



Moving the mandible in orthognathic surgery – A multicenter analysis



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ABSTRACT

Orthognathic surgery has always been a classical focus of maxillofacial surgery. Since more than 100 years, various surgical techniques for mandibular repositioning have been developed and clinically tested. Since the establishment of plate and screw osteosynthesis, orthognathic surgery became more stable and safe. Nowadays, different surgical methods for mobilising the mandible are existing. This international multicenter analysis (n = 51 hospitals) is providing first evidence based data for the current use of different surgical methods.

The dominating techniques were Obwegeser/dal Pont (61%) followed by Hunsuck/Epker (37%) and Perthes/Schlössmann (29%). The main osteosynthesis materials were plates (82%), bicortical screws (23.5%), or a combination of both (5.9%). 47% of all centers reported to use several surgical methods at the same time, depending on the anatomical problem and the surgeon's preference.

This shows that different surgical methods seem to work as comparable, safe, and reliable procedures in everyday clinical practise. On this basis, further prospective studies could evaluate possible advantages for our patients.

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1. Introduction

Orthognathic surgery is a principal focus of the oral and maxillofacial surgeon. Several surgical techniques have been developed in the last 100 years, with the first reported mandibular movement in 1849 (Hullihen, 1849). Surgical techniques have gradually become less invasive over the years, favouring an intraoral approach. Nowadays, several standardised operating techniques for mandible splits are used in orthognathic surgery, which have been optimised by constant modifications over decades (Falter et al., 2010; de Santana Santos et al., 2012; Landes et al., 2014). The mandibular bisagittal split operation (BSSO), published in the 1960's (dal Pont, 1961; Obwegeser, 1964) and 1970's (Hunsuck, 1968; Epker, 1977; Bell and Schendel, 1977) and the high oblique sagittal split (HSSO), developed in the 1920's (Perthes, 1922; Kaduk et al., 2012), seem to be well established in the clinical routine, as well as other surgical techniques (Hunsuck, 1968; Böckmann et al., 2015).

Safe and reliable osteosynthesis operating techniques have also been developed for maxillofacial surgery (Nkenke et al., 2012). The use of screws and plates has been well established by several *in vitro* and *in vivo* studies (Hadi et al., 2010; Ribeiro-Junior et al., 2010; Stockmann et al., 2010; Hsu et al., 2012; Olivera et al., 2012).

The maxillofacial surgeon clearly has many options for surgical technique in the field of orthognathic surgery. However, no information has been published regarding the preferred methods of choice. In this survey, we have analysed the different techniques currently in clinical use for orthognathic surgery of the mandible, in central Europe, mainly in German-speaking countries.

2. Material and methods

We present a multicentre evaluation of the surgical techniques for mandibular splitting currently in use in central Europe. We analysed which primary operation techniques (e.g. Obwegeser, Perthes, Hunsuck/Epker) are currently used in everyday clinical practise. We also evaluated the method of osteosynthesis in mandibular orthognathic surgery (miniplates with monocortical screws, bicortical screws, hybrid forms, etc.).

We contacted all maxillofacial departments in Germany, Austria, Switzerland and Norway, which were registered with the German society for oral and maxillofacial surgery (DGMKG) by electronic mail in June 2015. We asked for information on the type of operating techniques currently in use for mandibular splitting in orthognathic surgery. The current techniques of primary fixation (i.e. miniplates with monocortical screws, bicortical screws, hybrid

forms, etc.) were also requested. We did not seek ethical approval for this study as no patient data were analysed.

3. Results

Overall, 92 maxillofacial departments in Germany (n = 83, 35 University Hospitals and 48 Teaching/General Hospitals), Austria (n = 4), Switzerland (n = 4) and Norway (n = 1) were contacted and asked to provide information on the current surgical techniques in use for splitting the mandible in orthognathic surgery and the preferred method of fixation. The overall return rate of the questionnaire was 55.4% (51 of 92). Overall, 88.2% (45 of 51) of the answers came from German institutions and 11.7% (6 of 51) came from non- German hospitals. Answers were received from 45 German institutions, 3 Austrian institutions, 2 Swiss institutions and 1 Norwegian institution (see Table 1). All departments were specialised centres for tertiary care in oral and maxillofacial surgery, with a specific focus on orthognathic surgery. 25 university hospitals and 26 teaching/general hospitals responded.

