Fundamental Principles and Basic Characteristics of Functional Orthopedic Techniques

Wilma Alexandre Simões, C. D.*

Preliminary Report

Planas' laws of development and minimum vertical dimension and the study of his work, as well as those of other great masters, on the various functional orthopedic appliances, led us to the basic characteristics common to all of them. of these, undoubtedly, two fundamental principles can be used to dotermine whether the techniques applied in orthodontic treatment can or cannot be considered functional.

I. Introduction

Orthodontics is the speciality which uses all know technical means, trying to improve them at each step, to correct anomalies resulting from lack of correct jaw development and consequent bad dental positions ; the study of elementary subjects becomes therefore essential. Starting with the knowledge of what is normal during a whole life, orthodontics delves into physiopathology perfecting techniques.

Rickets' Begg's Edgewise's and others are techniques used with equal purpose in patients of same physiopathology, all of them undoubtedly accomplishing equilibrium of the Stomatognathic System. Different forms of treatment aiming the same results in patients of equal conditions were developed in the orthodontic technology world forming what we call today Dynamic Functional Orthopedics. The various characteristics of Functional Orthopedics were condensed into five enunciations, which we mention below. Of these, the first two are the Fundamental Principles of Functional Orthopedic Techniques, based first and foremost on Planas' Laws : Minimum Vertical Dimension[25)26)], and Transversal Sagital and

* AL : Santos, 2223 conj 121-12°-andar, CEP 01419-SAÕ Paulo, Brasil.

Vertical Development[25], and on what was presented in his work in 1961 : "Mouth Results of the Functional Orthopedics"[26]—(XXXIV[e]—Congrès de la Société Française de Orthopédie Dento-Faciale).

Teachings of several other great masters also contributed to establish these five enunciations. Bimler[6)11)], devisor of one of the greatest Orthopedic techniques, as well as advanced Fränkel[9] and Balters[4], Ackerman, Ailianos, Andresen, Autissier[1], Blau[5], Besombes, Cavanha[29], Chateau[8], Cauhépé, Delaire, Duyzings, Enlow, Eschler, Gola, Haupl, Held[12], Hoffer, Hotz[13], H. Petit[8)24)], Kawamura, Korkhaus[16], Macary, Maronneaud[19], Posselt, Robin, Schwarz, Thielleman and many others are responsible for this work.

We also wish to quote Professor Planas' words referring to his Development Laws : "……laws and fundamental principles already exist in science ; before being enunciated, one merely observes them, understands them and thus manifest them."

II. Fundamental Principles of Functional Orthopedic Techniques Enunciations and Considerations

lst. Principle : "Neural Excitation"

"Clinically, the Stomatognathic System equilibrium should be obtained from : CORRCET NEURAL EXCITATION OF TMJs (Temporo mandibular joints), MUSCLES, PERIODONTUM and MUCOSA provoked by stimuli given through functional orthopedic appliances applied within adequate patterns of Time, Intensity and Quality, using the quickest conduction velocity in each case"

Considerations

The structures responsible for the functions of chewing, swallowing, mimic and breathing are among the body's richest ones in Neural Terminations, and for a good anatomo-functional development it requires the correct perfomance of these structures. A functional orthopedic treatment starts with a correct neural stimulation. The most adequate pathways are chosen in each separate case according to the topography of the neural terminations[27], their capacity to adapt themselves slowly or quickly to stimuli[3)28)], conduction velocity[21], and various types of neural receptors[27] and conductors[21)31)], thus obtaining better therapy results in the shortest possible time. Going deeper into the study of neurophysiology, knowing where the impulses reach the CNS level and sensory mechanism motor activity[14)20)22)23)30)31)], we will work out better and maybe simpler techniques or, at least, take the best out of those we have available can offer as treatment result.

The neural excitation is a characteristic common to the techniques of Balters, Fränkel, Bimler and Planas, who use it in different intensities, adequately to the various structures[29].

