED CAST CLASP WHILE PATIENT RETAINS DENTURE

Another approach for repair of a gingivally approaching clasp with broken adjacent denture flange described by Livaditis[1] is to cut a groove into the denture base 2 to 3 mm deep, 4 to 5 mm wide and 10 to 15 mm in length below the necks of the denture teeth on the buccal surface. At least 2 raised resin index islands are maintained for retention and precise transfer from the working cast to the prosthesis and abutment. After taking an impression, the grooved area is filled with wax and returned to the patient. The cast is poured; undercuts are blocked out and replicated in refractory investment material. The clasp assembly is then waxed and cast. The framework is refined and relieved from

the walls of the groove but contact is maintained with the raised resin index areas. Temporary stabilizing arms are incorporated on to the clasp. An acrylic resin finish line is given onto the casting where the clasp emerges from the denture base to facilitate finishing of the repair resin. The clasp is polished, its position is verified intraorally and it is attached with autopolymerizing resin.

In order to simplify this sophisticated procedure described by Livaditis,[1] Sato et al[10] described a simple, quick and accurate method to replace a broken bar type cast clasp with a new cast clasp of the same design using a close fitting resin matrix which enables accurate positioning of the new clasp arm and eliminates the need for stabilizing arms recommended by Livaditis. The initial steps of making a groove in the denture, fabrication of the working cast and casting of the clasp are the same. The denture is returned to the patient after filling the groove in the denture with tissue conditioner. The new cast clasp is fixed in position on the working cast with sticky wax. A resin separating medium is applied on the cast, undercuts are blocked out with utility wax and a matrix is made out of autopolymerizing acrylic resin. The matrix covers the abutment, anterior part of the I-bar clasp arm and adjacent anterior teeth. The incisal surfaces of the stone teeth and the occlusal surfaces of the denture teeth are not covered to prevent interference in intercuspation. The set matrix is then removed from the working cast with the clasp arm connected to the matrix. The removable partial denture is seated in the mouth and the resin matrix with the new clasp arm is positioned in place. The space between the retentive segment of the new clasp arm and the resin in the groove of the denture is examined and additional space is created if required. The new clasp arm is then attached to the denture base with autopolymerizing acrylic resin and the matrix is removed once the resin sets.

REPAIR OF A FRACTURED OCCLUSAL REST

A fractured occlusal rest is a result of thin metal over the marginal ridge of the abutment tooth due to inadequate tooth preparation. Therefore, the first step in repair is to provide the required space for the rest by reducing the marginal ridge.[6] The lingual minor connector is then sectioned a few millimeters below the occlusal surface before making the pick-up impression so that the weld is not placed in an area of occlusal load.[2] The replacement rest is waxed on the lubricated repair cast and is sprued with a small round wax sprue lead.[6] To prevent distortion, a small amount of refractory material is painted around the wax-up and when it is set, the entire segment is freed from the repair cast. The repair is joined by the sprue lead to a sprue base of a complete removable partial denture wax-up as a 'rider' and cast in a normal fashion. The recovered repair segment is evaluated for fit on the repair cast and soldered.[9]

LASER WELDING

Laser welding is an attractive alternative method to join dental casting alloys and is proving to be superior to soldering due to various advantages offered. Pulsed lasers (commonly Nd:YAG dental lasers) are often used for metal repairs and can be set for variable parameters like pulse power, pulse duration, pulse energy and spot diameter.[11] Advantages of this technique include:

- High reproducible strength for all metals, consistent with that of the substrate alloy.[12]
- Localized heat production.[13]
- Accurate fit of the framework (since all the inaccuracies in the assembly caused by transfers from the master cast along with investment and heat distortions are reduced).[12,13]
- Possibility of welding in close proximity to acrylic resin or ceramic with little damage (cracking or color damage) due to pin point heat produced.[12,13]
- Reduced working time, ease of operation and no need for investment and soldering alloy.[13]
- Potentially all metals can be joined, particularly titanium, which is difficult to solder due to its high melting point and high reactivity. It helps to overcome the disadvantages of highly reactive titanium by providing a shielding gas (argon) during the welding process.[13] A high rate of laser beam absorption and low thermal conductivity makes it easier to weld broken titanium clasps.[14]

Air particle abrasion with alumina particles (50 μ) prior to the procedure increases the absorption coefficient of laser energy.[14] Welding is carried out under an argon shielding atmosphere to decrease oxidation contamination.[12] Laser welding requires a contact overlap the components. The standard procedures consist of tack welding in four widely separated places followed by continued welding all around the circumference using an overlap of approximately 70%.[15] The parent metal is placed at an angle of 45º and the laser beam is positioned such that one-third of it is directed at the parent metal and two-thirds is directed at the work piece to be welded.[13] When small gaps exist between overlapped components, filler materials must be inserted into the joint space to achieve contact of the components (e.g. Co-Cr wire). The resulting welds are not as strong or as dependable as those with component contact.[15] After definitive welding; the clasp is finished and polished conventionally.

Disadvantages of laser welding include technique sensitivity and increased equipment cost.[13] Success of the welding procedure depends on operator's dexterity and choice of welding parameters.[11]

CONCLUSION

This article is a review of various procedures that can be used to repair or replace fractured clasp assemblies. Although it is relatively easy to replace a broken clasp arm with wrought wire, it is considered to be an inferior replacement. Replacement with a cast clasp on the other hand, is a superior and long lasting restoration but requires additional laboratory steps thus, making the repair expensive and time consuming. Procedures in which the denture can be retained by the patient during the repair process enable temporary function of the removable partial denture and precise placement of the new clasp arm in the existing denture. Laser welding, due to its various advantages, is being increasingly used for joining dental alloys and has taken the place of soldering and brazing for most applications.

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