

A Retrospective Review of Metal Plate Removal in an Oral and Maxillofacial Surgery Department

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Abstract Objectives: To determine the rate of plate removal in orthognathic and trauma procedures requiring the use of metal plates, and determine reasons for plate removal and duration of plate life, to inform the consenting process. **Materials:** A four year retrospective review of operating theatre records identified all procedures where plates were inserted and removed. Records were categorised by trauma vs non trauma, primary procedure, reason for plate removal, age, sex and duration of plate being in situ. **Results:** 4044 procedures were carried out Sep 2012 to Sep 2016. Six hundred and thirty (630) of these involved plate insertion, and 72 involved plate removal. Mean age was 34 years, 69% male. Removal rates for common procedures included 16/165 bilateral sagittal split osteotomies, 9/136 le fort one osteotomies, 33/218 open reduction internal fixation (ORIF) mandible, 3/29 ORIF midface and 2/21 ORIF orbital floor. Average duration of plates being in situ was 1225 days (median 433 days, range 31 – 51037). **Conclusion:** Plate removal is a significant source of morbidity following OMFS surgery. Accurate knowledge of rates and reasons for removal of plates in common procedures is necessary for informed consent.

Keywords: bone plates, equipment failure, fracture fixation, human, informed consent, surgical specialties

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1. Introduction

Removal of metal plates following oral and maxillofacial surgery (OMFS) is a common procedure [1], recognised as a source of morbidity ever since metal plates were first introduced into practice. Some surgeons advocate the removal of all metal plates [2,3], however, leaving plates in situ has been shown to be safe and cost effective [4]. In our practice, most plate removal procedures require a general anaesthetic therefore this procedure represents a significant source of morbidity to patients. During the consenting process it is important to highlight and, if possible, to quantify risks and possible consequences of surgery [5]. Therefore it is important that everyone involved in gaining consent for OMFS procedures has knowledge of likely rates of plate removal for each type of plate insertion procedure.

Plates may be removed for a number of reasons, both objective and subjective, including pain, infection, dehiscence of soft tissues overlying plate, aesthetic issues, or to allow dental rehabilitation [6,7]. There are a number of studies of plate removal, both retro and prospective, usually single centre, and with sample sizes which range from 50 to over 800 patients [8,9]. Rates of plate removal in trauma patients following infection have been quantified by Cahill et al in their systematic review as being between 2.3-28.1% [9]. They do not differentiate between reasons for plate removal, and they concentrate on plates removed as a result of infection. Hernandez et al

[10] also focussed on infections, and also found that management of around half of infections required removal of metal hardware, but did not identify plates removed for other reasons. Raja et al looked only at orthognathic procedures, and found a removal rate between 9.5% and 27.5%, though noted that some centres advocate removal of all metal plates [2]. Angle of mandible fractures were studied by Regev et al in their robust meta analysis [11], and they identified removal rates of between 12 and 22%, identifying number of plates, type of plate (compression vs non compression), and type of screw (mono vs bicortical) as being significant factors in complication rates. The large variability in results, and heterogeneity of study methodologies makes it difficult to determine what figures should be quoted when informing patients.

It is important to note that a major variant in methodology of the studies is how they identify ‘rate’ of plate removal. In many of the studies identified by the authors, this was a ‘ratio’ of removed plates to inserted plates within a certain time period. The few studies which do give a true ‘rate’ may underestimate this, due to patients leaving that centre to receive treatment at a different centre, and short follow up [1]. Using a ratio to estimate rate is therefore attractive, though it requires stable numbers of procedures over time, and similar numbers of patients joining and leaving the cohort. The authors therefore decided to use a pragmatic approach, and repeat the methodology of previous studies to calculate a rate using the ratio between removed and inserted plates.

Another variant in studies is the reporting of the numbers of plates removed or number of patients who had

plates removed. We chose to report the latter, as this is relevant when informing patients of the risk of having to have plates removed (i.e. regardless of how many plates are to be removed, it is the hospital visit and general anaesthetic which are of most relevance to the patient).

We carried out a retrospective review of plate removal in patients who had undergone Oral and Maxillofacial surgery at our centre.

2. Materials and Methods

A retrospective review was conducted of all OMFS cases at Aberdeen Royal Infirmary, Scotland, over four years (September 2012 and September 2016). Procedures were gathered from the electronic operating theatre management system (Centricity Opera, General Electrics) and screened to select only cases involving plate insertion or plate removal.