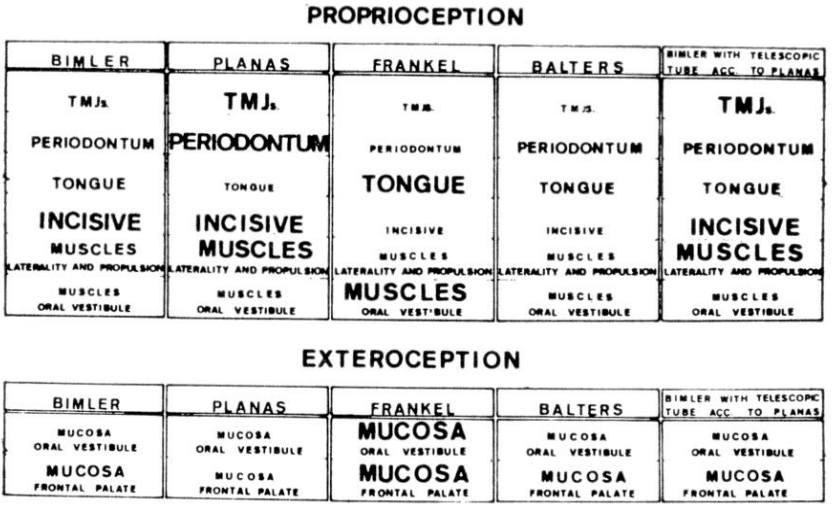

Fig. 1 Bimler and Planas act in a greater degree on the joints (allow laterality), periodontum and incisive proprioception; by using tubes, Bimler intensifies the stimuli on the TMJs and anterior teeth (better Gothic arch), consequently allowing a greater excitation of the laterality and propulsion muscles.

Balters stimulates with more intensity, evenly distributed (what is convenient to severalcases), the periodontum, tongue and frontal palate mucosa, at the same time continuing to act on other structures.

Fränkel acts principally upon the tongue sensorial mechanism, oral vestibule muscles and mucosa and, secondly, upon the TMJs sensorial mechanism and periodontum.

The table on the Fig. I has merely a didactic purpose, and three different sizes of characters have been in order to obtain a good perception of the several techniques action.

We note on the table above these techniques do not differ much one from the other; what does vary is the quality as well as the intensity of the exteroception or proprioception according to the point of application[29]. If convenient, more than one technique can be used for the same patient, depending on the intensity of the stimuli we wish to apply to the different structures at certain steps of the treatment (assuming, of course, that these techniques are properly executed).

The above techniques[4)6)9)11)26)], as well as all those which are functional orthopedic, obey all principles and basic characteristics mentioned in this article.

2 nd. Principle : "Change of Posture"

"Functional orthopedic appliances ALWAYS act bimaxilarly, modifying the position of the jaw either forward or backward".

Considerations

The human body is 40 % muscles approximately. The structures upon which we work in Orthodontics are some of the body's richest in motion. The coordination of these movements depends the neuromuscular system, and is charted through reflexes, which have the purpose of bringing the functional responses of chewing, swallowing, fonation, mimic, breathing[2], ……etc. Denny-Brown[18], Kawamura[1)14)15)], Szentágothai, Farbman[27], Emmelin, Takata[30], Matthews, Hagbarth, Corbin, Sherrington, Wall, Magnus, Loewenstein, Brill, Tryde, Melzak, Gairns, Bossma, Stewart, Ness, Dixon, Chen, Cordier and many others made it very clear that the proprioceptive stimuli are important as a basic for this. They came to the conclusion that there is no separate sensorial mechanism for posture and movement, defining these in terms of muscles and articulations.

On pictures Fig. 2 and 3, we can perfectly distinguish the change of posture, provoked by a Bimler appliance in a case of disto occlusion (Example of the 2 nd. Principle).

Movement could be explained as a series of postures or, rather, a change of posture. Posture would be the position assumed by the mandible in relation to the maxila, when in Centric Relation. Centric Relation would be the one between maxila and mandible at rest position, with free way space between the dental arches. We also call this position "postural", i. e. where there is no dental contacts; it is conditioned by the equilibrium of the mandible elevator and depressor muscles within an antagonic tonus called postural, based on the monosynaptic, anti-gravity, myotatic stretch reflex, through only two neurons. The mandible assumes this position most part of our lives, which confirms that the neuromuscular tonus is one of the main shapers of bone development.

