sciendo DOI: 10.2478/aoj-1992-0006

A PROCEDURE FOR ATTACHMENT OF GOLD CHAIN FOR TRACTION OF IMPACTED TEETH

AUTHORS
Sheung K Kaan BDS, MSc, DDO, MDO RCPS and GekKiow Goh BDS, MDSc, Singapore.

There is a need to improve the strength of the attachment of the gold chain to impacted teeth. Dislodgement of the gold chain requires a second surgery for reattachment. Failures have been observed to occur at two interfaces. The authors have devised a method of attaching the gold chain to the mesh pad securely, by ligating them together. This article describes the method and discusses other factors which enhance the retention of the gold chain to the impacted tooth.

Key words
Impaction, canines, incisors, active traction, gold, bonding.

Short Title
Attachment procedure.

Department of Orthodontics,
Government Dental Clinic,
First Hospital Avenue, Singapore 0316.

Introduction

The palatally impacted maxillary canine and the ectopic incisor often require some form of guidance or traction in their eruption into functional occlusion. In the management of impacted teeth, a correct diagnosis of the location[1,3] and angulation is essential for their successful eruption. This, together with their relationship to surrounding teeth and obstacle[1,4] will determine the direction of approach and traction.

Literature Review

Active traction of unerupted teeth has been indicated in the following situations:

1. teeth in a high palatal location
2. teeth developing in an ectopic position
3. teeth impacted by odontomes, mesiodens, cysts and ankylosed decidious teeth, where it is convenient to place a traction device during the surgery for the removal of the obstruction.

In all of the above examples, there is a need for active traction, rather than relying on residual eruptive force, once past the normal age for eruption of the impacted tooth.

Radiographs are required to establish the aetiology[1,3,6] and the accurate location[1,3] of the impacted tooth. Various methods of management of the impacted tooth, namely, surgical exposure of the crown,[6] transplant, excision, removal of obstruction, followed by passive eruption[7] or active traction into position of functional occlusion,[6] have been documented.

The earliest reports on traction employed eyelet wiring inserted into amalgam fillings in the impacted tooth; pins or screws with hooks attached embedded into the tooth[6]; silver caps cemented on to the crown; and stainless steel ligature lassooed around the cervical margin of the tooth. Lassooing is often associated with excessive removal of bone during surgical exposure of the crown and resorption around the area of tension.[9] Traction method included stainless steel ligatures, gold and elastomeric chains.[5]

With the introduction of BisGMA composites, bonding was incorporated into the procedure of attaching the traction devices to the unerupted tooth using mesh pads.[1,5] Failures associated with the gold chain procedure often occur at two interphases.

1. between the mesh pad and the enamel surface, i.e., bonding failure
2. at the joint site between the gold and stainless steel mesh pad.

Bonding failure could be effectively reduced with adequte isolation of the field and complete polymerization of the adhesive.

On the other hand, joint site failure is usually due to attempts to weld or solder two dissimilar metals. During welding, gold, which has a lower melting point than stainless steel, tends to melt around the mesh pad forming a purely mechanical bond. Fusion between these two metals seldom occurs. Weakening of this joint may result from corrosion and excessive manipulation. Attempts at improving joint strength by soldering gold chain to the mesh pad brings about its own problem of poor histocompatibility between tissue and corrosion products of the silver solder used. Union by heating also tends to anneal the surrounding metals, changing its physical properties.[8]

The author has devised a technique to securely strengthen the mechanical

attachment between the gold chain and the mesh pad, without soldering or affecting the mechanical strength of the two materials.

Procedure

1. Attaching the gold chain to the stainless steel mesh pad.

The objective is to create a secure but less stress-prone joint between the gold chain and the mesh pad. A 2 cm length of at least 18K gold or gold-plated chain, 1-1.5 mm thick, is required. The chain is composed of complete individual links, rather than just being pinched together, but the links should be sufficiently wide to permit passage of a 0.25 mm ligature wire. The author uses an open mesh pad manufactured by Dentaurum (799-102C) measuring 3 mm by 2.5 mm.

