



Distraction osteogenesis in the treatment of temporomandibular dysfunctions

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ABSTRACT: Introduction: Distraction osteogenesis is a surgical technique in which two bone segments are gradually separated at the level of the condyle to promote and favor the formation of reparative and regenerative bone and cartilage tissue. **Approach and justification:** Temporomandibular disorders constitute one of the main causes of attention in the clinical practice of dentistry. Understanding this type of disorders allows the clinician to identify the appropriate phase in which the dysfunction should be treated. **Objective:** To evaluate the technique of distraction osteogenesis associated with TMJ ankylosis as a corrective interventional therapy and potential regenerative approach. **Methodology:** A search was performed in the database (Pubmed) considering the keywords: distraction osteogenesis, neocondyle regeneration, regenerative therapy, osteotomy, condylar regeneration, distraction device; articles were selected with a 6-year restriction. Results: In the craniofacial team setting the orthodontist assists in planning distraction surgery, developing or adapting distraction devices and in managing post-surgical outcomes. **Conclusion:** The distraction osteogenesis technique represents a multidisciplinary alternative for the treatment of temporomandibular disorders associated with the integration of new diagnostic and planning technologies; although this alternative has certain advantages over other techniques, it presents certain limitations that can be eradicated by including regenerative therapy to the therapeutics associated with this clinical intervention.

KEYWORDS: Distraction osteogenesis, neocondyle regeneration, regenerative therapy, osteotomy, condylar regeneration, distraction device.

I. INTRODUCTION

Osteogenic distraction is a process in which new bone formation occurs between two segments that are gradually separated by incremental traction.^{1,2} Thanks to this it is possible to guide the bone formation taking into account the orientation in space to form a structural part of bone that is distracted. This technique was first used by Codivilla for femur lengthening, then McCarthy, et al. applied it to the craniofacial skeleton of children with congenital craniofacial anomalies.³

Temporomandibular disorders (TMD) constitute a complex and heterogeneous group of clinical conditions and alterations that affect the temporomandibular joints (TMJ), masticatory musculature, teeth and supporting apparatus, and therefore represent an important challenge for specialists in stomatology, because they represent an area of health with wide controversies in etiology, diagnosis and treatment.⁴

In general, TMD affect more than 50% of the world's population. Prevalence studies have shown that they are relatively frequent in the general population and it is estimated that 65% present at least one sign and 35% present at least one symptom, a product of the combination of malocclusion, emotional tension, stress and anxiety, among other psychogenetic factors, depending on the physiological tolerance or adaptive capacity of the individual.^{5,6}

II. METHODS

The aim of this study was to evaluate the technique of distraction osteogenesis associated with TMJ ankylosis as a corrective intervention therapy and the potential regenerative approach. To find this relationship, a database search was performed (Pubmed) considering the keywords: Distraction osteogenesis, neocondyle regeneration, regenerative therapy, osteotomy, cellular therapy,



condylar regeneration, distraction device, TMJ reconstruction. articles were selected with a 6-year restriction.

III. DEVELOPMENT

TMJ Dysfunction

Temporomandibular dysfunction syndrome is a disorder that comprises a set of signs and symptoms related to the structures of the stomatognathic system. The presentation of a disorder of this type ends up affecting the masticatory musculature, the TMJ and the structures related to it.⁷

Ankylosis, defined as a bony or fibrous adhesion of the condyle to the glenoid fossa, is a relatively debilitating condition that results in a restriction of the mouth opening, limits functional movements, if it occurs during the growth phase produces severe facial asymmetry which in turn causes difficulty in chewing, swallowing, speaking, airway obstruction, among others.^{8,9}

Distraction Osteogenesis

It is a procedure performed surgically in which two bone segments are gradually separated so that new bone and soft tissue can form between them. McCormick first recommended it in 1997, previous studies have reported several advantages, such as the opportunity for early post-surgical physiotherapy and the simultaneous correction of secondary deformities.^{10,11}

It also provides the opportunity to restore the anatomy and function of the TMJ, prevent facial deformities resulting from surgical procedures, as well as in cases of ankylosis, congenital deformities, trauma and tumors involving the TMJ. Create new bone without the need for bone grafting thus avoiding the morbidity of any donor site.¹²

Distraction Osteogenesis for treatment of ankylosis.

This technique allows reconstruction of the neocondyle in the craniofacial region, without the need for autogenous grafts or alloplastic materials thus reducing complications at the donor site. Distraction for condyle reconstruction is known to have beneficial effects on the harmony of the craniofacial complex and induces modification of the balanced muscles and soft tissues around the TMJ.^{12,13}

Neocondyle distraction is a novel approach to reconstructing the unity of the ramus and condyle, thereby restoring physiologic function of the TMJ, simultaneously correcting hard and soft tissue deficiency and preventing reankylosis.

With proper technique and patient compliance, it is a safe, predictable and effective procedure for TMJ reconstruction.⁸

Like any surgical technique, it has advantages since it does not require bone harvesting as it uses native bone, and it does not require patients to restrict TMJ movements in the postoperative latency period and in the lengthening phase. As for its disadvantages, it requires two operations for device placement and subsequent removal, subject to patient adaptations and physiological loads, and the difficulty of controlling the distraction vector.^{13,14}

Surgical Planning Technology Assistants

Three-dimensional virtual surgery simulation can help clinicians determine the optimal vector and amount of distraction with high accuracy in complex cases requiring simultaneous correction of a hypoplastic mandible and facial asymmetry. Considering the ultimate goals of condyle reconstruction, distraction osteogenesis can be considered an effective means of condylar reconstruction for an anatomic and functional TMJ with minimal complications. The use of 3D models can help make complex TMJ reconstruction procedures, such as distraction osteogenesis of condyle carriage, simpler and a more commonly chosen approach.^{12,15}

Regenerative Therapy

Numerous studies report that mesenchymal stem cells (MSCs) secrete a variety of growth factors and cytokines, and that paracrine effects of growth factors and cytokines secreted by implanted MSCs can promote tissue repair. Mesenchymal stem cells in conditioned media are reported to contain numerous growth factors such as insulin growth factor-1, vascular endothelial growth factor, and transforming growth factor which accelerate osteoblastic differentiation and bone regeneration. After a series of previous studies, it was revealed that some of the secretomes induce cell proliferation, cell recruitment, osteogenesis, osteoclastogenesis and angiogenesis. In this way, a greater control of the distraction process could be achieved by making use of regenerative medicine.¹⁶

IV. CONCLUSION

The use of distraction osteogenesis offers the possibility of correcting temporomandibular pathologies, this surgical technique has been improved through the use of new diagnostic and planning technologies, this alternative has certain advantages over other techniques, however it also has limitations that can be eradicated by including regenerative medicine and biomaterials, it is



suggested to continue researching about the application of these since most studies are limited in terms of time and cost.

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