

Is it Necessary to Accurately Know the Response of Facial Soft Tissues to Bone Movement in Orthognatic/Orthofacial Surgery?

¿Es Necesario Conocer con Agudeza la Respuesta de Tejidos Blandos Faciales al Movimiento Óseo en Cirugía Ortognática y Ortofacial?

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SUMMARY: Orthognatic and orthofacial surgery contains procedures designed to correct skeletal facial anomalies, presenting clear aesthetic and functional orientations. Outcomes have demonstrated that the technique is efficient in the short and long terms; nowadays, orthognatic surgery is common in facial surgical practice. Nevertheless, the aesthetic aspects of the indication and results of the surgery make accurate planning a challenge, raising doubts in terms of recognizing the real soft tissue response to the movement produced at bone level. A prospective, multicenter study will be necessary to define this clinical situation? This brief review is an example of how necessary to study new methodologies about the response of soft tissue to bone movements.

KEY WORDS: Orthognathic Surgery; Facial Surgery; Soft/Hard Tissue Ratio.

INTRODUCTION

Orthognatic surgery (OS) causes changes in the shape and position of hard and soft tissues in the face, resulting in modifications to the facial esthetic and function. The esthetic aspects of the surgery are an important element, and predicting the post-operative changes to the soft tissues has gained importance as part of the surgical planning (Mohamed & Perenack, 2014).

OS currently has well-defined and standardized procedures. The osteotomy for mandibular, chin and maxillary deformities is a recognized technique (Obwegeser, 2007) and common in the treatment of subjects with facial deformities or malformations.

In this vein, modifications to sutures, flap designs and additional cosmetic procedures such

as the use of implants in the middle third of the face have optimized the esthetic results (Seah *et al.*, 2012; Mohamed & Perenack, 2014), establishing that the facial soft tissue response is associated with both the movement in the facial skeleton and the additional procedures.

Although bone movements in OS have been assessed in terms of their stability and post-operative behavior (Proffit *et al.*, 2007), the soft tissue response and stability continue to be controversial due in part to inexact data and in part to the surgical planning, traditionally carried out with plaster models and drawings on acetate paper according to the lateral x-ray, and being modified by different types of software that offer more user-friendly, more accurate and faster planning (Swennen, 2014). Therefore, virtual

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planning in OS is a reality and requires constant refinement to achieve safety in the planning in both facial hard and soft tissues.

The variety of diagnoses and pathologies with facial deformities has revealed some relations between hard and soft tissues. However, the variables included in these studies are depended on factors related to the pre-operative, intraoperative and post-operative stages. A recent study by San Miguel Moragas *et al.* (2014) established that the response of soft tissues to the movement of bone tissue is likely related to: 1) variations in the patients: ethnicity, age, 2) variations in the surgery: execution of V-Y suture, additional procedures such as the installation of facial implants or rhinoplasty, need for mandibular rotation, position and change of angulation of anterior teeth (rotation of the occlusal plane), 3) variations in the study: quality of the x-ray image from which the measurement is taken, points selected to take the measurement, direction selected to take the measurement and others.

RESPONSE OF SOFT TISSUES TO BONE MOVEMENT

There is information published in the orthodontic and surgical literature reporting on different measurements in hard and soft tissues, determining a response with variations associated with factors that are not always recognized.

Thus, Keeling *et al.* (1996) reported that the soft tissue response decreases quickly between 2 and 6 months after surgery, but after 6 months there are limited variations, evaluated in follow-up of up to 2 years.

Koh *et al.* (2004) conducted a study on 35 Chinese patients by studying cephalometric x-rays in the post-operative stage using experimental software. They determined important variations between surgical prediction and post-operative results, and one of the probable causes they indicated lies in the fact that bimaxillary surgeries have greater variations in the results compared to monomaxillary surgeries. They also reported that variables like soft tissue thickness, muscle position and tonicity and soft tissue length can influence the study pre- and post-

operatively. Conversely, Chew (2005), using the same methodology, reported variations in the soft tissue response to surgery of the middle third due to modifications in the surgery such as the removal of the anterior nasal spine and modifications to the lip suture.

