

Are we still giving our patients accurate information?

A re-audit of bone plate removal for patients undergoing orthognathic surgery

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INTRODUCTION

Orthognathic surgery is a major operation to reposition the jaws. The operation aims to correct imbalance between the maxilla and mandible three dimensionally, which in turn enables the teeth to bite together correctly, thus improving function and eliminating associated detrimental effects on dental health. It can also have the benefit of correcting dentofacial disharmony thus altering and improving facial appearance. The surgery is undertaken in conjunction with orthodontic treatment using fixed appliances to ensure that the teeth are in the best relationship once the jaws have been repositioned.

During orthognathic surgery, cuts (osteotomies) are made in the mandible and/or maxilla to enable them to be repositioned. Miniplates and screws have been widely used for the fixation of the maxilla and mandible during osteotomy procedures since Champy *et al* adapted the technique in 1978.⁽¹⁾ Although a number of different materials are available, the majority of miniplates placed in the UK are made of titanium, which has good tissue compatibility and is considered to be non-carcinogenic, resistant to corrosion, non-toxic and without allergic associations.⁽²⁾ Originally, miniplates were designed to be removed on completion of bone healing. However, due to the biocompatibility of titanium, in the UK and indeed many parts of the world, it is common practice that titanium miniplates and screws are left *in situ* following bony union unless their removal is clinically indicated. On reviewing the literature, the most common reasons quoted for miniplate removal are plate-related infection and subjective discomfort.^(3,4,5,6)

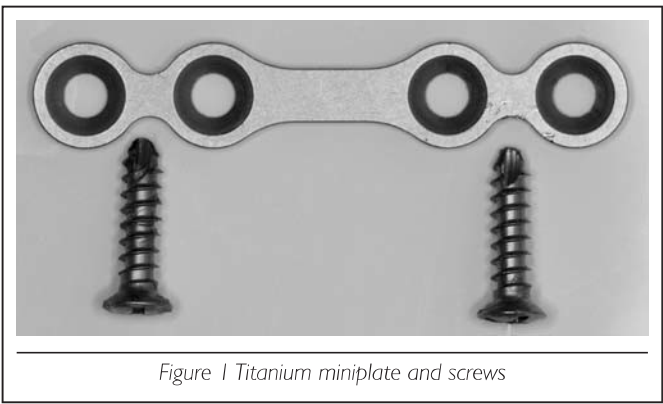


Figure 1 Titanium miniplate and screws

As miniplate removal is a recognised complication following orthognathic surgery, which requires an additional surgical procedure, it is discussed with the patient as part of the surgery consent process.⁽⁷⁾ Patients who had orthognathic surgery in 2004 at Royal Lancaster Infirmary (RLI) were

previously audited to determine the miniplate removal rate, which was found to be 5% of patients. This figure has since been quoted during the consent process. We decided to re-audit the subject to determine if the figure quoted is still valid to ensure that we are providing our patients with accurate information.

AUDIT

Aims

1. To determine the frequency of bone plate removal in the 24 months following orthognathic surgery.
2. To determine the reason(s) for bone plate removal.

Standard

One hundred per cent of bone plates should remain *in situ* for the 24 months following orthognathic surgery.

Method

A retrospective audit was undertaken of all patients who had orthognathic surgery in 2008 and 2009 provided at RLI. Patient notes and radiographs were assessed to identify those who had had a miniplate removed in the two years following their surgery. A proforma was designed to specifically collect the data for any patients who had a miniplate removed (see figure 2).

Identifier	Gender	Age	Surgery type	Number of plates		Reason for plate removal	Number and location of failed plates	Time between insertion and removal	Relevant MH	Any other information
				Maxilla	Mandible					

