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CLINICAL SECTION

Peri-operative second molar tube failure during orthognathic surgery: two case reports

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With improvements in bonding techniques, bracket base design and bond strengths, molar tubes are becoming more popular in orthodontics.[1,2] Molar tubes make an attractive alternative to conventional banding due to a reduction in clinical bonding time and ease of placement on partially erupted teeth. The use of molar tubes negates the need for orthodontic separation and subsequent cementation of bands, and offers improved periodontal health.[3] Their use on terminal molars, however, should be limited to non-orthognathic cases. This paper presents two cases of peri-operative second molar tube failure during orthognathic surgery. They are presented in the hope that it will highlight the importance of banding the distal terminal molar in orthognathic cases to prevent loss of molar tubes and peri-operative contamination of the surgical wound site.

Key words: Second molar tube failure, orthognathic surgery

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Introduction

Combined orthodontic and surgical techniques to correct facial disharmony were first routinely introduced by Trauner and Obwegeser in 1957.[4] Many papers have been written on the complications of the surgical management of such cases, mainly concentrating on the peri- and post-operative vascular, neural and osseous factors resulting from the surgery.[5]

Due to the elective nature of these procedures it is essential that surgeons and orthodontists are aware of the possible complications arising from the clinical intervention of each specialty.

It is now generally accepted that pre-surgical orthodontics is required in order to obtain optimal dental and facial aesthetics, function and stability. Pre-surgical orthodontics typically involves the alignment and levelling of the arches, arch co-ordination, and selective decompensation in accordance with the combined treatment plan.

It has become routine practice to band or bond all erupted molar teeth prior to surgery to prevent the creation of an occlusal step (and, therefore, a premature contact in occlusion) in addition to controlling and co-ordinating the inter-molar width within and between the arches.[6]

The option of bonding as opposed to banding the second molars has been available for several decades.[7]

Brackets bonded to molars in routine orthodontic cases have been shown to have a high clinical failure rate of between 11 and 21%, irrespective of orthognathic intervention.[8,9]

Attachments bonded to lower molars have a 3:1 probability of failure compared with maxillary tubes and are three times more likely to debond on the right compared with the left during routine orthodontics. The use of self-etching primers and other bond enhancers have shown that failure rates are comparable with conventional acid etching,[9] although exceptions exist.[10] Significant differences have also been found in the failure rate between first and second molars (9.66 and 20%, respectively).[11]

In addition to the increased incidence of second molar tube failure in non-orthognathic patients, the surgical phase of treatment potentially increases the possibility of traumatic mechanical debond during surgery.

The incidence of foreign body contamination of patients undergoing sagittal split osteotomies has been reported at 0.6%.[12] Contamination due to bracket failure without fully informing the patient of such sequelae may constitute negligence.

Case histories

Case 1

MP presented with a Class III malocclusion on a Class III skeletal base with average vertical proportions. The

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Figure 1 MP orthopantomogram

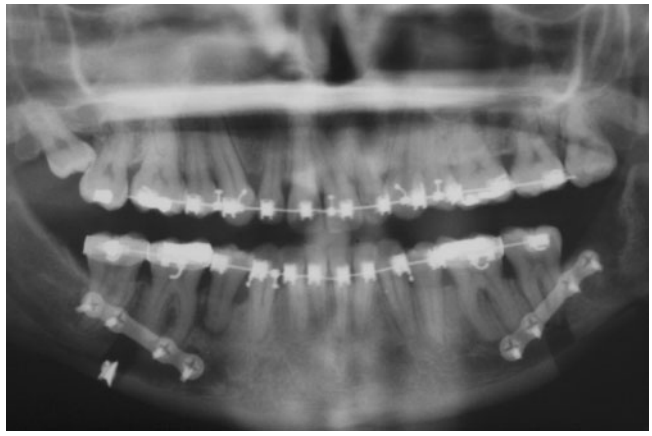

Figure 3 HF orthopantomogram

patient's pre-surgical phase of treatment commenced on a non-extraction basis. The upper second molars were banded during the alignment phase of treatment. The lower second molars had molar tubes bonded at the time of bond up. The pre-surgical phase of treatment was uneventful and the patient was planned for a bimaxillary osteotomy with a LeFort 1 forward movement of the maxilla and a bilateral sagittal split osteotomy to set back his mandible.

The peri-operative surgical phase of the treatment proceeded without any noted complication. The post-operative rotational tomogram (Figures 1 and 2), however, revealed that the second molar tube on the left-hand side had debonded during the operation and remained within the surgical wound site. It was not possible to palpate the molar tube due to the post-operative swelling. The patient was fully informed of this at review and it was decided to leave the tube *in situ*. There was no subsequent infection of the wound site and the tube was not palpable once the swelling had subsided.

