Indications and Frequency of Orthognathic Surgery in Sweden –
a Questionnaire Survey

Jesper Elenius

Eusebio Ramirez

Tutor: Mats Sjöström
ABSTRACT
Orthognathic surgery is today a standard procedure for improving the intermaxillary relationship by moving either one or both jaws surgically. However, statistics for frequency and indication for orthognathic surgery in Sweden are today non-existent. The purpose of the study is to examine indications, frequency and surgical techniques for orthognathic surgery performed in Swedish Oral and Maxillofacial Surgery (OMFS) clinics.

A questionnaire survey was performed on all Swedish OMFS clinics for the year 2011 to identify gender and age of the patients, surgical techniques, indications, frequency of operations and whether patients underwent one- or two-jaw surgery. A total of 47 out of 50 clinics responded to the survey. According to it, 894 patients were treated with orthognathic surgery. Slightly more women underwent orthognathic surgery than men and 91% of the patients were 26 years or younger. The most common indication was functional and the most common main jaw discrepancy aimed to correct was of sagittal nature. The survey shows great discrepancies between the counties concerning one- vs. two-jaw surgery.

The results regarding frequency, age and gender distribution in orthognathic surgery was somewhat expected. However, the spread in frequency regarding one- vs. two-jaw surgery between the counties is concerning. The main indication for performing orthognathic surgery in Sweden is by far functional but there is reason to suggest that aesthetic indication is not negligible.
INTRODUCTION
Orthognathic surgery
Orthognathic surgery is a type of procedure combining both maxillofacial surgery and orthodontics. Discrepancies between dental arches or in relation between maxilla and the mandible can cause functional disorders concerning speech and mastication. More severe discrepancies can also affect the patient’s psychological wellbeing. Less severe discrepancies are possible to correct with orthodontics alone. Orthognathic surgery is required when correcting more severe discrepancies as this involves skeletal disharmony in addition to discrepancies between dental arches and discrepancies in interrelations between jaws (Reyneke, 2003).

There are various types of surgical procedures and techniques, which can be applied depending on the indication(s) for orthognathic surgery and the nature of the dento-facial deformity. In situations with greater discrepancies, a combination of maxillary and mandibular procedures may be needed, due to the relation between the magnitude of the movement and stability after surgery, to avoid risking significant relapse. When treating combinations of discrepancies or facial asymmetry, both maxillary and mandibular surgery may be needed as well. Moving the maxilla up and the mandible forward is considered to be the most stable movement, whilst moving back the mandible, widening or moving down the maxilla is considered to be the least stable movement, with a higher risk of relapse (Proffit et al., 2007).

Surgical procedures
Maxillary surgical procedures
Le Fort I osteotomy is a surgical technique which is performed to correct discrepancies regarding vertical and sagittal relation. The surgery is performed with an osteotomy subapical to the teeth but inferior to the infrayzygomatic crest from the piriform aperture to the pterygo-maxillary junction. Osteotomy is also performed on the nasal septa and the tuberosity is separated from the pterygoid plates. Osteotomy of these strategic structures enables the displacement of the maxilla to a new desired position, where it is rigidly fixed to correct the vertical and/or sagittal discrepancies (Reyneke, 2003).
When a narrowing or widening of the dental arch is needed, or a level of the occlusal plane is desired, a segmental Le Fort I can be performed. This procedure differs from a Le Fort I mainly in the way that the maxilla is split into segments. Le Fort II and Le Fort III osteotomies are similar to the Le Fort I but the Le Fort II involves osteotomies to the orbital floor and the Le Fort III osteotomy involves the lateral orbital rim and zygoma (Reyneke, 2003; Miloro et al., 2004).

Surgically assisted rapid maxillary expansion (SARME) is a distraction osteogenesis procedure expanding the maxilla transversally, using either a tooth-borne or a bone-borne distractor after surgery. The surgery is performed by a corticotomy from the piriform aperture to the pterygo-maxillary junction followed by a vertical osteotomy at the anterior nasal spine and the median palatal suture in order to separate the maxillary halves. The transversal widening is performed by the distractor (Koudstaal et al., 2005).

