Plate removal following orthognathic surgery

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Objectives. The objectives of this study were to analyze outcomes with miniplates in orthognathic surgery and define risk factors resulting in plate removal.
Study design. Clinical files of 570 orthognathic surgery patients operated between 2004 and 2009 were reviewed: 203 had a bimaxillary operation, 310 a lower jaw osteotomy, and 57 an upper jaw osteotomy. Age, sex, and jaw movement were analyzed. Reasons for hardware removal were recorded.
Results. Hardware was removed in 157 patients (27.5%). Seventy-eight patients (13.7%) needed removal because of plate-related infection; 66 (11.6%) because of clinical irritation; 5 (0.9%) for dental implant placement; and 8 (1.4%) for other reasons. Average time between operation and removal was 9.9 months. More women (31.7%) than men (20.3%) had plates removed, but age was not a factor except with infection.
Conclusions. More than a quarter of patients developed complications from plates and screws, necessitating their removal, and infection occurred in 13.7%. Prompt removal constituted adequate management. **(Oral Surg Oral Med Oral Pathol Oral Radiol Endod 2011;112:737-743)**

Miniplates have been widely used in the osteosynthesis of the lower and upper jaws during orthognathic surgery since Champy et al.[1] adapted the technique in 1978, as described by Michelet et al.[2] In most units, it is routine policy not to remove plates and screws following bony union unless doing so is clinically indicated.[3] In some units, however, the routine policy is to remove plates and screws because late removal becomes very difficult as a result of bony overgrowth of the plates.[4] Many studies have investigated the removal of miniplates in trauma cases, but relatively few studies have focused exclusively on orthognathic surgery operations. The reported incidence to date of plate removal per patient in orthognathic surgery ranges from 10.0% to 18.5%[5-9] in mandibular osteotomies and from 1.0% to 11.1%[10-12] in maxillary osteotomies (Table I).

This retrospective study examined the rate of plate removal from the maxilla and mandible, and the risk factors that may contribute to it. The purpose was to analyze the outcome of miniplate usage in orthognathic surgery and to define risk factors leading to signs or symptoms that eventually result in plate removal.

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MATERIAL AND METHODS

Records for 570 consecutive patients operated between 2004 and 2009 were reviewed retrospectively (Table II). All patients had undergone either a bimaxillary, a Le Fort I, or bilateral sagittal split ramus osteotomies (BSSO) performed by 1 of the 3 senior staff members of the Department of Oral and Maxillofacial Surgery at St. John's Hospital in Genk. Records were included only of orthognathic patients for which the same operative technique and the same postoperative clinical attitude toward removal of osteosynthesis material were applied.

The patients included 363 females and 207 males, with a mean age at surgery of 26.7 years (Table III). A total of 513 mandibular and 260 maxillary osteotomies were evaluated, and 203 of the patients had a bimaxillary operation. We studied the operative charts for age, sex, the direction of the movement of the jaw, the incidence of plate removal, and the type of plate that was placed. Within the group that underwent plate removal, we noted the indication for the removal, the interval between operation and removal, if removal was indicated in the upper or the lower jaw, and the side (left/right) of the jaw that needed a removal.

This retrospective study had institutional review board approval, and was conducted in compliance with the Helsinki Declaration guidelines.

Operative technique

All of the BSSOs included in this study were performed by 1 of 3 resident surgeon staff members. We

Table I. Review of reported incidence of plate removal after bilateral sagittal split ramus osteotomy and Le Fort I procedures

First author	Year	No. of patients receiving plates	Orthogn/ trauma	Area of jaw	No. of patients w/ plate removal	% patients w/ plate removal	No. of plates inserted	No. of plates removed	% plates removed
Beals[10]	1987	53	Orthogn	Maxilla	—	—	200	2	1.0%
Schmidt[11]	1998	190	Orthogn	Maxilla	21	11.1%	738	70	9.5%
Manor[12]	1999	70	Orthogn	Maxilla	—		260	31	12%
Bhat[5]	2003	172	Trauma	Mandible	28	18.3%	308	51	16.6%
Bhat[6]	2005	153	Trauma	Mandible	21	—	308	32	—
Nagase[13]	2005	266	Trauma	Maxilla mandible	45	33.3%	497	135	27.2%
Theodossy[7]	2006	80	Orthogn	Mandible	16	—	160	25	15.6%
Alpha[8]	2006	533	Orthogn	Mandible	—	10.0%		—	6.5%
Kuhlefelt[9]	2010	153	Orthogn	Mandible	29	18.6%	308	56	18.2%
Falter	Present data	570	Orthogn	Maxilla mandible	157	27.5%	3197	622	19.5%

Orthogn, orthognathic surgery; —, data not reported.

Table II. Number of patients with plate removal according to the type of surgery

	BSSO only	Bimaxillary	Le Fort only	Total
No. of patients w/ an osteotomy	310	203	57	570
No. of patients w/ plate removal	80	63	14	157
% of plate removal	25.8%	31.0%	24.6%	27.5%

BSSO, bilateral sagittal split ramus osteotomy.

Table III. Analysis of the need for plate removal for different variables

	Total	Plate removal	Non-plate removal	%
No. of patients	570	157	413	27.5
Male	207	42	165	20.3
Female	363	115	248	31.7
Average age	26.7	26.9	26.6	

performed the modified sagittal split osteotomy as described by Epker[14] and Falter et al.[15]

After completing the osteotomies on both sides in the lower jaw, a wafer was introduced onto the lower jaw, and intermaxillary fixation was ensured. Internal fixation was established with titanium miniplates and monocortical screws of the 2.0 system, as described by Tulasne and Schendel[16] (Fig. 1). Almost all of the miniplates used, with the exception of 12 Tekka-plates (Tekka, Brignais, France), were from the Leibinger miniplate system (Leibinger, Tuttlingen, Germany). The monocortical screws placed before 2008 were from the Leibinger system (4.0 mm); after that time, we used screws distributed by Stryker (Kalamazoo, MI, USA) (5.0 mm).

All wounds were sutured with polyglactin (Vicryl) in 2 layers. During all of 2009, all sagittal split wounds were perioperatively rinsed with a 10% povidone-iodine (iso betadine) solution with careful closure of the periosteum to achieve a 3-layered closure of the operation wound. This change did not improve the rate of plate removal and was abandoned again in 2010. No suction drainage was used in any case of a sagittal split osteotomy.

The Le Fort I osteotomy was performed as described by Epker and Fish.[17] All patients received perioperative intravenous antibiotics, as well as a dose of methylprednisolone 125 mg intravenously. A second dose of methylprednisolone was administered 8 hours after the first dose. Postoperatively, antibiotic treatment was continued for 5 days. No intermaxillary fixation was used, except for light elastics on surgical hooks to guide the patient into the right occlusion during jaw movements.

The follow-up always lasted at least 18 months and included 1 consultation every week during the first 6 weeks and 1 at 3 months, 6 months, and 1 year postoperatively. During the first 6 weeks, a wafer (occlusal splint) was retained in the mouth. Guiding elastics were placed only during these 6 weeks if the occlusion deviated from the desired result. If any inflammatory wound reaction was seen at the operation site during the first 6 weeks, a removal of the plates was planned at 3 months after the operation date. An "infectious" reaction was considered to be present whenever wound dehiscence over the plates, granulation tissue at the plate site, or an intraoral fistula with pus at the plate site was observed. No wound cultures were obtained in any case. A persistent swelling and redness at the osteosynthesis site