

Impact of Mandibular Condyle Fractures on Facial Growth in Growing Patients (The Importance of an Early Diagnosis)

Patrizia Defabianis*

Associate Professor, Department of Surgical Science, Section of Pediatric Dentistry, CIR-Dental School, University of Turin, Italy

***Corresponding Author:** Patrizia Defabianis, Associate Professor, Department of Surgical Science, Section of Pediatric Dentistry, CIR-Dental School, University of Turin, Italy.

Received: March 17, 2020; **Published:** April 10, 2020

Abstract

The knowledge of what happens to the stomatognathic system when some of its parts are altered is very important. Normal development of the mandible as well as some portions of the upper jaw and face are related to good function of the masticatory apparatus: the integrity and interaction of bony and soft-tissue structures may be highly disturbed by injury of the temporomandibular joints (TMJ) and result in facial and occlusal disharmonies. An early, correct diagnosis of the pathology is very important as proper restoration of normal anatomy and function is a key-point in the success of treatment. Unfortunately, traumatic lesions of the temporomandibular joint (TMJ) often are overlooked as they can apparently occur with relatively little pain, few clinical signs and without sufficient reaction by the child to obtain the adult's attention regarding the seriousness of the injury. The frequent underestimation of the problem is due to the fact that pain assessment in children is difficult as the mechanisms of pain perception differ somewhat from that in adult people. Only a year or two later, when growth disturbances show up, they are perceived as a problem, but, at that time, the dysplastic growth pattern has stabilized and will continue during years.

This paper outlines a case report that draw attention to how this can occur and the impact this condition may have on facial development. Available data will be illustrated and discussed.

Keywords: Trauma; Condylar Fractures; Children; Facial Growth; Development

Introduction

Diagnosis and treatment of facial trauma must focus not only on direct damage to osseous structures, but also on future disturbances in dentofacial development. A significant part of pediatric dentistry must be concerned with children's growth pattern. Normal development of the mandible - as well as some portions of the upper jaw and face - is related to proper function of the masticatory apparatus. The growth process works toward an ongoing state of composite functional and structural equilibrium: during this process no part can be fully segregated and/or altered without affecting "balance" with other parts, and their state of physiologic equilibrium as well. Facial growth is a process requiring intimate morphogenic interrelationships among all of its component and is the result of numerous interdependent factors. The maxillae, mandible and dental occlusion are considered parts of the postural alignment of the skeletal system: a change in any of them must be proportionately matched by appropriate growth changes and adjustment to sustain and progressively achieve functional and structural balance of the whole [1-3]. In a broad sense, although the basic blueprint of bone is inherent and genetic factors determine the development of bone structure mainly during the prenatal period, the form and architecture may be modified during prenatal and postnatal growth by local and systemic influences. For the cranio-facial-dental complex to function properly, teeth, jaws, masticatory muscles and cranial bones must be in harmony with each other. The net forces transferred to the occlusion (teeth, periodontal ligaments,

bones, mucosa) are dependent on the forces created by the contraction of the closing muscles and on the position of the plane of occlusion relative to the reference horizontal. The relative position of the plane of occlusion to the cranial base determines the direction of the forces generated in the cranium during occlusal function: the vectors of forces created by the closing muscles (mainly the masseter, the medial pterygoid and the temporalis muscles) are directed to the central area of the cranium in a symmetrically balanced way [4,5]. In normally growing patients, the plane of occlusion is level, the mandible, articular disk, and head of the condyles are in good position and the neuromuscular system is in harmony. When the neuromuscular system is in harmony, the mandibular muscles collectively exert their effect on both position and movement of the jaw and the loading of forces on the temporomandibular joints (TMJ) is optimal and balanced. It is a normal condition for the temporomandibular joints to be loaded: the constant tension of the muscles of mastication on the mandible makes this so [6]. The movements of the mandible are automatic, and their patterns are engraved in the memory of neuromuscular mechanism: they obey a reflex command and are in synchrony with the movements of the tongue. The swallowing reflex brings the maxillary and mandibular teeth into contact and the tongue is raised to the hard palate. The vectors of forces created by the closing muscles (mainly the masseter, the medial pterygoid and the temporalis muscles) are transmitted via the palatine, maxillae and vomer to the sphenoid in a symmetrically balanced way. Furthermore, the muscle tension of the TM joint forces the head of the condyles against the articular disks and slope of the articular eminences. In this way the mandibular muscles collectively exert their effect on both position and movement of the jaw and the forces created within the TM joints and transmitted to the temporal bones and to the rest of the cranium are symmetrical [6,7] (See figure 1).