**Mandibular surgical procedures**

The Bilateral sagittal split osteotomy (BSSO) has a wide range of indications and can be used in almost every possible movement, which includes the entire horizontal ramus of the mandible. The surgical procedure starts with a horizontal cut through the lingual cortex of the vertical ramus above the mandibular foramen. The sagittal cut through the cortex follows the oblique line. The final osteotomy before the split is a vertical osteotomy through the buccal cortex in the mandibular body (Miloro et al., 2004). Intraoral vertical ramus osteotomy (IVRO) is a procedure mainly correcting mandibular prognathism making a vertical cut through the ramus of the mandible proximal to the mandibular foramen (Miloro et al., 2004). The main advantage with IVRO compared to BSSO is a lower incidence of damage of the inferior alveolar nerve. The main disadvantage with IVRO compared to BSSO is the need of maxilla-mandibular fixation (MMF) due to the lack of possibility of rigid fixation between the segments (Ghali and Sikes, 2000; Miloro et al., 2004). A variant of IVRO is the extraoral vertical ramus osteotomy (EVRO), making an extraoral incision, dissecting to get to the inferior border of the mandible before making the osteotomy. This has been advocated for large mandibular setbacks (> 10mm), large vertical moves and difficult facial asymmetries. Except for the risk of scarring and the risk of damaging
the mandibular branch of the Facial nerve, the same risks have been reported as for IVRO (Miloro et al., 2004).

Distraction osteogenesis
Another approach to perform a movement of either the mandible or the maxilla is distraction osteogenesis, where the movement is performed gradually after surgery, using a distractor device. The main advantages of osteodistraction compared to conventional orthognathic surgery is that; it allows the soft tissue to expand simultaneously as the bone expands, it does not require bone grafts, it is possible to repeat surgery at the same site and the fact that it is a simple technique with minimal blood loss (Andersson et al., 2010).

Genioplasty
In cases treating patients with micrognathia, retrognathia, prognathia, chin asymmetry or mandibular vertical height discrepancies, sliding genioplasty is a treatment option, which involves an osteotomy repositioning the chin to the desired position. This procedure is performed together with, or without orthognathic surgery to be able to achieve good aesthetic results, with fairly high predictability in soft tissue response and low complication risk (Guyuron and Raszewski, 1990; Chang et al., 2001).

Indications
Malocclusion
Dental malocclusion is described as a state of the dentition that differs from the optimum functional occlusion, meaning an occlusion that is least likely to cause pathology. Occlusion can be analysed from different dimensions. In a sagittal dimension a dental and skeletal analysis is possible. Dental malocclusions can be due to misplaced teeth only but those can also have a skeletal cause, a result of discrepancies in jaw relationships or, as often is the case, a combination of both. E.g. a skeletal class II malocclusion describes an occlusion where the mandibular position is situated posterior in relation to the maxilla. This can be due to a mandibular retrognathism, maxillary prognathism or a combination of both (Sugawara & Mitani 1997; Miloro et al. 2004; Proffit et al. 2013). In a skeletal class III malocclusion the mandibular position is instead situated anteriorly to the maxilla and is due to mandibular prognathism, maxillary retrognathism or a combination of both.
Vertical discrepancies describe the bite depth, meaning the amount of overbite of the maxillary incisors in relation to the mandibular incisors. A patient can thus have a satisfactory overbite, an anterior open bite or an anterior deep bite (Proffit et al. 2013).

Cross bite and scissor bite are two types of transversal discrepancies. Cross bite is described as an occlusion where the buccal cusps in one or more premolars and/or molars in the upper jaw are situated in the fossae of the corresponding mandibular teeth when occluding, instead of on its buccal surface (Proffit et al. 2013). A scissor bite is when the upper premolars and/or molars bite on buccal surface of the opposite teeth in the lower jaw (Proffit et al. 2013).