Another relevant aspect in this discussion was raised by Joss *et al.* (2010), who presented a systematic review on the effect of the mandibular sagittal osteotomy on soft tissues, concluding that there are no satisfactory evidence-based medicine studies, since the studies analyzed are deficient in methodology, number of patients, study design, and other issues.

In terms of what numerical data exists regarding the relationship between bone tissue and soft tissue, the effects of mandibular advancement on soft tissues have determined that pogonion presented changes between 108% and 97% in cases of mandibular advancement, although the authors also indicated there are different parameters among class II subjects with different degrees of angulation of the mandibular plane, which generates a new variation in terms of soft tissue response to mandibular bone movement (Iizuka *et al.*, 2004).

Landes *et al.* (2002) showed significant variations in mandibular advancements, up to 105% of the advancement, whereas mandibular setback was 66% of the initial proportional value. Also in mandibular surgery, Ewing & Ross (2003) presented less consistent results when the mandibular surgery was evaluated in conjunction with genioplasty compared to mandibular surgery exclusively, which could determine that genioplasty may contribute to modifications in the somewhat unexpected soft tissue response.

Nevertheless, in chin advancements, Lines & Steinhauser (1974) reported values where the advancement of the lower lip in relation to tooth level had a relationship of 0.66:1 and soft pogonion a 1:1 relationship with bone advancement. Park *et al.* (2014) found that in chin setbacks, a stable relationship was observed with a support of 0.9:1 at the Li point, 0.7:1 at sPg and 1:1 at the sMe point. Others studies, like that of Marsan *et al.* (2009a, 2009b), have

shown results that contrast with others reported in the literature, so that it is not yet possible to count on clear and necessary data in terms of the hard tissue/soft tissue relationship.

In the analysis of the facial middle third, Conley & Boyd (2007) concluded that the soft tissues in relation to the upper incisor were in a relationship 0.9:1 with soft tissues when rotational movements of the maxillomandibular complex were studied in patients with obstructive sleep apnea. Conversely, Marsan *et al.* (2009b) found different values for bimaxillary surgical movements where the middle third always showed lower values for the hard tissue/soft tissue relationship compared to the mandible. Relationships of 0.3 between hard and soft tissues were reached, identifying a significant standard deviation among the evaluations.

Although it is not yet possible to collect objective data in the studies conducted, the data currently presented depend on the variables of the patient, the surgery and the technology applied for the morphometry. In addition, the quality of some published studies does not allow extrapolation of the data to define the relationship between hard and soft tissues.

For this reason, it is necessary to define with greater objectivity the numerical data regarding the interconnectedness between hard and soft tissues in subjects of different races and ages, through a multicenter prospective study, based on current technology, and with a sufficient number of patients to be used as elements of surgical planning in the new methodologies applied to orthognatic and orthofacial surgery.

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RESUMEN: La cirugía ortognática y ortofacial contiene procedimientos destinados a corregir anomalías del esqueleto facial, presentando claras orientaciones funcionales y estéticas. Los resultados han demostrado que la técnica es eficiente en el corto y largo plazo; hoy en día, la cirugía ortognática es común en práctica quirúrgica facial. Aun así, los aspectos estéticos de la indicación y resultados de la cirugía hacen que la planificación quirúrgica sea desafiante, eliminando dudas sobre el reconocimiento de la real respuesta de los tejidos blandos al movimiento producido a nivel óseo. ¿Un estudio prospectivo, multicéntrico será necesario para definir esta situación? La presente revisión corta es un ejemplo de cuan necesario es estudiar nuevas metodologías par entender la respuesta de los tejidos blandos a los movimientos óseos.

PALABRAS CLAVE: Cirugía ortognática; Cirugía facial; Relación tejidos blandos/duros.

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