To avoid the problem of joining two dissimilar metals, the gold chain is ligated to the mesh pad instead of being welded or soldered on to it. Two holes are pricked in the centre of the mesh pad about 1 mm apart with a probe to allow for passage of an 0.25 mm ligature wire (Fig. 1). One end of the gold chain is ligated to the mesh pad and secured by twisting the ligature ends into a short pigtail (Fig. 2). The end is secured to the mesh pad by welding to one corner of the mesh pad (Fig. 3), leaving the central area intact. To facilitate threading of the free end of the gold chain through the surgical site, a 3 cm long ligature pigtail is fashioned (Fig. 4). The attachment device is then sterilized chemically in preparation for the surgery.

2. Effective bonding of mesh base to surgically exposed enamel.

The objective is to ensure a more complete polymerization of the adhesive and reduce the bulk of the bonded mesh pad.

Thorough irrigation with distilled water to clear the etched enamel surface of salt deposits prior to bonding, is recommended. However, this must be done carefully and slowly, with a syringe, as hypotonic solutions can cause tissue damage. Precise positioning of the suction tip would ensure sufficient dryness of the etched surface and prevent exposure of tissues to the distilled water.

Ultra-sure* light cure bonding adhesive is used to bond the mesh pad to the etched enamel surface. The mesh paid is adapted to the curvature of the exposed tooth surface just prior to bonding. The material is added in small precise amounts with all excess removed between light curing intervals, especially around the links of the gold chain.

The bonding is tested with a good tug prior to suturing up of the operation site. The excess links are cut, leaving 4-5 links free for subsequent traction. Traction is not advised until after the removal of stitches.

To date, this procedure has been used on fifteen patients and there have been no detachment failures reported.

Discussion

There are several advantages with this technique:

1. The Dentaurum mesh pad is preferred because its mesh is finely woven leaving the edges well trimmed and smooth. It is sufficiently small for bonding on to the small area of exposure on the impacted tooth and soft enough to allow for on-site adaption to the area of tooth exposed. The open mesh permits light cure

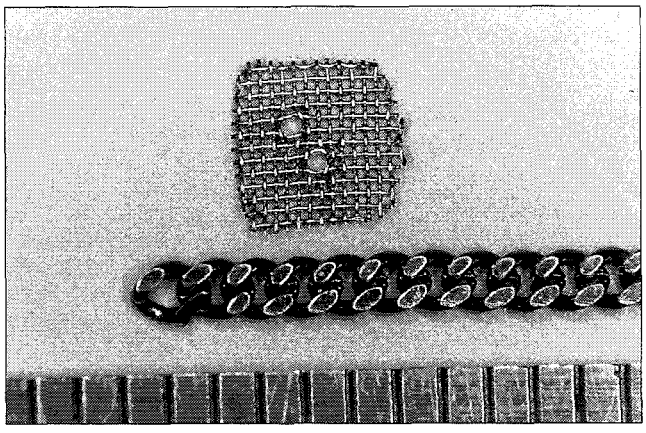

Fig. 1. Dentaurum 799-102C mesh pad prepared with 2 holes 1mm apart. Closed links 1.5mm thick 22K gold chain.

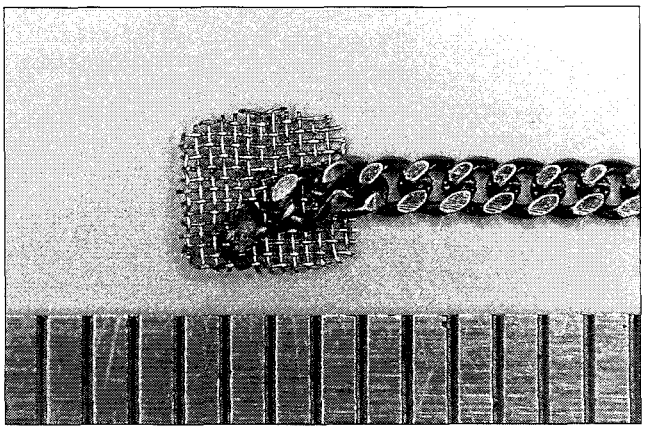

Fig. 3. Tag of ligature welded to a corner of the mesh pad.

