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A new intermaxillary fixation method using adhesive cast splints for avoiding skin puncture

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Abstract
Intermaxillary fixation using arch bars is performed for mandibular and maxillary fractures. They are applied to the respective maxillary and mandibular arches with circumdental stainless steel wires. Skin puncture may pose a risk for the surgeon. Therefore, the authors have developed and tested a method for using intermaxillary fixation using an adhesive cast splint. The resulting strength was found to be generally superior to that achieved with arch bars. Despite some problems, this technique is considered a useful method for avoiding skin puncture.

Key words: Intermaxillary fixation, avoiding skin puncture, HIV infection, adhesive cast splint.

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Introduction

Intermaxillary fixation using arch bars is performed for most mandibular and many maxillary fractures not requiring open reduction or internal fixation. These are applied to the respective maxillary and mandibular arches with circumdental stainless steel wires.

Immobilization is achieved using intermaxillary wires or elastics. However, there is a possibility of inadvertent skin puncture and thus contamination by virus-infected saliva or blood. The number of persons infected with human immunodeficiency virus (HIV) has been increasing in the world and is of great concern to many individuals involved in the treatment of facial fractures.

It is important to lessen the possibility of the sharp ends of wires causing skin puncture during maxillofacial surgery. Therefore, intermaxillary fixation needs to be achieved without using circumdental stainless steel wiring. The authors have applied a method of intermaxillary fixation using an adhesive cast splint which was made on working models and bonded to the tooth enamel with adhesive resin.

Materials and methods

For six months between May and October 1993, 18 patients with facial fractures were hospitalized in Komaki City Hospital.

The new technique of adhesive cast splinting was used for 10 patients who had sufficient molars to maintain vertical dimension; 7 of these patients had mandibular fractures, two had maxillary fractures, and one had multiple fractures. Three patients with condylar fractures did not undergo open reduction so intermaxillary fixation with elastics was carried out. Seven cases underwent open reduction combined with rigid fixation by miniplates.

It was sufficient to use one cast splint extending from the first molar to the first premolar in each quadrant. A dimple was created on the contour (0.5~1.0 mm) in the enamel (Fig. 1). A rubber base impression in a small custom tray was obtained to provide maximal accuracy of the working models which were then cut and repositioned. A wax pattern was fabricated on the duplicated cast, and the pattern was then invested and cast in 12% Au-Ag palladium alloy (Fig. 2). Before insertion the casting was adjusted on the model to avoid premature contact (Fig. 3.) The cast was then disinfected by immersion in 2% glutaraldehyde solution for 30 minutes. When the fracture line occurs between the

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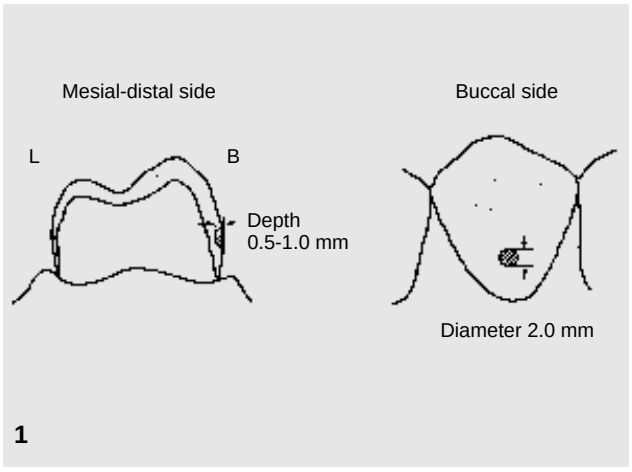