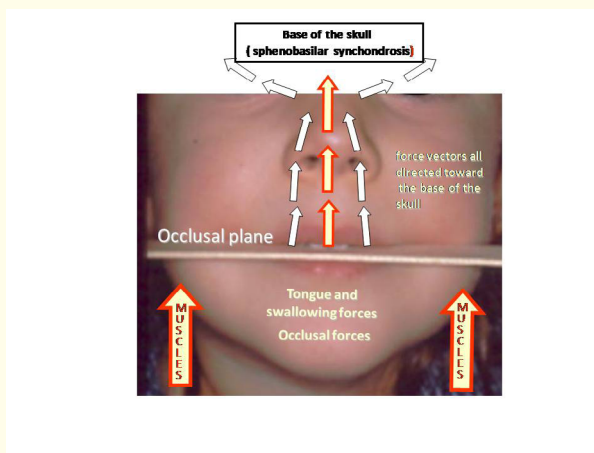


Figure 1: When the plane of occlusion is aligned parallel to the horizontal reference plane, force vectors are all directed toward the base of the skull. In this way the loading of forces on the TM joints is optimal and balanced, creating so conditions for harmonic growth.

Unfortunately, TMJ fractures may alter completely this balance with loss of the support to the mandible against the temporal component and loss of the functional effect of the lateral pterygoid muscle on the mandible. They are generally associated to a more or less severe damage to the capsule and disk and large, adaptive changes may occur in both the fractured and the contralateral condyle. As a resistance, disturbance of mandibular growth and TMJ dysfunction may occur depending on the age of the patient and the fracture site. Furthermore, in cases of TMJ fractures the mechanical restrictions created by scarring and loss of motion may cause morphological alterations of the condylar shape, with modification on their dynamics and alterations in muscular activity [8,9]. If the position of the body of the mandible changes, there is a concomitant change in the position of the condyles in the TM joints: the deviation of the plane of occlusion from its parallel relationship to the reference horizontal, will cause excessive and unbalanced occlusal forces in the system

with consequent pathological results affecting teeth, periodontal ligaments, bone, mucosa, cranium, facial muscles, neck, shoulders, and the rest of the body [9].

When the plane of occlusion is misaligned, the vectors of forces will be misdirected away from the cranial base resulting in a pathological condition. In this way, the distorted plane of occlusion can be a contributing factor inside bending, rotation and torsion of the sphenobasilar synchondrosis. The main consequence of that is that TMJ loading becomes unbalanced in spite of optimal positions of the articular disks and head of the condyles. The forces transmitted to the temporal bones and to the rest of the cranium become unbalanced and this can be a major factor in creating an externally rotated temporal bone on the low side and internally rotated temporal bone on the high one with disharmony in the neuromuscular system causing muscle tension on the cranial attachment points and abnormal forces in the mechanism. Unequal vertical forces generated on the teeth and hard palate during swallowing and chewing, are not transmitted to the sphenobasilar synchondrosis, but are greater on the low side. This phenomenon occurs because the muscles of the high side loose strength due to chronic hypertonicity. The stabilisation of this condition may result in facial alteration and asymmetries [10-12] (See figure 2).

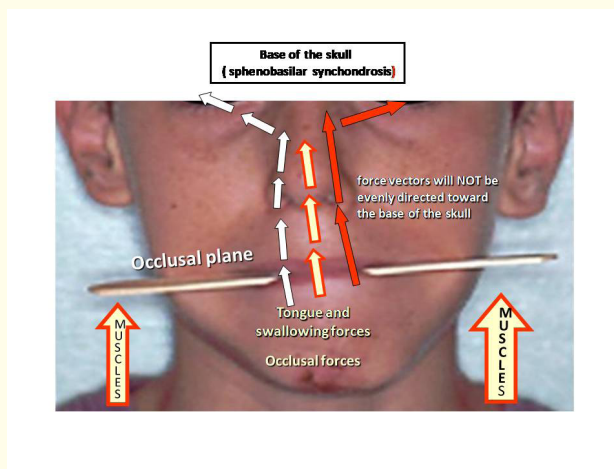


Figure 2: When the plane of occlusion is misaligned and the vectors of force are all misdirected away from the base of the skull, the loading of forces on the TM joints becomes unbalanced and the result is a dysplastic pattern of growth.