Basic demographic information was gathered for all patients. Reason for plate removal was identified from the clinic letter, and duration of plate being in situ was calculated by identifying the date of insertion procedure (from clinic letter or electronic records) and subtracting this from removal date.

Rate of plate removal for each procedure was calculated using a statistics package (SPSS by IBM, version 24) by identifying the ratio of removed to inserted plates for each procedure type. Where more than one procedure had been carried out during the initial surgery, the procedure was counted in all of the appropriate categories (eg 'Bimaxillary osteotomy with genioplasty' would be counted as BSSO, le fort 1 and genioplasty).

3. Results

Four thousand and forty four procedures (4044) were carried out by the OMFS department between September 2012 and September 2016. Six hundred and thirty (630) of these involved plate insertion, and 72 involved plate removal. Mean age was 34 years (median 29, range 16- 89 years), with 69% male. Plate insertion procedures included Le fort 1 osteotomy, Bilateral sagittal split osteotomy (BSSO), genioplasty, open reduction internal fixation (ORIF) mandible, ORIF midface, ORIF zygoma, ORIF orbital floor, ORIF frontal bone and fixation of bone graft following resection of infected or neoplastic bone.

One hundred and ninety three patients underwent non trauma procedures. Of these, 124 four were female (64%), and average age was 29 years (median 26, range 18-66).

Non trauma procedures included 165 bilateral sagittal split osteotomies, 136 le fort one osteotomies and 34 genioplasties. The majority of these procedures were carried out as bimaxillary osteotomies (129). Genioplasties were not analysed further due to coding issues which made it impossible to identify which cases subsequently had plates removed. Plates were removed from 16 patients who had undergone BSSO and 9 who had undergone le fort one osteotomy (see Table 1).

Four hundred and forty patients underwent trauma procedures. Of these, 370 were male (85%) with average age of 36 years (median 31, range 16-89). Trauma procedures included 218 ORIF mandible, 29 ORIF midface, 166 ORIF zygoma, 21 ORIF orbital floor, and 3 ORIF frontal bone. The ORIF zygomas also included open reduction without metal plate fixation, so further analysis was not carried out. Plates were removed from 33 patients who had undergone ORIF mandible, three patients who had undergone ORIF midface, three patients who had undergone ORIF orbital floor and six who had undergone ORIF zygoma (see Table 1).

Reasons for plate removal identified in clinic letters included pain (39/72), infection (22/72), exposed plate (12/72), to allow dental rehabilitation (implants, denture or planned extraction)(5/72), planned removal (3/72), and continued diplopia (2/72).

Average duration of plates being in situ was 1225 days (median 433 days, range 31 – 51037). The plate removed earliest (31 days) was due to plate failure at a parasymphseal fracture, and the longest lived plate (51037 days) was inserted forty years previously for a fractured zygoma, and was preventing comfortable denture wearing.

4. Discussion

Removal of metal plates following OMFS procedures represents a significant source of mortality. Informing patients of likely rates of and reasons for plate removal is important to allow informed consent. We present a retrospective review of removed plates from a single centre over a four year time period.

We identified removal rates for trauma and orthognathic procedures. The removal rate was higher in trauma procedures than non trauma procedures. There are a number of possible reasons for this difference, including duration of exposed fracture site to oral environment (higher in trauma patients), oral hygiene (which may be worse in trauma patients) or increased age of trauma. The rates we identified are in agreement with published rates [2,9,10,11].

Table 1. Removal rates and demographics of patients undergoing common procedures. (BSSO=Bilateral sagittal split osteotomy, ORIF= Open reduction internal fixation.)

Procedure	Number of procedures (mean age, % male)	Number of patients required plate removal (mean age, % male)	Median duration of plate life (min, max)	Rate of plate removal
BSSO	165 (29 years, 36%)	16 (31 years, 43%)	390 days (106-5177)	9.6%
Le Fort 1	136 (28 years, 36%)	9 (30 years, 100%)	453 days (128-9274)	6.7%
ORIF Mandible	218 (33 years, 80%)	33 (37 years, 79%)	433 days (31- 6892)	15.1%
ORIF Midface	29 (32 years, 82%)	3 (35 years, 67%)	306 days (77- 622)	10.3%
ORIF Orbital floor	21 (46 years, 62%)	2 (61 years, 0%)	100 days (54- 145)	9.5%
ORIF frontal bone	3 (33 years, 100%)	1 (33 years, 100%)	4674 days (4674-4674)	-

