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Short Communication

Behaviour of TMJ in Response to Myofunctional Treatment of Distoclusion

Rohit Kulshrestha*

Senior Lecturer, Department of Orthodontics and Dentofacial Orthopedics, Terna Dental College, Navi Mumbai, Maharashtra, India

***Corresponding Author:** Rohit Kulshrestha, Senior Lecturer, Department of Orthodontics and Dentofacial Orthopedics, Terna Dental College, Navi Mumbai, Maharashtra, India.

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The modern concept of craniofacial growth and orthodontics can be viewed for heuristic purposes as a series of competing theories. These theories occupy a continuum, ranging from a complete emphasis on intrinsic genetic factors to a complete denial of genetic factors and total reliance on functional determinants of facial growth. Emphasis on genetic factors was prominent up to the middle of 20th century, but later been changed towards the functional factor as a growth determinant- the current focus on epigenesist. An offshoot of the nurture side of the nature nurture equation is the 'form-function' principal, which emphasizes the role of biological purpose, behaviour and the environment i.e. 'function' in the production of form. The 'form function' principal is also useful in accounting for the results of grossly abnormal function such as effects of digit sucking on incisor proclination, effects of muscle paralysis on skeletal growth and form, the appearance of muscle attachments on bones etc.

Development of TMJ [1]

Ide., *et al*. (1991) described the changes with age in TMJ i.e. from infancy to adulthood.

The size of the fossa increases by 1.2 to 1.3 times after eruption of deciduous teeth compared to before and it increases again at the beginning of eruption of permanent teeth. The degree of anterior inclination of eminence changes drastically when the deciduous teeth erupt. Eventually it becomes steeper by three times in the permanent dentition than it was before the eruption of deciduous teeth. In new born their free movement of mandible in antero-posterior plane. With increase in overjet there is change in shape of articular surface and small ridge on articular eminence. When deciduous canine and molars erupts, proprioceptive sensory feedback mechanism is responsible for change in TMJ. Still changes occur during eruption of permanent dentition.

Experimental studies of form function relationship [2]

The effect of alerted function on growing craniofacial complex has been studied extensively either cephalometrically or histologically by number investigators in numerous animal experiments. Various devices have been constructed to prompt the lower jaw into a protrusive position, thereby altering the function of muscles associated with the position mandible. Many authors like Brodie (1941), Bjork (1951), Ricketts (1952), Hiniker and Ranfjord (1966), Joho (1968), Breitner (1930, 1933, 1940) believe on genetically predetermined length of mandible. Krogman (1974) reviewed the research pertaining to craniofacial growth and concluded that research in 1920 s-1940's was primarily concentrated on the study of structures of craniofacial skeleton with little or no consideration on functions of stomatognathic system. Early research was based on genomic 'paradigm, with search for norms and standards of craniofacial growth. The primary concern for research was facial growth prediction. Rise of functional paradigm was apparent after the studies of Vander Klaauw (1945) Melvin Moss (1960). This led to the shift from genomic to functional paradigm.

Melvin Moss's work was based on Wolff's findings. Wolff pointed out that shape and internal structure of femur head is closely related to lower extremity function. Trabecular alignment in head of femur reflects the stress trajectory formed in resistance to the functional stresses. This theory concerning relationship of bone morphology and muscle function is recognized in the field of biodynamic as 'Wolff's Law'. Comparative and experimental anatomic research using animal models gave momentum to functional view. In 1960's to 1980's functional paradigm became the dominant view with introduction of functional Matrix Hypothesis by Melvin Moss (1962). According to functional matrix hypothesis, the craniofacial skeleton, like all skeletal structures throughout the body, develops initially and grows in direct response to its extrinsic, epigenetic environment. As stated by Moss (1972), 'bones do not grow, bones are grown'. Craniofacial skeleton does not grow in a primary fashion to permit expansion of the soft tissues, organs and spaces, comprising the functional matrix. Rather translation of skeletal units and associated local transformational bone growth occurs secondarily and in compensatory fashion to growth of functional matrix. It is in particular of growth-related expansion of the capsular matrices that is the brain, eyes, nasal, or and pharyngeal functioning spaces.

Johnston (1976) in his work on craniofacial growth commented 'The functional matrix hypothesis was at least in the beginning, a heuristic synthesis which emphasized the need to consider the form and function of the entire craniofacial complex in order to understand the growth of embedded skeleton. Haupl and Psansky (1939) Hoffer and Colico (158), Baume and Derichsweller (1961) and Stockli and Willert (1971) demonstrated that the condylar cartilages exhibit compensatory tissue responses to the experimental alterations of mandibular position. In histochemical studies, Vogel and Pignanelli (1958) found that experimental protrusion of the mandible in monkeys resulted in an increase in chondrogenic activity at the head of mandibular condyle. In a similar study, Joho (1968) noted an opening of the gonial angle an in increase in the mandibular length.