Case 2

HF presented with a Class II division 1 malocclusion on a Class II skeletal base with a decreased lower facial height. The patient had her lower third molars extracted six months before her surgery. Her pre-operative phase of treatment consisted of upper and lower fixed appliances to align, level and decompensate, and co-ordinate her arches prior to a mandibular advancement procedure. Upper first and second molars had tubes bonded in addition to the lower left second molar at the time of bond up.

During the operation the upper right second molar tube debonded without detection. The post-operative rotational tomogram (Figures 3 and 4) and postero-anterior skull radiographs (Figure 5) revealed this tube to be positioned within the surgical wound site, trapped within the cortices of the mandible in the line of the sagittal split. Again this wound site healed without any infection or damage to the inferior-alveolar nerve. It was decided to leave this *in situ* unless problems arose in

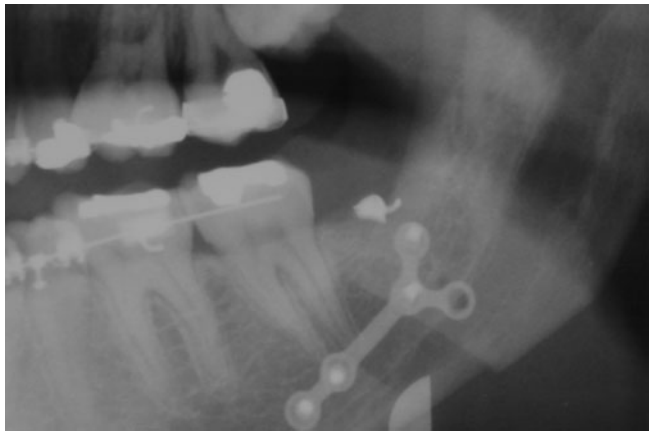

Figure 2 MP orthopantomogram

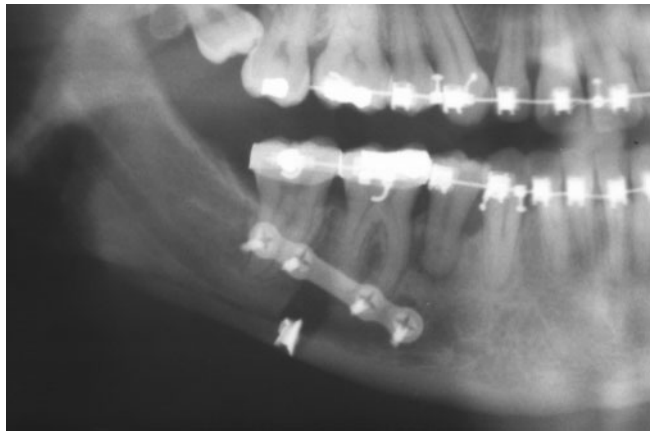

Figure 4 HF orthopantomogram

Figure 5 HF postero-anterior skull radiograph

the future. The patient was fully informed of this complication.

Discussion

Molar tube failure in non-surgical cases

A number of studies have looked at the debond incidence of molars tubes and sought to explain why they exhibit a higher failure rate compared with other bonded attachments.

Millett *et al*. carried out a retrospective evaluation of clinical performance of bonded first molar tubes. They found that there was an overall failure rate of 21% of first molar tubes bonded in their study. They postulated that the inferior quality of the etch pattern achieved on molars, the difficulty in attaining adequate moisture isolation during bonding, inadequate adaptation of the bracket base and large masticatory forces posteriorly were the primary causes of molar tube failure.[8]

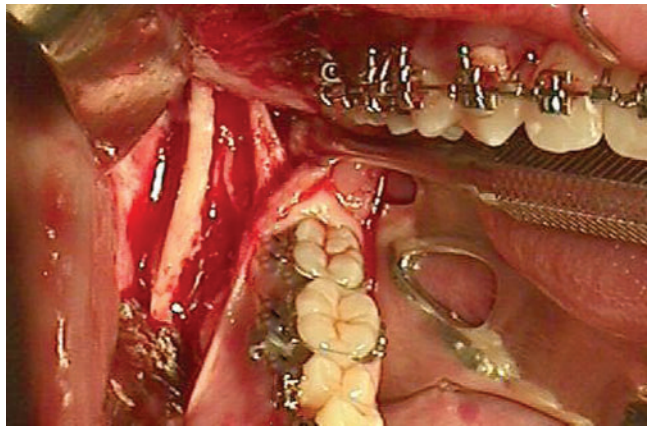

Figure 6 Intra-operative view of a sagittal split osteotomy. Note the proximity of the anterior relieving incision to the position of the molar band