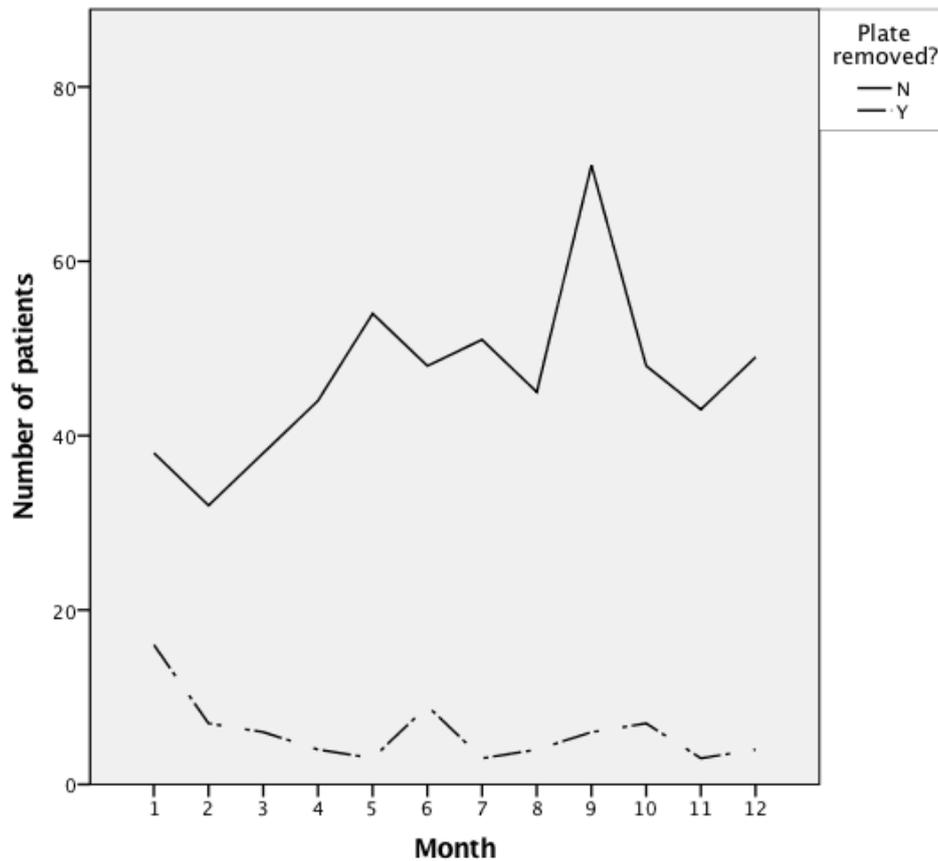


Figure 1. Inserted plates and removed plates divided by month of insertion

Duration of plate being in situ was highest after Le Fort one osteotomies, and lowest following ORIF orbital floor. The reason for removal of both orbital floor plates (diplopia) presented early on follow up, whereas most other presenting symptoms of removed plates were later complications (e.g. dehiscence over plate, need for further dental rehabilitation). The mean duration of plate life in our review is longer than some others [1], probably due to the methodology which permitted long follow up of patients whose plates were inserted before our study began.

Reasons for plate removal are well documented, and mainly appear to represent a continuum of infection (pain is an early symptom, then swelling and further pain, and finally dehiscence of overlying tissues). The five cases who had plates removed to allow dental rehabilitation (two extractions of wisdom teeth, one of a carious lower second molar, one to allow insertion of dental implants, and one to allow the patient to wear a denture comfortably) were not all predictable preoperatively, particularly as the denture patient had the metal plate in situ for over thirty years. Throughout the study period, month of insertion was unrelated to whether or not plates were subsequently removed (see Figure 1).

Shortcomings of the present study include low numbers, which prohibit further meaningful statistical analysis. Though any plate removal is clinically significant for the patient, knowing the number, exact position and screw status (ie tight, loose, absent) would be useful for the clinician. Absence of further data such as smoking status, past medical history and perioperative antibiotic prophylaxis also makes further analysis of reasons for plate removal difficult. Repetition of the study over a

longer time period, with further information as noted above, would make the findings more robust and enhance clinical utility.

5. Conclusion

Plate removal is a significant source of morbidity in OMFS patients. Informing patients of rates of plate removal and likely reasons for removal is an important step in the consenting process. We present a four year retrospective review of plate removal in an OMFS department, and give calculated rates of plate removal for common procedures.

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