Malocclusion may cause decreased masticatory function due to less inter-maxillary contacts, causing a reduced occlusal contact area. On patients who have undergone treatment for malocclusion, e.g. orthognathic surgery, it has been shown that masticatory function is still inferior compared to controls and with no significant improvement directly after surgery. It seems that the masticatory muscle function is decreased after surgery, due to the adaption of the muscles to the new bone position and the stretching of the muscular fibres. After 5 years, studies have shown significant increase in masticatory function (Magalhães et al., 2010). The impact of malocclusion on articulatory speech has been somewhat discussed, with a few studies relating some specific types of malocclusion with misarticulations in speech (Chua et al., 2010). However, today there is no clear evidence between the relationship between malocclusion and speech discrepancies or the effect orthognathic surgery has on speech. Before any conclusions on the subject can be drawn, further and better studies are needed (Hassan et al., 2007). Of importance is that despite an alternative occlusal configuration, if the masticatory system is functioning physiologically and without pathology, there is no need of correction unless there is another indication (Okeson, 2008).

**Temporomandibular disorders (TMD)**

TMD is an umbrella term referring to multiple disorders, meaning that there are multiple aetiologies and therefore also several treatments to affect the different aetiologies (Panula, 2003; List and Axelsson, 2010). TMD includes not only the temporomandibular joint (TMJ) as a source of disorder but includes the entire
masticatory system – meaning the TMJ, masticatory muscles and head and neck-muscles (Okeson, 2008).

Symptoms occur when strain on the masticatory system surpasses its physiological capacity. Some common symptoms are e.g. pain in the TMJ area, limited mouth opening, sounds in the TMJ and masticatory muscle wear (Panula, 2003; Okeson, 2008). Approximately ¼ of patients in a general population claim to have symptoms but only about 5% have symptoms severe enough to seek treatment. Epidemiological studies also show that women are over-represented regarding to experiencing symptoms (Magnusson et al., 1993; Panula, 2003; Okeson, 2008). There are several treatments undertaking TMD including surgical therapy which is advised to be enforced first after attempts with less invasive treatments (Panula, 2003; List and Axelsson, 2010).

The literature describes a wide range (14-97%) of orthognathic surgery patients having TMD before surgery (Fujimura et al., 2004; Al-Riyami et al., 2009). It can also be concluded that a majority of the patients who had TMD and underwent orthognathic surgery were women (Phillips et al., 1997; Fujimura et al., 2004). Even though there is no great evidence that orthognathic surgery cures or prevents TMD, questionnaires conveyed that 26% of the men and 46% of the women stated this as a strong motivation for undergoing orthognathic surgery (Phillips et al., 1997). When it comes to patient satisfaction there seems to exist a correlation between severe symptoms of TMD preoperative and a lower patient satisfaction postoperative (Fujimura et al., 2004).

Generally, systematic reviews (Cascone et al., 2008; Al-Riyami et al., 2009) show that TMD symptoms decreases rather than increases after orthognathic surgery, that joint clicking also tends to decrease but that joint crepitus tends to stay the same. The movement ability often decreases after surgery, but goes back to a normal state two years after surgery.

Despite the results these reviews conclude that it is difficult to draw any conclusions with great evidence due to the fact that there is a lack of well-designed studies and the heterogeneity between the different study designs. The fact that there is a great
variation in results between the studies is also concerning. A recent, fairly well-designed prospective controlled study draws similar conclusions as the systematic reviews with significant decrease in myalgia, arthralgia and disc displacement with reduction, but the authors conclude that more studies on the subject, with similar study designs are needed (Abrahamsson et al., 2013).

**Preprosthethics**
Concerning preprosthetic surgery the main goal is to achieve a biology that allows supportive or retentive mechanisms to make prosthetic rehabilitation possible and thereby achieving a functional dentition and satisfying aesthetic demands (Miloro et al., 2004). In the edentulous patient, the resorptive pattern of the jaws, accentuates the inter-maxillay discrepancy, moving the mandible anteriorly and the maxilla posteriorly from a sagittal direction. This movement can lead to problems reconstructing the teeth and jaws with both fixed and removable prosthodontics (Miloro et al., 2004).

When treating the severe atrophic maxilla with unfavourable intermaxillary relationship, the Le Fort I osteotomy in combination with interpositional bone grafting is an option before implant placement (Sjöström et al., 2007). However, there are rather few and small studies conducted on the subject, and those studies have shown lower survival rates on implant supported fixed dental prosthesis after Le Fort I osteotomy and interpositional bone grafting than on implants placed in native bone (Att et al., 2009).