The dominating techniques of choice were Obwegeser/dal Pont (60.8%, 31 of 51) followed by Hunsuck/Epker (37.3%, 19 of 51) and Perthes/Schlössmann (31.9%, 15 of 51). 6 centres reported the use of the original Obwegeser technique (11.7%) and 3 centres reported the use of other techniques (5.9%, i.e. modified Converse-technique, Schröder-technique, Trauner-technique). 24 centres (47.1%) reported the use of several surgical techniques, depending on the anatomical problem and the surgeon's preference (see Table 2). All techniques were performed with an intraoral approach. No departments reported the standardized use of a vertical ramus osteotomy.

The first choice-surgical technique was Obwegeser/dal Pont in 22 centres (43.1%), Hunsuck/Epker in 14 centres (27.5%), Perthes/Schlössmann in 12 centres (23.5%), and the classical Obwegeser in 3 centres (5.9%).

Plates were used for fixation in 42 centres (82.4%). Screws were used in 12 hospitals (23.5%), and 3 departments used a combination of bicortical screws and a plate (5.9%) (it was possible to provide several answers, when several techniques were in use in the same centre, see Table 3). 16 centres reported the use of multiple methods of osteosynthesis, largely depending on the surgeon's personal preference (31.4%). No department reported the use of metal wires for osteosynthesis.

A sub-analysis of the "plate group" (n = 42 of 51) revealed that 25 departments used normal 2.0 miniplates (59.5%), 5 departments

used the mandibular sliding plate (also called split fix plate, or Joos plate) (11.9%), and 12 departments used dysgnathia plates (also called ramus plates, trapezoid plates, or fence plates) (28.6%) (Joos, 1999; Stoelinga and Borstlap, 2003). As mentioned above, 12 centres used bicortical screws (2 or 3 per side) and no plates at all (see Table 4).

4. Discussion

This multicenter analysis provides the first information regarding the methods currently used for splitting the mandible in orthognathic surgery. We identified 3 different surgical techniques (Obwegeser/dal Pont, Hunsuck/Epker, and Perthes/Schlössmann) currently dominating mandibular orthognathic surgery in central Europe, particularly in Germany. Nearly all the data in this study were received from German hospitals (88.2%), only 11.7% of the data were provided by non- German hospitals. This study does has a specific focus on German-speaking countries which might have biased the results due to possible traditions in orthognathic surgery which might be different in other countries.

The various advantages and disadvantages for the different surgical techniques have been well documented in the medical literature (Hågensli et al., 2013; Iannetti et al., 2013; Mensink et al., 2013), but only a few retrospective studies with a limited number of patients have directly compared the different techniques (Seeberger et al., 2013; Al-Nawas et al., 2014). To the best of our knowledge, prospective randomised or multicentre studies comparing the risk factors of different surgical techniques in orthognathic surgery do not exist so far. We also do not provide a direct comparison of risk factors or re-operation rates. But this analysis could be used as the basis to evaluate the most common surgical techniques in further multicentre settings.

In this analysis, miniplates were identified as the principal method for primary fixation (82%), although bicortical screws and hybrid forms (1 or 2 bicortical screws and one miniplate) were also in clinical use. Direct comparisons of the different osteosynthesis techniques in mandibular orthognathic surgery have been published (Paeng et al., 2012; Lee et al., 2014; Sato et al., 2014; Roh et al., 2014; Oh and Kim, 2015) and these techniques are well established and analysed (van Sickels and Richardson, 1996; Marchetti et al., 1999; Becelli et al., 2004; Mavili et al., 2009). Even though multiple techniques of internal fixation have been described in detail before, we provide the first overview of the current clinical use of these different methods (Stoelinga and Borstlap, 2003).