Aim of the Study

The aim of this work is to demonstrate how this can occur and the impact this condition may have on facial development to make people aware of the problem.

Case Report

A healthy five-year-old boy was referred to by his pediatrician for an examination because of a developing face asymmetry. The mother stated that the asymmetry had become more evident during the last year. She reported that gestation and delivery of the child had been uneventful: delivery had been vaginal and with no forceps been used. There was a history of trauma to the mandible which occurred at the age of three resulting from a bike fall. On that occasion the boy cut his chin and was brought to his pediatrician, but as he apparently had a relatively minor pain without any disturbances to other structures - neither dental nor facial - no radiographic examination was performed. The slowly developing face asymmetry went unnoticed for two years and then suddenly perceived as a problem. The clinical examination disclosed a facial asymmetry due to a deficiency on the right side, with some apparent effect on adjacent areas of the

maxilla. A shift of the chin (5 mm) towards the right side was evident (See figure 3). Opening movements were within normal limits with a limitation in both protrusive (5 mm) and lateral excursions, particularly on the left (3 mm). The intraoral examination showed a mixed-dentition stage, with a developing second class malocclusion (See figure 4a and 4b).

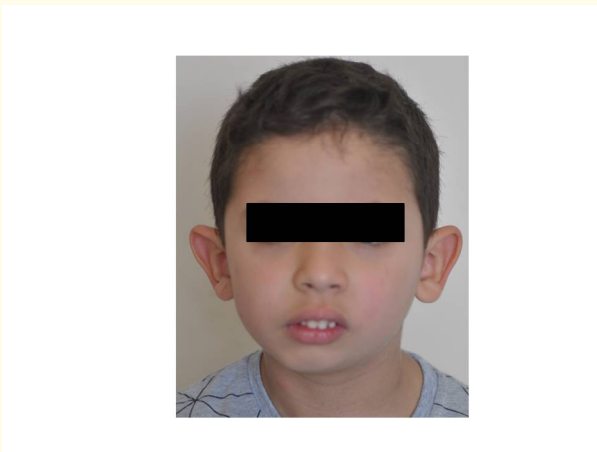


Figure 3: Frontal photograph: a developing face asymmetry with a shift of the chin towards the right side is evident.



Figure 4: Intraoral view at the first visit: a mixed-dentition stage with a developing second class malocclusion can be observe on a) the right and b) on the left side.

The panoramic radiograph showed an evident remodelling of the right condyle and of the right condylar fossa which was more flat when compared to the left one (See figure 5). A postero-anterior cephalometric projection was performed and evidenced an undeveloped ramus on the right side of the mandible (See figure 6). The boy is still under observation to monitor facial growth and development.



Figure 5: The panoramic radiograph shows the remodelling of the right condyle and the right condylar fossa (more flat when compared to the other one).



Figure 6: The postero-anterior cephalometric projection evidences an undeveloped ramus of the mandible on the right side.

Discussion

The integrity and interaction of bony and soft-tissue structures may be highly disturbed by injury of the temporomandibular joints. Early diagnosis of TMJ fractures is mandatory for the prevention of long-term functional and esthetically debilitating sequelae [13], but they are often underestimated because of the limited clinical signs and the relatively little pain reported by the child. Adequate pain assessment in children is often difficult and, sometimes, impossible, particularly in children younger than 10 [14]. This may lead to a delay in diagnosis and treatment with possibly serious consequences for facial development.

