

Summary

A general introduction on Mandibular Midline Distraction (MMD) and Surgically Assisted Rapid Maxillary Expansion (SARME) was provided in chapter 1. Both MMD and SARME are surgical techniques to widen respectively the mandible and the maxilla using distraction osteogenesis. Hereby, a distractor is used to widen the mandible or maxilla following an osteotomy. The historical context of the techniques was provided as well as the indications and the technical outline of both procedures. At the end, the aims of this thesis were outlined. The general aim was to assess the long-term dental and skeletal effects of MMD and SARME. The other aims were:

- To test the hypothesis that a rigid bone-borne distractor would reduce skeletal tipping and stress on the temporomandibular joint was studied. To introduce a new rigid bone-borne distractor and compare it with a non-rigid distractor.
- To systematically assess the complications in MMD using a bone-borne distractor
- To assess patient experience and satisfaction during and after SARME and MMD
- To assess what has been studied regarding MMD using 3D imaging techniques

A systematic overview of the literature on the clinical aspects of MMD was provided in chapter 2. Concluded was that the feasibility of MMD as a technique to widen the mandible is acknowledged. However, controversies exist including the type of distractor, relapse, patient experience and satisfaction.

A second systematic review was presented in chapter 3, the focus of this review lies on the three-dimensional evaluation of MMD. As three-dimensional imaging techniques are more commonly in use and imaging software have improved since the review presented in chapter 2 this review was performed. The conclusion of this systematical review was that a limited amount of studies have been performed using three-dimensional imaging techniques to assess the effects of MMD in a clinical setting. Little is known on the effects of MMD on soft tissues and the temporomandibular joint. These findings might be an incentive for future studies.

A new rigid bone-borne distractor for MMD was introduced in chapter 4, the Rotterdam Mandibular Distractor. The biomechanical aspects of this bone borne distractor were compared to a non-rigid distractor in an in vitro model with cadaver heads. The results show that a more rotational movement and tipping of the hemi-mandibles were observed in the non-rigid distractor group. This could lead to more stress on the temporomandibular joints using a non-rigid distractor. In addition, more relapse is expected in the non-rigid distractor group due to the unfavorable distraction vector. It is concluded that a rigid bone borne distractor is biomechanically more favorable than a non-rigid distractor.

Few studies have been performed to assess the complication rate of MMD and specifically using a bone-borne distractor. Therefore, in chapter 5 a study was conducted to evaluate the number and type of complications using the Clavien-Dindo classification system. This is a method to grade complications in a systematical manner. All the records

of patients who underwent MMD in the Erasmus Medical Center, Rotterdam the Netherlands between 2002 and 2014, were retrieved and hand searched for complications. Most of the complications encountered are mild and related to the distractor itself. It was suggested that due to the position and method of fixation of the distractor more dehiscences are to be expected than in tooth-borne distractors. Together with the need for a second operation to remove the distractor, a shift in clinical care is made towards the use of a tooth-borne distractor. In general, MMD was regarded as a safe method to widen the mandible.

In literature little is known on the long-term effects of both MMD and SARME. As the stability on the long-term is essential for the decision to perform MMD and SARME, long-term effects of these treatment modalities were presented in chapter 6 and 7.

In chapter 6 a study on the long-term biomechanical effects of MMD was presented. In this study patients who underwent MMD were followed at fixed time points, before and after surgery. To assess the biomechanical effects of MMD, dental casts and posterior-anterior cephalograms were made at these time points. To evaluate the long-term stability, a long-term timepoint was added whereby the mean long-term follow-up was 6.5 years. The dental cast analysis showed a significant and sustained widening of the mandibular arch. The most significant increase in widening is observed in the premolar region. On the posterior-anterior cephalograms little and temporary effects are seen in the temporomandibular joint region. This study showed that MMD is a reliable and stable method to widen the mandible.

The long-term biomechanical effects of SARME were outlined in chapter 7. This study is the continuation of the randomized controlled trial performed earlier in our group¹. In this study, the biomechanical effect of bone- and tooth-borne distractors were compared. No significant findings were found in this study between both distractors. Due to the small sample size in the long-term group and the conclusions of the initial study, both groups were combined in this study. Measurements are made on dental casts and posterior-anterior cephalograms. On the long-term, significant increases are seen in the canine, premolar and molar region. In addition, the palatal width increased significantly in the premolar and molar region, indicating bony expansion. The posterior-anterior cephalogram study showed an increase of the maxillary width, no changes are observed in the nasal base region. The conclusion is that SARME is a stable method to widen the maxilla.

In the end it is the outcome we provide for our patients and the quality of life of our patients that matters most. To assess satisfaction and experiences of patients during and after MMD and SARME a study was initiated and presented in chapter 8. In this study two patient cohorts are used. The first cohort consists of a group of patients that was seen during a long-term follow-up recall, 6.5 years postoperatively. The second cohort consists of a group of patients that were followed from pre-operatively until approximately one year postoperatively. The first cohort is asked to respond to a post-surgical patient satis-

faction questionnaire on a 7-point Likert scale. The mean satisfaction rate is 6.4, which can be considered as being high. In the second cohort, patients were asked to respond to a visual analogue scale questionnaire (ranging from 0-10). The questionnaires were answered at fixed timepoints during the first year after surgery. The mean satisfaction rate is 8.0 and did not significantly differ from the pre-operative expectations. In general pain scores are low, although significantly higher pain scores are reported for the MMD procedure directly post-operative. Less hindrance of the distractor is reported in SARME group compared to the MMD group.

In chapters 9 and 10 the results of the studies included in this thesis were discussed, conclusions were drawn, and suggestions for future research were made.

1. Koudstaal MJ, Poort IJ, van der Wal KG, Wolvius EB, Prahl-Andersen B, Schulten AJ. Surgically assisted rapid maxillary expansion (SARME): a review of the literature. *Int J Oral Maxillofac Surg* 2005;34:709-14.