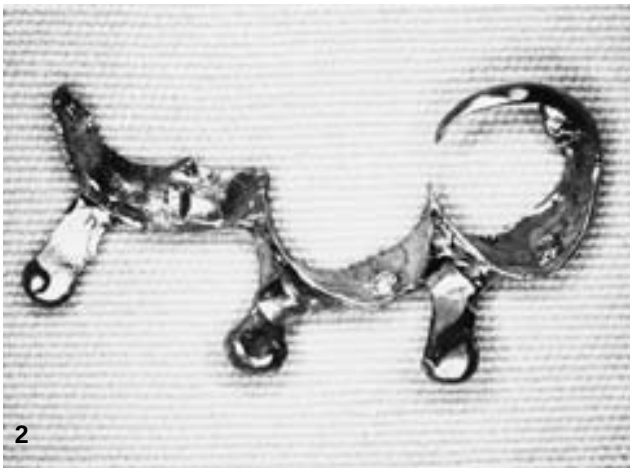

Fig. 1.—Dimple prepared on contour (0.5~1.0 mm) of the enamel.
Fig. 2.—Appliance cast from palladium alloy.
Fig. 3.—Cast splints adjusted on model to prevent contact with each other.
Fig. 4.—Combination method using direct bonded brackets.
Fig. 5.—Immobilization achieved using 0.4 mm stainless steel wires.
Fig. 6.—Oral hygiene during period of intermaxillary fixation.

first and second premolars, the splints should not include the first premolar. If necessary, the bracket can be applied by the direct bonding system[3] (Fig. 4).

The splints were carefully inserted and the fit checked intraorally. The teeth to which the splint were bonded were polished to remove the pellicle and the enamel surfaces were etched, then irrigated and dried. Grit blasting with alumina was carried out to obtain firm adhesion. The splints were attached to the teeth by adhesive resin. The resulting

strength was found to be generally superior to that achieved with arch bars (Fig. 5).

Discussion and conclusion

Dental arch bars are the most frequently employed fixation method in the treatment of mandibular fractures,[4] and they are also used in maxillary fractures. They are simple to use, but the health professional applying the peridental wires is at risk of acquiring blood-borne diseases through perforating injuries from sharp wire ends.[5] In recent years, the number of people infected with HIV has increased. In Europe, Gimeno *et al.*[6] reported that the incidence of HIV + patients was high (19.8 per cent) in the mandibular fracture group. Therefore, skin puncture must pose a danger for the oral and maxillofacial surgeon.

Recently, the period of intermaxillary fixation has been reduced by rigid fixation techniques but, generally, intermaxillary fixation is indispensable. Direct bonding of a bracket with adhesive resin[3] instead of wires for mandibular and maxillary fractures to prevent periodontal tissue injury and to improve oral hygiene was tried by the authors. However, this method required complicated procedures and had some disadvantages such as easy detachment when not properly placed. Therefore, the authors developed and tested a method of intermaxillary fixation using an adhesive cast splint. Ten cases were treated with this technique. The method reduced the use of wires to a minimum and, therefore, also reduced the risk of skin puncture. The cast splints proved to be sufficiently stable without surgery in three patients when elastic intermaxillary fixation was applied during the postoperative period. They also proved to be sufficiently stable during and after surgery in seven patients who underwent open reduction with miniplates and rigid intermaxillary fixation during surgery. To obtain stronger stability of the splints, a dimple was created in the enamel using the interdental undercut, and the splints were bonded to the teeth with adhesive resin containing 4-methacryloxyethyl trimellitate anhydride.

To ensure metal bonding using an adhesive resin, pretreatment of the metals is essential to obtain firm adhesion with the resin.[7] There are various methods of pretreatment including an alloy conversion method, ion coating surface treatment from a Cu target, pretreatment with a metal primer, and tin electroplating.[7-9] The authors used the simple metal surface treatment of grit blasting with alumina.

The use of the cast splints reduced the surgical time significantly (and may even eliminate the need for local anaesthesia because the cast splints can be applied without causing pain due to mouth opening as is necessary when applying ordinary arch bars). Other advantages included the ease with which proper hygiene was maintained, and freedom from gingival impingement. Oral hygiene was markedly improved during the period of intermaxillary fixation since no ligatures were present. Therefore, the gingival health of the patients was not compromised (Fig. 6).

The major disadvantages of these cast appliances are that there is little tolerance for errors in fabrication or surgical positioning, they are expensive, and they require a special laboratory facility for construction. Generally, some limitations in their application were observed including few interdental undercuts in young patients and problems in bonding to teeth with metal crowns. There was a possibility of causing secondary caries when preparing dimples in the teeth. However, this technique has proved a useful supplement to previously used methods, and is useful for avoiding skin puncture.

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