Two are the possible causes of a growth deficiency following injuries to the condyle: a loss of stimulus to normal growth and a growth deficiency due to the mechanical restrictions created by scarring and loss of motion. The persistent dysfunction can also lead to disease in the joint secondary to the changes in functional load with morphological alterations of condylar and articulating surfaces [15]. Facial structures have been shown in humans and animals to be strongly dependent on muscular balance. Unfortunately, TMJ fractures can alter completely this balance with loss of the support to the mandible against the temporal component and loss of the functional effect of the lateral pterygoid muscle on the mandible. Particularly, unilateral, displaced fractures cause a shift of the chin towards the injured side and a rise of the mandible of the same side. The subsequent, asymmetric developing sequence acts as a stabilizing factor on face development and osseous asymmetry. Abnormal muscle function on one side of the face or the other can cause joint compression and bone remodelling, and results in aberrations in the occlusal plane in orientation [16-18]. Because the temporo-mandibular joints are compressible and subject to bone remodelling, TMJ loading becomes unbalanced and the forces transmitted to the temporal bones and to the rest of the cranium are misdirected away from the base of the skull. The stabilisation of this condition may compromise the biomechanical environment resulting then in facial asymmetries [19]. In the case described above the consequences of the trauma became evident two years later, when the child began to develop a facial asymmetry because of a lack of growth on the injured side. The spontaneous healing of the displaced TMJ fracture lead to a functional ankylosis which resulted in mandibular deformity and alteration of related structures. After consolidation of mandibular dysfunction and facial maldevelopment, even though the deformity may not be progressive, it is not self-correcting and there is no way to compensate for the loss or retarded growth [19]. The persistent mandibular dysfunction can also lead to disease of the joint, secondary to the changes in functional load: these patients develop quite frequently an arthropathy with skeletal remodelling and alterations in the degree of TMJ loading which may add stress to one or both joints. Late symptoms may also appear on the uninjured side owing to changes brought about by alterations in biomechanical loading of this joint. As a resistance of the mechanical dysfunction, disturbance of mandibular growth and TMJ dysfunction may occur. Facial growth, in these cases, proceeds in close to normal fashion with the imposed initial defect: if not treated, the dysplastic patterns of growth continues and worsens during the years. Unequal vertical forces generated on the teeth and hard palate during swallowing and chewing are greater on the low side as the muscles of the high side loose strength due to chronic hypertonicity [6]. The dentoalveolar compensation for abnormal jaw relationships causes the inclination of the teeth towards their opposites; this capability is provided by the moulding force of the tongue and cheeks and the responsiveness and adaptability of the alveolar bone. Since teeth erupt only until they achieve contact, the decreased vertical height of the affected side of the mandible causes interference with the vertical eruption of the maxillary posterior teeth as well as the mandibular ones [20]. This results in a change in the relation between the dental arches including supracontact between the molars on the fractured side and rotation of the occlusal plane. Clinical expression of these asymmetries are occlusal alterations and the tilting of the occlusal plane when examined in the frontal view with supracontact between the molars on the affected side [21]. Disturbances in the harmonious interplay of the masticatory muscles cause further deviation of the mandible towards the affected side when the patient opens his mouth wide, as well as limitation of lateral excursions towards the unaffected side [7].

Conclusion

Early diagnosis and treatment of TMJ fractures are mandatory for the prevention of long-term functional and esthetically debilitating sequelae. For the above-mentioned reasons, in case of facial trauma, the clinical history of the patient must be evaluated very accurately; overall clinical conditions must be carefully examined, no matter how mild and asymptomatic they may be. Often, there is a diagnostic dilemma, especially when the clinical findings are not clear since a thorough clinical examination and normal occlusion do not rule out condylar head fracture. So, in all face trauma, radiographic examination is highly recommended even if this can be difficult, particularly as far as obtaining satisfactory X-rays. Plain x-rays can contribute to the diagnosis but in many cases are inconclusive, are difficult to interpret and are of limited value. When clinically possible, pantomograms and CT are highly recommended as they may enable detection of fractures and osseous cortical abnormalities that might be missed on TMJ radiograms. CT should be especially considered in cases in which temporal or facial bone trauma is suspected. After a diagnosis has been made, appropriate treatment of the patient is essential to

avoid or, at least, to limit consequences on facial development. Complete regeneration of the condyle is not uncommon in young patients as a result of a remodelling process, with no residual deficiency in function and growth following fractures. Better regeneration occurs in actively growing patients under the age of 12 [22]. The follow-up of these patients must cover the entire period of growth during the mixed dentition stage until the permanent occlusion has become stable.