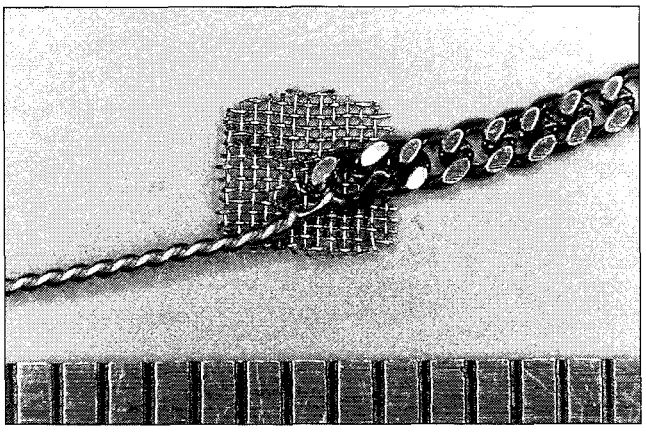

Fig. 2. 0.25mm SS ligature is used to secure gold chain to the mesh pad.

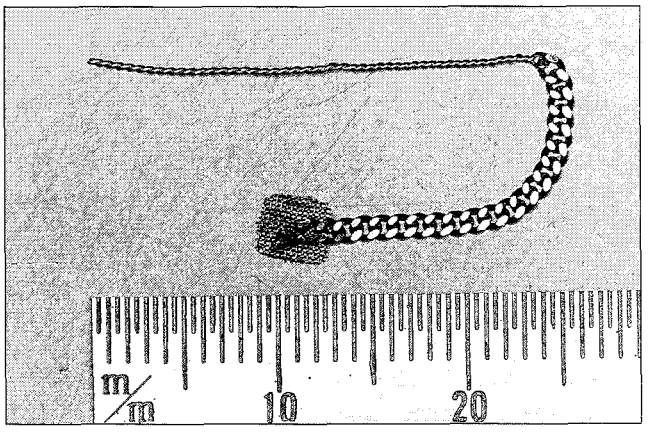

Fig. 4. A 3cm long ligature pigtail attached to the free end of the gold chain as a threader.

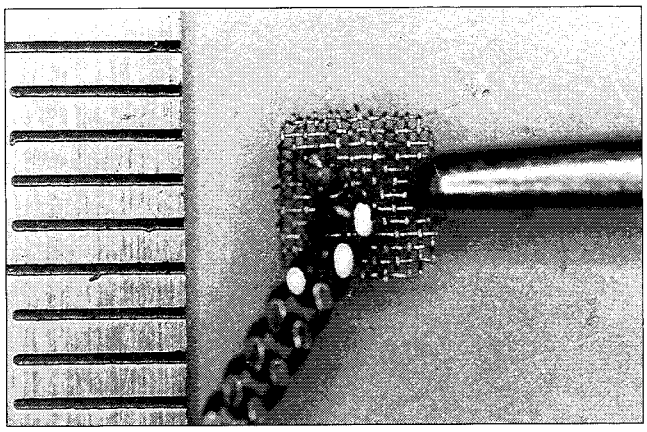

Fig. 5. A 3cm long ligature welded to a corner of the mesh pad.

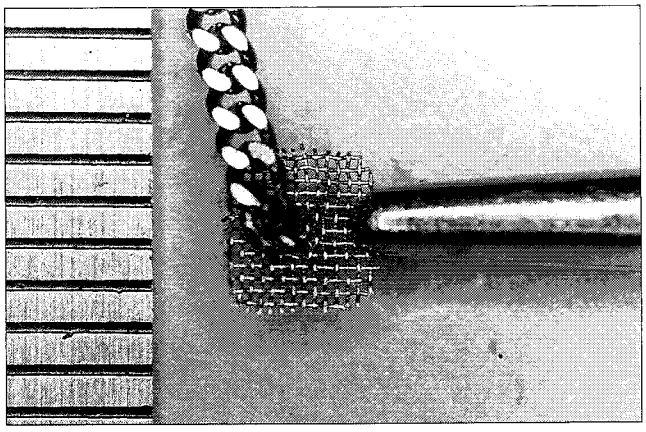

Fig. 6. The ligature joints allow free movement of the gold chain.

