Editorial

"DISTRACTION OSTEOGENESIS" AN EMERGING CONCEPT IN THE CORRECTION OF CRANIOFACIAL DEFORMITIES

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Correction of complex craniofacial deformities in anteroposterior, transverse and vertical planes, is one of the most challenging problems in oral and maxillofacial surgery.

Facial development depends upon primary interactions between genetic instructions for morphogenesis and the capacity in the local tissues for the unhindered completion of complex metabolic processes, which are necessary for cell replication, survival and programmed cell death. Morphogenesis and growth may be influenced by factors as diverse as chromosomal anomalies on one hand resulting in congenital deformities such as Craniofacial scoliosis, Goldenhar, Nager's, Pfeiffer's and Pierre Robin syndromes, which have got multifocal involvement like mandibular hypoplasia, facial asymmetry with deviation of the chin to the affected side, hypoplasia of the investing soft tissues, associated with microtia; interacting environmental factors on the other hand like mandibular growth deficiencies resulting from condylar fractures and temporomandibular joint ankylosis suffered at an early age, causing considerable aesthetic deformity and functional disability. All these defects require invasive treatment to achieve functional growth as well as quality of the final aesthetics.

Skeletal deformities like maxillomandibular hypoplasia, facial asymmetry, congenital micrognathia and other such deformities, have been managed in the past by osteotomies either on the mandible or maxilla or both, followed by acute orthopaedic movements and skeletal fixation, with or without interpositional bone grafts. However, these treatment modalities have several limitations such as impaired vitality of toothbuds, neurological incompetence and inability of the muscles and soft tissues to be acutely stretched without the inherent risk of relapse. Moreover, various types of autogenous bone grafts, harvested from a distant site, allogenic and xeno-grafts and prosthetic implants used to camouflage and correct these defects, are associated with a high rejection and relapse rate, a requirement of blood transfusions, prolonged maxillo-

mandibular fixation and tracheostomies. Surgical interventions to correct these deformities permit only acute changes in the spatial arrangement of bones with limited scope for new bone growth. It does not allow complete bone sculpting, i.e. changing the shape and form of the bones to deal with the three-dimensional structural, functional and aesthetics needs of the patient.

An alternative approach of "Distraction osteogenesis" to correct these deformities is a new horizon in the field of craniomaxillofacial reconstructive surgery. This is a versatile technique directed at modulating de novo bone growth and involves stimulation of the genetically in built potency of the local tissue to increase in bulk, rather than transfer of it from another site.

The concept of Distraction osteogenesis popularized by Gavriel Ilizarov [1] in correction of deformities of long bones, such as the femur, was first tried by Snyder [2], experimentally in dogs, for mandibular reconstruction. The technique was then successfully applied to the craniofacial region by McCarthy [3] who lengthened the malformed human mandible. Subsequently, other case reports using different types of distractors have been published, with encouraging results. The latter half of the last decade has witnessed a resurgence of this technique which has become increasingly popular and opened new therapeutic perspectives for the treatment of numerous congenital and acquired craniomaxillofacial deformities, the most commonly encountered one being, mandibular hypoplasia with facial asymmetry as a consequence of temporomandibular joint ankylosis resulting from trauma.

In Distraction osteogenesis, tissues are subjected to slow and steady physiological traction and become metabolically activated with increased biosynthetic cellular function and proliferation. There is generation of new bone in a gap between two bone segments in response to the application of a graduated tensile stress across the bone gap. A unique feature of the distraction technique is that bone regeneration by distraction osteogenesis is accompanied by simultaneous expan-

sion of the functional soft tissue matrix, including blood vessels, nerves, muscles, skin, mucosa, fascia, ligaments, cartilage and periosteum. These adaptive changes of the surrounding soft tissues through the tension that is generated by the distraction forces applied on the bone, is also termed as "Distraction histogenesis".

With the advent of miniaturized intraoral distractors [4], the technique of distraction osteogenesis has drastically transformed the concept of correction of maxillofacial deformities. They have manifold advantages [5] over the extraoral distractors in that they improve patient acceptability and compliance during the consolidation phase because they are inconspicuous, having no external component; eliminate skin scarring caused by translation of transcutaneous fixation pins; reduce proneness to get traumatized; limit risk to neurovascular bundles (branches of facial and inferior alveolar nerves); enable invisible distraction of the mandible, thus doing away with frequent monitoring and limitation on social life [6]; and improve stability of the attachment of the device to the bone [7].

Vertical or horizontal distraction [8] of the ramus or body of the mandible respectively, or combinations of both can be accomplished by performing a corticotomy at the desired location and positioning the intraoral distractor appliance in a linear, vertical or angular direction. After a latency period of 5 to 7 days postoperatively to allow for soft tissue healing and formation of soft callus, the bones on either side of the osteotomy are slowly distracted apart at the rate of approximately 1 mm per day at a distraction rhythm of twice or thrice a day, until the desired length and contour is achieved, after which the device is left implanted for a contention period of 8 to 16 weeks, as a means of stable, neutral fixation for allowing consolidation of the bony regenerate [9]. In this way, a true three-dimensional reconstruction of the growth retarded mandible is achieved uni-or bilaterally.

This treatment modality is a relatively minor surgical procedure vis-a-vis osteotomies and bone grafting procedures for maxillo-mandibular reconstruction, thus avoiding a prolonged hospital stay and permitting early return to employability. It also eliminates the necessity of bone grafts and associated donor site morbidity, need for implants and problems of incompatibility and the requirement of maxillo-mandibular fixation. As native bone is created, it enables the surgeon

to have post-operative control allowing the procedure to be stopped at any point of time according to requirement of the case [10]. It also provides good long-term stability, since locally regenerated original bone is created along with appropriate neuromuscular re-adaptation and stimulation of the efficiency of the reduced functional matrix in the region, thus yielding aesthetic results that are much superior to those obtained by skeletal surgery or by soft tissue surgery done independently, or by combination of both [11].

This technique is a successful and exciting proposition in reconstructive surgery for patients with a variety of craniofacial deformities involving the jaws and dentoalveolar processes and offers new hope to patients with severe facial abnormalities without undergoing invasive surgical procedures.

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