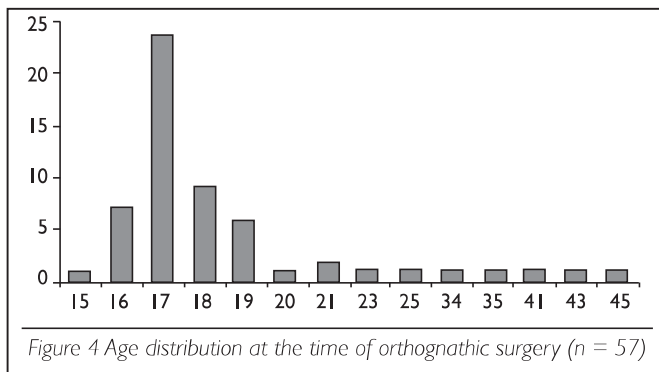
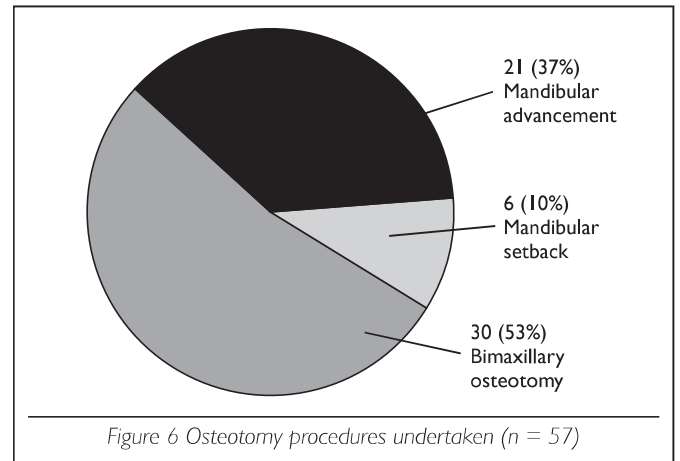
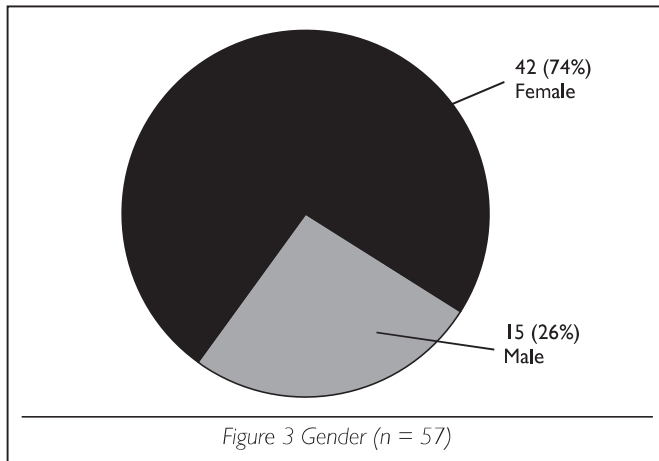
Figure 2 Data collection proforma

Results

A total of 57 patients had orthognathic surgery in 2008 and 2009. Of these, 42 (74%) were female and 15 (26%) were male (see figure 3).

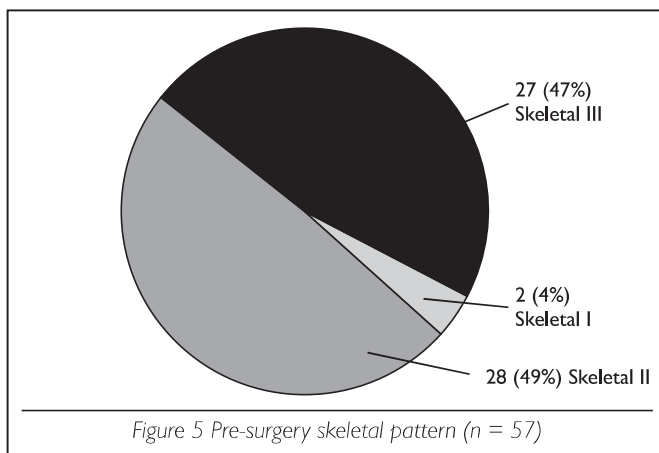
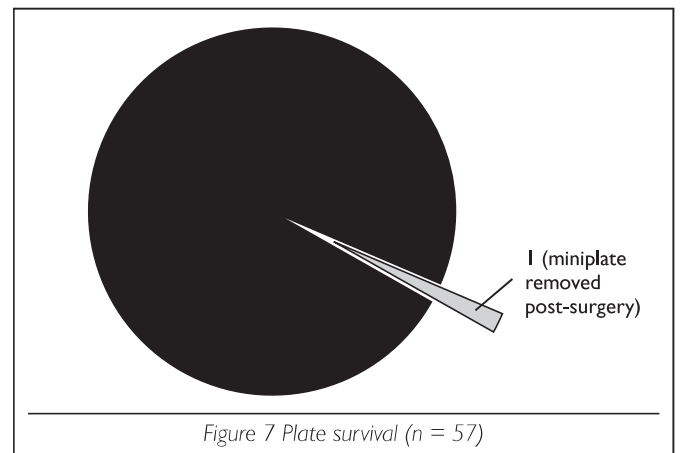
There was an age range of 15-45 years at the time of surgery, with the mean age being 19 years 7 months (see figure 4).

Figure 5 illustrates the distribution of pre-surgical skeletal pattern, where 28 (49%) of the patients had a skeletal II pattern, 27 (47%) a skeletal III and 2 (4%) a skeletal I.

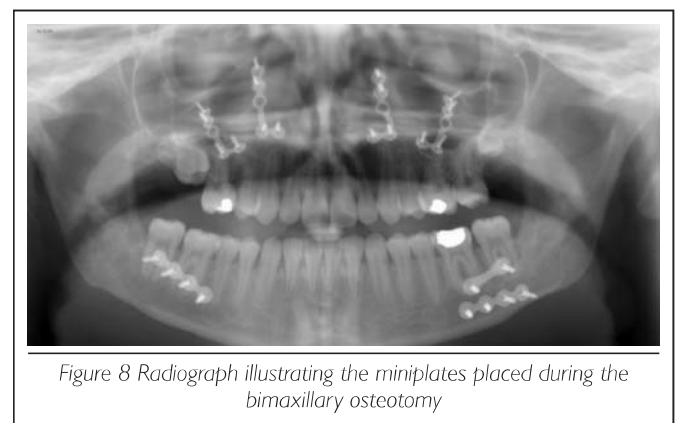


Thirty (53%) of the 57 patients underwent a bimaxillary osteotomy, 21 (37%) a mandibular advancement and 6 (10%) a mandibular setback procedure (see figure 6).