**Aesthetics**
The importance of aesthetics is described as one of the main reason for patients to going through orthognathic surgery (Thomas, 1995; Chang et al., 2001; Elsalanty et al., 2007). Regarding the ideal facial aesthetic features, there are rules, which deal with these aspects as an attempt to achieve facial harmony and symmetry, anteriorly and sagittaly, e.g. the rule of thirds and the rule of fifths, (Fig 1). The rule of thirds divides the face anteriorly in three equal parts horizontally, in which the lowest part (nasolabial area, lips and chin) in its turn, should be able to be divided into another three equal parts. The rule of fifths divides the face anteriorly in five equal parts, with dividing vertical lines through the lateral and medial canthus, where the nasal area
should be somewhat larger or equal to the intercanthal width and the mouth should not exceed the interpupillary width (Elsalanty et al., 2007).

Regarding the importance of the smile as an aesthetic aspect, the lip line is a major factor. A high lip line is generally considered aesthetically undesirable by surgeons and orthodontists (Peck and Peck, 1995). High lip line is often believed to be a consequence of a short upper lip, but studies have shown no significant difference in lip length between persons with high lip line and persons without. Rather, it seems to be an effect of vertical maxillary excess, meaning that surgical treatment is the only way to treat the cause of the condition (Peck and Peck, 1995).

To achieve good aesthetic results sliding genioplasty may be needed in addition to orthognathic surgery to reach the functional and aesthetic treatment goal. Of the genioplasty patients, 90-98% are very satisfied with the results after surgery. Therefore, genioplasty should be considered in orthognathic surgery cases with high aesthetic demands (Guyuron and Raszewski, 1990; Chang et al., 2001).

It is shown that dental and facial aesthetics are major factors, which can affect patients’ psychosocial condition and self-image. It is therefore important when planning surgery to take the aesthetic aspect in consideration from the start. It is also important for surgeons and orthodontists to have a thorough treatment planning process in which the patient is involved to be at the same level when it comes to the clinical end points. For instance, in certain cases, patients are satisfied with achieving functionality and only a certain improvement of aesthetics and therefore there is no need of surgical treatment. In these cases treatment with orthodontic camouflage may be used instead of orthognathic surgery (Thomas, 1995).

Orthognathic surgery is today a standard treatment in Sweden. However, statistics for frequency and indication for orthognathic surgery in Sweden are today non-existent. The purpose of the study is to, through a survey on all Swedish Oral and Maxillofacial Surgery (OMFS) clinics; examine gender, age, frequency of patients, surgical techniques, indications, and whether patients underwent one- or two-jaw surgery for orthognathic surgery performed in 2011.
MATERIAL & METHODS
To obtain background information, a PubMed search was performed (Table 1). In addition information from textbooks and doctoral theses were used.
In order to identify the current indications and the frequency for orthognatic surgery in Sweden year 2011, a questionnaire survey (Appendix 1) was performed on all (50) Swedish OMFS clinics. The clinics were identified on the official website for the Swedish Association of Oral and Maxillofacial Surgeons. The questionnaire identified gender and age of the patients, surgical techniques, indications, whether patients had undergone surgery on one or both jaws and also frequency of the operations. The questionnaire was coded and reminder letters were sent 4 weeks after the first circular if no response was received, and thereafter if still no response, a personal reminder by e-mail and/or by telephone.
Collected data was enrolled in a spreadsheet in Microsoft Excel by going through the answers by code and by the way they were distributed in the survey questionnaire. Unclear or missing answers were registered.

Ethical consideration
In the questionnaire study no ethical dilemma was found due to the fact that no delicate patient data was treated and because of the fact that the patient data had already been processed by the participating clinics meaning that no patients could be identified.

RESULTS
The survey questionnaire was performed on a total of 50 OMFS clinics of which 47 responded. Two of the three non-responding clinics ceased to exist and one did not reply. A total of 23 (48.9%) of the responding clinics performed orthognathic surgery in the year 2011 on a total of 894 patients, in 16 of a total of 21 counties. Of the patients, 56.2% were women and 43.8% were men (Table 2A), found in every age range but foremost in the age range under 27 years, with most patients in the age range between 19-22 years (57.8%), followed by patients younger than 19 years (21.3%) and patients between 23 and 26 years (11.8%), (Fig. 2A).