adhesive to be used. It also allows for ligation of the gold chain, thereby obviating the need for high temperature welding or soldering as when compared to using rigid backed base. The gold chain is mechanically tied to the mesh pad and welding occurs only between the stainless steel mesh and the ligature tag. The mechanical strength of the mesh pad is not affected as welding is done only at the corner of the mesh pad, away from the ligation site.

2. The stress-breaking structure of the ligature joint and gold chain links, together with more complete polymerization, allows for a smaller mesh pad to be used. Thus, only a small surface area of the buried tooth need to be exposed and tissue disturbance is kept to a minimum. By not securing the gold chain too rigidly to the mesh pad, adaptation for a different direction of traction is permitted, even after bonding (Figs 5, 6). Ligating rather than soldering the gold chain to the mesh eliminates histocytoxicity of silver corrosion products from the solder, which could cause staining of gingival tissue upon eruption.

3. The use of low-filled light-cure resin, *Ultra-sure light-cure bonding adhesive, is recommended for three reasons.

Firstly, the rapid polymerization during light curing reduces the risk of contamination from blood and tissue fluid from the surrounding tissue. Secondly, a more complete polymerisation of the light-cure resin is enhanced,[10] if applied in relatively thin layers and when the illumination time is increased.[2] The material can be applied in precise amounts with minimal excess. Thirdly, the absence of free residual monomer and the smooth contour is more histocompatible with oral tissues. This low-filled light-cure composite leaves a smooth and glossy surface over the mesh pad when it sets with complete polymerization. This has a distinct advantage over the chemical-cured composite which may cause adverse soft tissue reaction as a result of reported leaching of its residual monomer.[4] The lower abrasion resistance of the low-filled resin is not a clinically significant factor in this situation. Although it is difficult to sterilize the light source unit to ensure asepsis, disposable sterile sleeves should eliminate this problem.

Conclusion

This method of ligating gold chain to the mesh pad enhances its attachment to the tooth.

It allows for a small thin pad to be effectively attached to the tooth with a flexible direction of traction. The use of a low-fillled light-cure resin promotes a stronger and more histocompatible bond.

*Ultradent Products Inc.

References

1. Bishara S., Kammer D.D., McNeil M.H., Montagano L.N., Oesterle L.J., Youngquist H.W. (1976): Management of impacted canines, Am. J. Orthod. 69:371-387.
2. Cook W.D. (1980): Factors affecting the depth of cure of UV polymerized composites, J. Dent. Res. 59:800-808.
3. Coupland M.A. (1984): Localization of misplaced maxillary canines. Orthopantomograph and posteroanterior skull views compared, Brit. J. Orthod. 11:27-32.
4. Heys R.J. (1981): Biologic considerations of composite resin, Dental Clinics of N America 25:257-270.
5. Hunt N.P. (1977): Direct traction applied to unerupted teeth using the acid-etch techniaue, Brit. J. Orthod. 4:211-212.
6. Kettle M.A. (1958): Treatment of the unerupted maxillary canine, The Dent. Pract. 8:245-255.
7. Oliver R.G., Hardy P. (1986): Practical and theoretical aspects of a method of orthodontic traction to unerupted teeth illustrated by three cases, Brit. J. Orthod. 13:229-236.
8. Phillips R.W. (1982): Skinner's science of dental materials, WB Saunders Co. 8th edition.
9. Shapira Y., Kuftinec M.M. (1983): Treatment of the impacted cuspids. The hazard lasso, Angle Orthod. 51:203-207.
10. Tirtha P., Fan P.L., Dennison J.B., Power J.M. (1982): In vitro depth of cure of photo-activated composites, J. Dent, Res. 61:1184-1187.

Received for publication, June 1992.