Petrovic, Stutzman and associates (Charlier 1967, Charlier, Petrovic and Hermann 1968; Charlier, Petrovic Stutzman 1969, Lemoane, Charlier and Petovic 1968, Petrovic 1976, 1972, Petrovic Oudet and Gsson 1973; Petrovic 1974, 1975a, 1975, Stuzmann 1976) in a series of animal studies on rats reported that anterior displacement of the mandibular condyle resulted in n increased growth of the condylar cartilage. They found highly significant intensification of local alkaline phosphatase activity indicating a increase in endochondral ossification of the condylar cartilage site. James McNamara in 1981 studied the relationship between form and function in both the growing and non-growing individual. Experimental studies in non-growing rhesus monkeys were cited as an example of the closed relationship between the presence and function of the masseter muscle and the resulting osseous adaptations at the gonial region. Three experiments are also described in growing monkeys in which the function of the mandibular condylar is altered. Increased growth of the mandibular condyle is shown following functional protrusion and intermaxillary traction experiments while a decrease in mandibular growth occurs following intermaxillary fixation. These experimental studies demonstrate the close relationship between the functional and structural components of the craniofacial region.

Alexandre G Petrovic, Jeanne J Stutzmann and Nicole Gasson in 1981 investigated the effect of appropriate orthopedic appliances on the rat mandible and studied the increase in the condylar cartilage growth rate and growth amount. i.e. the mandible becomes longer than that of control animals. Periodic increase in the thickness of postural hyperpropulsor results in a new increase in lateral pterygoid muscle activity as recorded electromyographically (and, certainly a new increase in solicitation of the retrodiscal pad activity) and consequently, brings about new increase in the rate and amount of condylar cartilage growth was removed after the growth of animal was completed. No relapse was observed. When the appliance was removed before growth was completed no significant relapse was detected if a good intercuspation had been achieved during experimental phase; if a good intercuspation had not been achieved, the 'comparator' of servosystem imposed an increased or decreased condylar growth rate until a state of intercuspal stability was established. Functional maxi propulsion involving periodic forward repositioning appears to be the best procedure to elicit orthopedically mandibular overlengthening. No genetically predetermined final length of the mandible could be detected in these experiments.

Jos M.H. Dibbets, Robde Bruin, Leo Th. Van del Weele in 1986 found that adolescent mandibular growth sometimes proceeds in less regular manner than is generally assumed. Growth processes of the mandible do not always proceed at uniform rate for corpus and ramus, concluding that the growing mandible may favour ramus and corpus alternatively. This finding tends to support those theories that postulate local control factors for mandibular growth. Illing, Morris and Lee (1998) found that Bionator and Twin block appliance demonstrated a statistically significant increase in mandibular length with anterior movement of Pog and Pt. B. TBA group showed forward movement of Pt. A due to change in inclination of mandibular plane. Ratner Toth and James McNamara (1999) done retrospective cephalometric study to compares the treatment effects produced in 40 patients treated with the Twin-block appliance to those seen in a matched sample of 40 children treated with the FR-2 appliance of Fränkel and to changes undergone in 40 untreated Class II controls from The University of Michigan Elementary and Secondary School Growth Study. The average starting ages for the Twin-block, Fränkel, and control groups were 10 years 5 months, 10 years 2 months, and 9 years 11 months, respectively. The T2 to T1 observation period was adjusted to an average of 16 months for all groups. Significant decreases in overbite and overjet were observed at the end of treatment in the Twin-block and Fränkel groups. Compared with the untreated subjects, statistically significant increases in mandibular length were observed in both treated groups. The Twin-block patients achieved an additional 3.0 mm of mandibular length, whereas the Fränkel group increased 1.9 mm more than did the controls. No significant restriction of midfacial growth was observed in either functional appliance group relative to controls. A significant increase in lower anterior facial height was evident in both treatment groups. Vertical increase in the Twin block patients was significantly greater than in the FR-2 group. In general, more extensive dentoalveolar adaptation was observed with the tooth-borne Twin-block appliance than with the more tissue-borne FR-2 of Fränkel. The Twin-block and FR-2 samples both showed significant retroclination and extrusion (eruption) of the maxillary incisors. The Twin-block patients also exhibited distal movement of the upper molars; however, there was no extrusion. Slight lower incisor proclination was noted in both treatment groups, and lower molar extrusion was found to be significantly greater in the Twin-block group compared with the other 2 samples. No horizontal differences were detected in the lower molars among groups. The present study suggests, therefore, that Class II correction with the Twin-block appliance is achieved through normal growth in addition to mandibular skeletal and dentoalveolar changes. Class II correction with the FR-2 is more skeletal in nature, with less dentoalveolar changes noted.

Bibliography

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