A slight majority of the surgeries were performed on a single jaw (55.2%) and bi-maxillary surgery was performed in 44.8% of the cases, though a rather large spread
in distribution between the clinics and the counties was observed (Table 2B). For example, when comparing the two largest counties in Sweden, Skåne län and Stockholms län, it can be observed that a majority of the surgeries in Stockholms län are bi-maxillary (62.7%) whilst the majority of the surgeries in Skåne län are performed in one jaw (61.4%). Generally this divergence can be observed in the rest of the counties as well. Orthognathic surgery in the maxilla was performed on 72.7% of the patients and in 63.4% surgery was performed in the mandible, including both single jaw and bi-maxillary surgery. In addition to traditional orthognathic surgery, genioplasty was performed in 8.8% of the cases. In two cases, subapical mandibular osteotomy and in one case alloplastic chin augmentation was noted as surgical procedures, though not being an alternative in the survey. For more detailed information concerning the specific surgical procedures, see Figure 2B.

According to the OMFS clinics, the main indication for performing orthognathic surgery was mainly functional (89.3%), followed by aesthetic/psychological (9.8%). Few of the surgeries were performed on pre-prosthetic indication (1.0%). In two cases the results regarding aesthetic/psychological indications, there was a grand deviation from the overall results, e.g. in some clinics, aesthetic/psychological was given as the main indication in 60-75%, making the majority of the prevalence. Concerning the correction of the main jaw discrepancies, the most frequent discrepancy was of sagittal nature (47.0%). Correcting vertical jaw discrepancies was the main aim in 13.0% and correcting transversal jaw discrepancies was the main aim in 9.9% of the surgeries. In 30.1% of the cases, the aim was to correct a combination of different discrepancies.

Regarding the incidence of orthognathic surgery in Sweden it is determined to be at least 0.0094% the year 2011 (calculation based on a population of 9.482 855 inhabitants in 2011 according to Statistiska centralbyrå). However, there is a rather large spread between the counties regarding the incidence. The county with highest incidence e.g. had an incidence of 0.0163%, while the county with the lowest incidence had an incidence of 0.0053% (calculations based on the OMFS clinics approximation of the population in their catchment area). For further detailed information of the incidence in each county, see table 2B.
DISCUSSION

The aim of the study was to achieve data on orthognathic surgery performed in Sweden. In our search we found no studies describing the situation of orthognathic surgery neither in Sweden nor in no other country. Year 2011 was chosen for collecting data due to the fact that the probability of there existing recent compiled statistics in the clinics would be greater than if year 2012 would have been chosen. Overall, the answer frequency of the survey was very high, making the data representative for Sweden as a country. As in all survey questionnaires, there are difficulties in knowing the accuracy of the answers from the clinics and knowing how they interpreted the questions.

In two surveys, the clinics chose to answer the questions in percentage instead of numbers. In those cases we recalculated the percentage to solid numbers, in some cases leading to non-whole numbers. When numbers didn’t add up by far, we chose to exclude those results, however, in cases with small discrepancies (1 or 2 units) we chose to include those answers.

The gender distribution, with a small majority towards female patients, was expected and is described in several other studies (Proffit, Jackson, et al., 2013). When it comes to performing surgery in one or two jaws, the large distribution of results is concerning. Today it is well known that the larger the surgical movement, the risk of relapse increases. At the same time, surgery in both jaws may lead to a higher risk of neural and vascular complications, but due to the fact that the magnitude of the movements decreases, the risk of complications may decrease as well. Studies comparing the different risks are needed to reach consensus in which cases two-jaw surgery is preferable to one-jaw surgery.

Our results show that functional indication by far is the main indication for performing orthognathic surgery. Though aesthetics has been noted as one of the primary motivation for surgery for patients, only in 9.8% of the surgeries, aesthetics was given as the main indication. Perhaps this indicates discrepancies between the patient’s expectations and the surgeon’s aim of treatment, which may lead to a result not fulfilling the patient’s expectations. For example, genioplasty, despite being a proven and safe procedure, with high patient satisfaction is performed in less account
than we expected. Possibly, flaws in communication between the surgeon and patient could explain this occurrence. This could also be explained by the fact that the question regarding the main indication in our survey could be interpreted in several ways, depending on the surgeon’s subjective point of view and also the patient’s ability of expressing its main reason for undergoing surgery. For this reason this result means that the other indications, mainly aesthetics, are not negligible. This could also explain the reason why two clinics deviated so considerably from the others.