Table 1

Participating countries in this analysis, with number of departments responding.

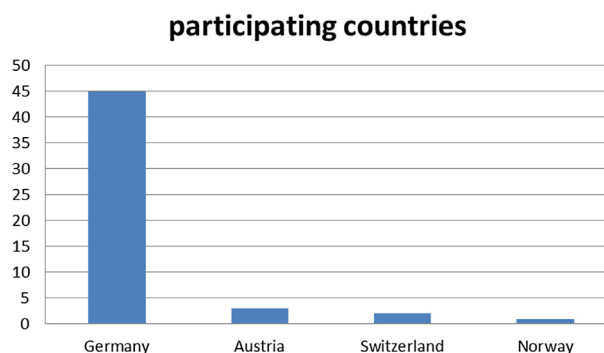


Table 2
Distribution of surgical techniques currently in use in the participating departments (n = 51, several answers possible).

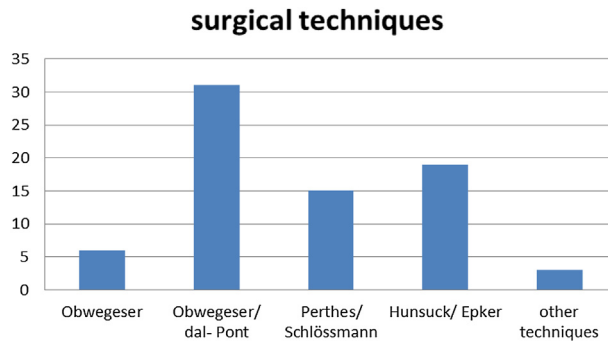


Table 3
Type of osteosynthesis used for primary fixation of the mandible in the participating departments (n = 51, several answers possible).

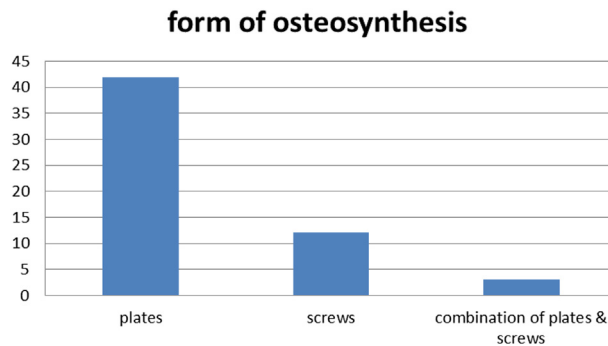
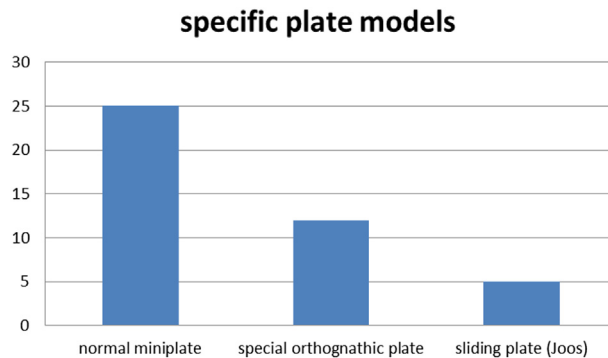


Table 4
Subanalysis of the different types of plates (n = 42) used in the participating centers.



5. Conclusion

This study shows that different operating techniques are currently used for mandibular orthognathic surgery. In nearly 50% of all responding departments, several surgical techniques are established and used on a regular basis. Additionally, different osteosynthesis methods are in use. For all these techniques, risk and benefit analyses have been published in the medical literature, demonstrating that these techniques offer comparable safety and reliability in everyday clinical practise, in the hand of the experienced surgeon. Further direct comparisons of the different surgical techniques in a prospective, multicenter study are needed to obtain higher evidence-based data regarding the possible advantages for our patients.

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Conflict of interest

All authors declare no conflict of interest.

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