Bonded second molar tubes were shown to have the highest failure rate of all quadrants with more debonds in the mandible. This was attributed to heavier occlusal forces on the posterior segment of the arch, heavier occlusal contacts on mandibular teeth, and poor bonding technique due to the difficult access and partially erupted teeth.[10]

In a follow-up study, the same investigators made a comparative assessment of failure rates of molar tubes bonded with self-etching primers and conventional acid etching. They stated that there was no significant difference between the two bonding methods. However, they did find that second molar tubes had a three-fold increase in failure compared with first molars. Mandibular tubes were shown to have a 3:1 probability of failure compared with maxillary tubes and failed three times as often on the right-hand side compared with the left-hand side.[9]

In summary, the literature highlights the fact that molar tubes have high incidence of failure even without the introduction of orthognathic surgical procedures.

Molar tube failure during surgery

The surgical phase of treatment increases the possibility of mechanical debond due to the close proximity of the tubes to the surgical field. The relieving incision made during in a standard bilateral split osteotomy extends from the external oblique ridge of the mandible descending inferiorly around the distal aspect of the second molar up to the buccal mid point of the tooth. From there it descends vertically towards the border of the mandible.

Figure 6 shows the proximity of the field of surgery to the mandibular second molar. This illustrates how

associated instrumentation may cause inadvertent debond of a second molar tube with subsequent loss of the bracket into the surgical site. With the patient in the supine position, the head rotated towards the surgeon, the effect of gravity will allow a debonded molar tube, from either the upper or lower second molar, to fall into the exposed wound area. Case 2 demonstrates failure of an upper second molar tube resulting in the contamination of the mandibular surgical site caused by disto-buccal displacement of the tube, which may be attributed to the position of the patient and gravity. Alternatively the molar tube may fall down the airway. An intra-operative throat pack will prevent inhalation during surgery, but may be lost down the trachea during extubation. This may go unnoticed by the surgeons.

Teltzrow *et al.* reported that out of 1264 patients who underwent a bilateral sagittal split osteotomy, eight (0.6%) suffered from foreign body contamination. These included fractured burs and orthodontic brackets. In all instances reported these foreign bodies were left *in situ* in the immediate post-operative phase. The authors reported that infection was never a consequence of this complication. However, they did state that most of these foreign bodies were later extricated at the time of removal of the osteosynthesis material. No reason was given as to why the osteosynthesis material had to be removed.[11]

Foreign bodies left behind rarely lead to clinical symptoms. Removal of debonded molar tubes is an option, but is best left until full consolidation of the osteotomy has been achieved at approximately six months. Alternatively they may be left *in situ* and monitored unless they become infected. Exact location may be problematic within the soft tissues and the associated morbidity of exploratory surgery must be taken into account. If molar tubes debond and are trapped within the mandibular split, neuropraxia of the inferior alveolar nerve due to compression may result.

In order to avoid litigation, if molar tubes are to be used instead of molar bands then the patient must be fully informed of the potential complications of debond during the consent process.

Although such contamination appears to occur very rarely and seems to offer a low infection risk, it is of medico-legal importance. Contamination due to bracket failure without fully informing the patient of such sequelae may constitute negligence.

Clinical suggestions in orthognathic case set-ups

- Ideally both first and second molars should be banded in orthognathic cases.
- Alternatively, always band the terminal molar in both mandibular and maxillary arches. This allows the first molar to be bonded. If the first molar tube should debond then it will not be able to slide off the arch wire due to the position of the second molar band.
- If first and second molar tubes are bonded then they should be tied together before surgery to avoid loss if failure should occur.
- Consideration may be given to annealing and cinching the archwire to prevent loss during surgery. However, this may inadvertently cause failure of the molar tube and may also complicate removal of the archwire in the post-operative phase of treatment.
- Another option is to remove second molar tubes immediately prior to surgery. However, one may then lose control of the second molars in the post-operative phase of treatment, making it necessary to go back and rebond these teeth in order to settle the occlusion.
- Always inform the surgeon if molar tubes are being used. The surgeon should always check for the presence of second molar tubes before and after the completion of surgery in such cases.
- Always inform the patient and the surgeon if molar tubes are to be used on the terminal molars and warn them of the risk of debond during surgery. The surgeons should be asked to count the number of bonds before and after the surgical phase of treatment.

Conclusion

These two case reports serve to remind us that bonding terminal molar tubes is not normally appropriate in orthognathic cases. Both maxillary and mandibular second molar can debond, and contaminate the surgical site with potential infection and iatrogenic damage to the inferior dental nerve. Ideally, the terminal molar should always be banded.

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