The incidence of orthognathic surgery in Sweden was somewhat expected but a certain spread can be observed among the counties. This could be due to the fact that some counties did not perform orthognathic surgery (5/21) but instead remitted patients to other counties. The reason for not performing orthognathic surgery could be the proximity to larger OMFS clinics in neighbouring counties, with greater resources for this type of treatment.

**Conclusions**
The results concerning frequency, age and gender distribution in orthognathic surgery was somewhat expected. However, the spread in frequency concerning one- vs. two-jaw surgery between the counties is concerning. The main indication for performing orthognathic surgery in Sweden is by far functional but there is reason to suggest that aesthetic indication is not negligible.

**ACKNOWLEDGEMENTS**
We would like to offer a special thanks to the participating Oral and Maxillofacial Surgery clinics, which have made this thesis possible. A special thanks to Lina Holmström and Hanna Hjelmqvist for their valuable help during this process.
Last but not least, our sincere gratitude to our tutor Mats Sjöström for the guidance, the help and for being a valuable source of knowledge throughout the process with this thesis.
REFERENCES


Table 1. Table demonstrating the search strategy.

<table>
<thead>
<tr>
<th>Filters activated</th>
<th>Search terms</th>
</tr>
</thead>
<tbody>
<tr>
<td>Review, Systematic Reviews, Ranomized Controlled Trial, Clinical trial, Meta-Analysis, Publication date from 1990/01/01 to 2013/12/31, Humans, English</td>
<td>“orthognathic surgery” AND “malocclusion“</td>
</tr>
<tr>
<td>PubMed</td>
<td>&quot;orthognathic surgery&quot; AND &quot;oral surgical procedures, preprosthetic“</td>
</tr>
<tr>
<td></td>
<td>&quot;orthognathic surgery&quot; AND &quot;prosthodontics“</td>
</tr>
<tr>
<td></td>
<td>“orthognathic surgery” AND “temporomandibular joint disorders”</td>
</tr>
<tr>
<td></td>
<td>&quot;orthognathic surgery&quot; AND “age groups” OR “age distribution”</td>
</tr>
<tr>
<td></td>
<td>&quot;orthognathic surgery” and &quot;sex distribution“</td>
</tr>
</tbody>
</table>
Table 2A. Table demonstrating frequency of; gender, single jaw/bi-maxillary surgery, main indication for surgery and dentofacial deformity aimed to correct. Answer frequency in parenthesis in the headline. Data in non-whole numbers if answers in percentage.

<table>
<thead>
<tr>
<th>Number of patients (23/23)</th>
<th>Gender (23/23)</th>
<th>Number of jaws (23/23)</th>
<th>Main indication (21/23)</th>
<th>Dentofacial deformity (14/23)</th>
</tr>
</thead>
<tbody>
<tr>
<td>894</td>
<td>Men: 389.5 (43.8%)</td>
<td>One jaw: 492 (55.2%)</td>
<td>Functional: 751.6 (89.3%)</td>
<td>Sagittal: 180.5 (47.0%)</td>
</tr>
<tr>
<td></td>
<td>Women: 500.5 (56.2%)</td>
<td>Two jaws: 399 (44.8%)</td>
<td>Pre-prosthetic: 8 (1.0%)</td>
<td>Vertical: 50 (13.0%)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Aesthetic/psychological: 82.4 (9.8%)</td>
<td>Transversal: 38 (9.9%)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Combinations: 115.5 (30.1%)</td>
</tr>
</tbody>
</table>
Table 2B. Table demonstrating distribution of patients undergoing surgery, distribution of single jaw surgery/bi-maxillary surgery and incidence in Sweden and in each county separately. Incidence calculated on the clinics self-reported catchment area.