Conflict of Interest

I declare that there is no financial interest and that no conflict of interest exists.

Bibliography

1. Schellhas KP. "MR of muscle of mastication". *American Journal of Neuroradiology* 10 (1989): 829-837.
2. Pieritz U and Schmidseider R. "Central dislocation of the jaw joint into the middle cranial fossa". *Journal of Oral and Maxillofacial Surgery* 9 (1981): 61-68.
3. Kallal RH., et al. "Cranial dislocation of the mandibular condyle". *Journal of Oral and Maxillofacial Surgery* 43 (1977): 8-19.
4. Raadsheer MC., et al. "Masseter muscle thickness in growing individuals and its relation to facial morphology". *Archives of Oral Biology* 41 (1996): 323-332.
5. Chinnappi As and Getzoff H. "The dental-chiropractic co-treatment of manipulative structural disorders of the jaw and temporomandibular joint dysfunction". *Journal of Manipulative and Physiological Therapeutics* 18 (1995): 476-481.
6. Rocabado M., et al. "Physical therapy and dentistry: An overview". *Journal of Craniomandibular Practice* 1 (1982): 46-49.
7. Waite DE. "Paediatric fractures of jaw and facial bones". *Paediatrics* 51 (1973): 551-559.
8. Halperin G. "Normal asymmetry and unilateral hypertrophy". *Archives of Internal Medicine* 49 (1931): 676-682.
9. Defabianis P. "Treatment of condylar fractures in children and youths: the clinical value of the occlusal plane orientation and correlation with facial development (case reports)". *Journal of Clinical Pediatric Dentistry* 26 (2002): 243-250.
10. Demianczuk AN, et al. "The effect on facial growth of pediatric mandibular fractures". *The Journal of craniofacial surgery* 10 (1999): 323-332.
11. Ingervall B and Thilander B "Relation between facial morphology and activity of the masticatory muscles". *Journal of Oral Rehabilitation* 1 (1974): 131-137.
12. Raadsheer MC., et al. "Masseter muscle thickness in growing individuals and its relation to facial morphology". *Archives of Oral Biology* 41 (1996): 323-332.
13. McGrath PA and Hillier LM. "The enigma of pain in children: an overview". *Pediatrician* 16 (1989): 6-15.
14. MC Bushnell., et al. "Pain perception: Is there a role for primary somatosensory cortex?" *Proceedings of the National Academy of Sciences of the United States of America* 96 (1999): 7705-7709.
15. Lindahal L and Hollender L. "Condylar fractures of the mandible. A radiographic study of remodelling processes in the temporomandibular joint". *International Journal of Oral and Maxillofacial Surgery* 6 (1977): 153.
16. Gionhaku N and Lowe AA. "Relationship between jaw muscle volume and craniofacial form". *Journal of Dental Research* 68 (1989): 805-809.

17. Ingervall B and Helkimo E. "Masticatory muscle force and facial morphology in man". *Archives of Oral Biology* 23 (1978): 203-206.
18. Ingervall B and Thilander B. "Relation between facial morphology and activity of the masticatory muscles". *Journal of Oral Rehabilitation* 1 (1974): 131-147.
19. Okeson JP. "Management of Temporomandibular Disorders and occlusion, 4th Edition, C.V". Mosby Co (1998).
20. Bjork A. "Cranial base development A follow-up X-ray study of the individual variation in growth occurring between ages 12 and 20 years and its relation to brain case and face development". *American Journal of Orthodontics and Dentofacial Orthopedics* 41.3 (1955): 195-225.
21. Halperin G. "Normal asymmetry and unilateral hypertrophy". *Archives of Internal Medicine* 49 (1931): 676-682.
22. Sessle BJ, *et al.* "Effect of functional appliance on jaw muscle activity". *American Journal of Orthodontics and Dentofacial Orthopedics* 98 (1990): 222-230.

Volume 9 Issue 5 May 2020

© All rights reserved by Patrizia Defabianis.