235 miniplates had been placed in the 57 patients during the audit period. This demonstrates a miniplate failure rate per plate of 0.43% and a patient rate of 1.75%.



Of the 57 patients who underwent orthognathic surgery during the audit period, only one patient had a single miniplate removed post-surgery (see figure 7). This was due to infection. It was a female who was 17 years 11 months at the time of surgery. Her medical history revealed that she had smoked occasionally since her surgery and was taking an oral contraceptive at the time of miniplate removal. She had had a bimaxillary procedure and it had been documented in the surgical notes that there had been an unfavourable fracture of the mandible ('bad split') during the left sagittal split osteotomy, which had necessitated the placement of two miniplates (see figure 8). It was the upper of the two plates that had become infected 13 months after the original surgery.



From analysis of the number and type of procedures that had been undertaken, it can be extrapolated that approximately

DISCUSSION

A limited number of studies investigating the failure rate of miniplates in patients having undergone orthognathic surgery can be found within the literature.^(3,4,5,8,9) The basic methodology of these studies is very variable and not fully comparable with that of this audit. For example, some studies do not include different osteotomy procedures and only include single jaw procedures, some include patients treated by multiple operators or collate data from more than one unit and others include miniplates made from different materials, for example vitallium and stainless steel.

Miniplate removal rates vary significantly within the published studies, with ranges of 11.1 to 27.5% per patient and 9.5 to 19.5% per plate.^(3,4,5,8,9) These figures are considerably higher than those found in this audit (1.75% per patient and 0.43% per plate). It is also lower than the per-patient rate of 5% found following the initial audit for patients having surgery in 2004. This lower removal rate may be explained by having an established and experienced surgical team with the same two surgeons (PVD and MN) operating together since 1998, and hence over both audit periods. Additionally, the initial audit only looked at one year of patient data, which involved just 19 patients.

When the results of this audit were presented at a departmental audit meeting, it was felt that the failure rate found in the audit was lower than that perceived by the maxillofacial team. It was postulated that there might have been an error in the initial identification of patients who had developed problems with a miniplate, as this was initially carried out by viewing radiographs on the hospital picture archiving and communications system (PACS) to limit the number of sets of casenotes requested from the medical records department. It is planned to repeat this audit to include patients having undergone orthognathic surgery in 2010 to add to the data. The methodology will be changed to also cross reference theatre day lists to aid the initial patient identification. In addition, it is planned to carry out this audit on a prospective basis for those operated on in 2011 onwards, as they are reviewed for two years post-operatively.

The miniplate removed during the audit period was removed due to infection 13 months post-surgery. Infection is the most common reason cited in the literature for miniplate removal.^(3,4,5,6,8) This may be defined as pain, swelling, wound dehiscence and pus discharge in the region of the plate. Clinical irritation/subjective discomfort is the second most common reason cited.^(3,4,9) Other reasons for miniplate removal include: for dental implant placement or tooth extraction; interference with denture construction; and patient request.^(4,6,8) Studies that have looked at the timing of miniplate removal have found the majority of plate removals are performed during the first post-operative year.^(3,4,5)

A number of risk factors have been identified as increasing the incidence of miniplate removal, including: smoking;^(4,10) an operation time of greater than 190 minutes;^(5,6) and age, where being over 30 years of age increases the likelihood of miniplate removal, possibly due to increased bone density.^(6,8) The patient identified in this audit underwent a bimaxillary procedure, which on average takes 150 minutes, and was also noted to have smoked occasionally during the post-operative period.

It was also identified that the patient was taking an oral contraceptive at the time of plate removal. Patients are advised to stop oral contraceptives for the three months prior to orthognathic surgery due to thromboembolic risks. However, they are able to recommence them post-surgery. There is a suggestion in the literature that females taking an oral contraceptive are more likely to experience alveolar osteitis (dry socket) following a dental extraction. It could be surmised that this may influence healing post-orthognathic surgery and contribute to the loss of a miniplate.

CONCLUSIONS

- The standard of 100% of bone plates should remain *in situ* for the 24 months following orthognathic surgery was not met.
- A rate of miniplate removal per patient of 1.75% and 0.43% per plate was found for patients who had orthognathic surgery in 2008 and 2009 at RLI.
- The miniplate removal rate per patient of 1.75% was lower than that found following the initial audit (5%).

ACTION PLAN

1. A range of miniplate removal rate of 1.75-5% will be provided to patients as part of the consent process, referring to the audits undertaken. These figures will be updated as further data become available.
2. To audit the patients who had orthognathic surgery in 2010 to provide further data and improve its accuracy.
3. To undertake this audit on a prospective basis for patients who had orthognathic surgery in 2011 onwards, to enable an ongoing update of the accuracy of the data that is provided to patients prior to them embarking on the orthognathic surgery journey.

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