<table>
<thead>
<tr>
<th>County</th>
<th>Number of patients</th>
<th>Single jaw surgeries</th>
<th>Bi-maxillary surgeries</th>
<th>Incidence of orthognathic surgery</th>
</tr>
</thead>
<tbody>
<tr>
<td>Blekinge län</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0.007%</td>
</tr>
<tr>
<td>Dalarnas län</td>
<td>20</td>
<td>9 (45.0%)</td>
<td>11 (55.0%)</td>
<td>0.014%</td>
</tr>
<tr>
<td>Gotlands län</td>
<td>4</td>
<td>4 (100.0%)</td>
<td>0 (0.0%)</td>
<td>0.007%</td>
</tr>
<tr>
<td>Gävleborgs län</td>
<td>41</td>
<td>32 (78.0%)</td>
<td>9 (22.0%)</td>
<td>0.016%</td>
</tr>
<tr>
<td>Hallands län</td>
<td>49</td>
<td>17 (34.7%)</td>
<td>32 (65.3%)</td>
<td>0.008%</td>
</tr>
<tr>
<td>Jämtlands län</td>
<td>9</td>
<td>4 (44.4%)</td>
<td>5 (55.6%)</td>
<td>0.014%</td>
</tr>
<tr>
<td>Jönköpings län</td>
<td>52</td>
<td>39 (75.0%)</td>
<td>13 (25.0%)</td>
<td>0.016%</td>
</tr>
<tr>
<td>Kalmar län</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0.007%</td>
</tr>
<tr>
<td>Kronobergs län</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0.007%</td>
</tr>
<tr>
<td>Norrbottens län</td>
<td>24</td>
<td>22 (91.7%)</td>
<td>2 (8.3%)</td>
<td>0.010%</td>
</tr>
<tr>
<td>Skåne läns</td>
<td>184</td>
<td>113 (61.4%)</td>
<td>71 (38.6%)</td>
<td>0.012%</td>
</tr>
<tr>
<td>Stockholms län</td>
<td>169</td>
<td>62 (37.3%)</td>
<td>104 (62.7%)</td>
<td>0.006%</td>
</tr>
<tr>
<td>Södermanlands län</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0.007%</td>
</tr>
<tr>
<td>Uppsala län</td>
<td>30</td>
<td>10 (33.3%)</td>
<td>20 (66.7%)</td>
<td>0.012%</td>
</tr>
<tr>
<td>Värmlands län</td>
<td>38</td>
<td>26 (68.4%)</td>
<td>12 (31.6%)</td>
<td>0.014%</td>
</tr>
<tr>
<td>Västerbottens län</td>
<td>29</td>
<td>16 (55.2%)</td>
<td>13 (44.8%)</td>
<td>0.011%</td>
</tr>
<tr>
<td>Västernorrlands län</td>
<td>30</td>
<td>18 (60.0%)</td>
<td>12 (40.0%)</td>
<td>0.012%</td>
</tr>
<tr>
<td>Västmanlands län</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0.007%</td>
</tr>
<tr>
<td>Västra Götalands län</td>
<td>113</td>
<td>73 (64.6%)</td>
<td>40 (35.4%)</td>
<td>0.009%</td>
</tr>
<tr>
<td>Örebro län</td>
<td>24</td>
<td>10 (41.7%)</td>
<td>14 (58.3%)</td>
<td>0.008%</td>
</tr>
<tr>
<td>Östergötlands län</td>
<td>78</td>
<td>37 (47.4%)</td>
<td>41 (52.6%)</td>
<td>0.005%</td>
</tr>
<tr>
<td>Total</td>
<td>894</td>
<td>465 (54.9%)</td>
<td>382 (45.1%)</td>
<td>0.009%</td>
</tr>
</tbody>
</table>
Figure 1. Rule of thirds and fifths. Left picture, anterior view, demonstrates the rule of thirds and fifths. Right picture, sagittal view, demonstrates the rule of thirds. Pictures published after permission from the model.
Figure 2A. Bar chart demonstrating the age ranges when surgery is performed.
Figure 2B. Bar chart demonstrating the frequency regarding surgical procedures.

<table>
<thead>
<tr>
<th>Surgical procedures</th>
<th>Number of patients</th>
</tr>
</thead>
<tbody>
<tr>
<td>LF 1 (1-piece)</td>
<td>423</td>
</tr>
<tr>
<td>LF 1 (seg.)</td>
<td>87</td>
</tr>
<tr>
<td>LF 2/3</td>
<td>1</td>
</tr>
<tr>
<td>SARME</td>
<td>70</td>
</tr>
<tr>
<td>MaxD</td>
<td>6</td>
</tr>
<tr>
<td>BSSO</td>
<td>470</td>
</tr>
<tr>
<td>VRO(i)</td>
<td>30</td>
</tr>
<tr>
<td>VRO(e)</td>
<td>11</td>
</tr>
<tr>
<td>GenP</td>
<td>71</td>
</tr>
<tr>
<td>ManD</td>
<td>1</td>
</tr>
</tbody>
</table>

**Explanations**

- **LF 1 (1-piece)**: Le Fort 1 (1-piece)
- **LF 1 (seg.)**: Le Fort 1 (segmental)
- **LF 2/3**: Le Fort 2/3
- **SARME**: Surgical assisted rapid maxillary expansion
- **MaxD**: Maxillary distraction
- **BSSO**: Bilateral sagittal split osteotomy
- **VRO(i)**: Intraoral vertical ramus osteotomy
- **VRO(e)**: Extraoral vertical ramus osteotomy
- **GenP**: Genioplasty
- **ManD**: Mandibular distraction
Appendix 1

Hej käkkirurgiska klinik.

Vi är två tandläkarstudenter (Eusebio och Jesper) på Tandläkarprogrammet, termin 8 Umeå, som genomför ett examensarbete inom kursen Examensarbete, 30 hp. Vår handledare är universitetslektor Mats Sjöström, Odontologiska Institutionen/Käkkirurgiska kliniken i Umeå.


Har Ni några frågor kring enkäten kontakter ni oss via e-mail eller telefon (se nedan).

Tack på förhand för Ert deltagande.

Umeå 30/9-2013

Eusebio Ramirez och Jesper Elenius, Tandläkarprogrammet, T8, Umeå Universitet.
ejel0018@student.umu.se eller telefon 070-6843069

Mats Sjöström
Övertandläkare/Universitetslektor, avd. för käkkirurgi, Umeå Universitet.
mats.sjostrom@odont.umu.se
Enkätundersökning; Frekvens och indikationer för ortognatkirurgi

1. Utfördes några ortognatkirurgiska operationer på er klinik år 2011.

   JA □
   NEJ □

Om Nej, tack för ert deltagande, var vänlig och skicka tillbaka enkäten med det bifogade kuvertet.

Om Ja,

2. Hur många individer bor inom ert upptagningsområde?

   __________ personer

3. Hur många patienter opererades med ortognatkirurgi på er klinik år 2011?

   __________
4. Hur många patienter opererades med ortognatkirurgi i en respektive två käkar år 2011?

   En käke: __________
   Två käkar: __________

5. Hur många män resp. kvinnor opererades med ortognatkirurgi på er klinik år 2011?

   Antalet män: __________
   Antalet kvinnor: __________

6. Hur många patienter i respektive åldersgrupp opererades med ortognatkirurgi på er klinik år 2011?

   <19 år  __________
   19-22 år  __________
   23-26 år  __________
   27-30 år  __________
   31-36 år  __________
   37-42 år  __________
   43-53 år  __________
   ≥54 år  __________

7. Hur många patienter opererades med ortognatkirurgi på er klinik år 2011 där huvudindikationen var följande;

   - Funktionell __________
   - Preprotetisk __________
   - Estetisk/Psykologisk __________
Klinikkod:

8. Av patienterna som opererades med ortognatkirurgi på er klinik 2011 vilken bettavvikelse syftades huvudsakligen till att korrigeras:

- Sagittal avvikelse
- Vertikal avvikelse
- Transversell avvikelse
- Kombinationer

9. Hur många typoperationer genomfördes på er klinik:

- Le Fort I (Hel)
- Le Fort I (Sektionerad)
- Le Fort II alt III
- SARME
- Maxillär distraktion
- Bilateral sagittal ramusosteotomi
- Vertikal ramusosteotomi (intraoral)
- Vertikal ramusosteotomi (extraoral)
- Hakplastiker
- Mandibulär distraktion

Tack för ert medverkande, var god och skicka tillbaka era svar i det bifogade kuvertet.