When the postural relation, equilibrated by the mandible antagonist muscles isometric contraction, results from nociceptive reflexes, through more than two neurons, the functional orthopedic appliances operate modifying these relations and

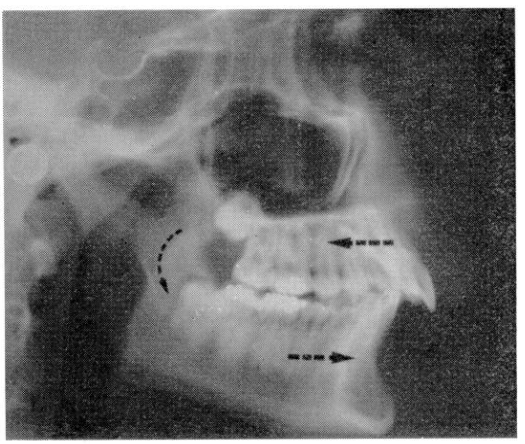

Fig. 2

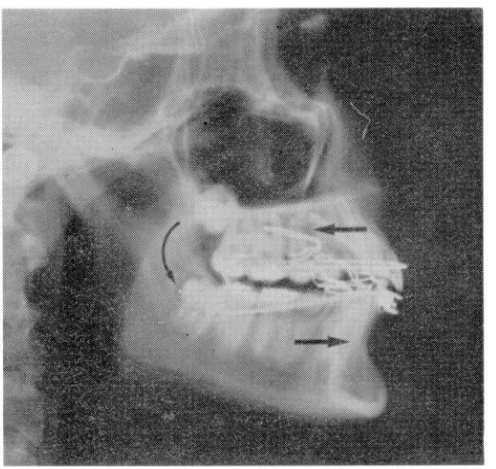

Fig. 3

conditioning new monosynaptic reflexes to substitute the pathologic circuits.

This can be better understood in Angle's Class II and III cases; however, in Class I cases of anomaly there is also no correct postural relation and, technically, the appliance should modify this, seeking the incisive neural excitation and therefore forcing the mandible to assume a new position (should be a little more forward trying to establish contact between the superior anterior and inferior teeth).

III. Basic Characteristics of the Functional Orthopedic Techniques Enunciations and Considerations

lst. Characteristic : "Dental Support"

"Functional orthopedic appliances do not depend exclusively on dental support. They can float inside the oral cavity".

Considerations

Technically, teeth are not fundamental supporting elements of a functional orthopedic appliance, because the latter works bimaxilarly stimulating the neural excitation of many other structures besides teeth, releasing the hindered movements, removing the occlusive interferences, modifying the mandible's postural relation.

Basically, functional orthopedic appliances do not require dental support, even though, obviously, rotation of teeth and some dental movements are achieved when the appliances' accessories conveniently touch the teeth. Resuming, rather than upon the teeth, the appliance is anchored in its bimaxilary situation, i. e. modifying the maxila-mandibulary relations positions. This basic characteristic is extremely important in the treatment of cleft palate.

2 nd. Characteristic : "Precocious Treatment"

"Functional orthopedic appliances work also in precocious stages of development".

Considerations

Functional orthopedic appliances have the following possibility : they do not depend on either total or partial eruption of the permanent teeth. They are effective in early stages of development, working on deciduous or mixed dentition, cleft palate, etc., for the very reason that dental support is not essential. They also use change of posture and neural excitation of other structures (bimaxilarly anchored)-Fundamental Principles-to stimulate motor activity. The results obtained through motor activity are better in precocious stages of development. However, the possibility of satisfactory results in adults is not excluded.

The longer the pathological reflexes are allowed to act on the Stomatognathic System functioning, the more time will be spent with less chances of either

anulling or substituting them. A quick and efficient nouromuscular and bone structure response to therapy is closely associated with the patient's age : the younger the better (Rickets, Bimler, Planas, Fränkel and others).

Pierre Robin equates : freedom of mandibular movements, neuromuscular tonus, adequate TMJs adaptation equals perfect function; on the other hand : difficult mandibular movements, lack of correct neuromuscular excitation, incorrect TMJs adaptation equals atrophy of the system and deficient function. Planas assures that we should be able to diagnose this vicious pathological circuit in order to interfere at the right moment.

The TMJS are partly pre-determined by heredity and partly adaptable to the function they perform (Korkhaus[17], Hoffer, Schwarz). There is no doubt that, as in any branch of medicine, one lesion creates another, in a chain reaction, and are the so-called lesions of compensation (Carlier and Goudaert[7], moreover, the functional lesions of the masticatory system of ten reach the vertebral column causing alterations in the posture or in the way of walking (Cauhépé, Duyzings, Fernex[10], Macary, Korkhaus, etc.). We could also mention other compensation lesions cause by bad occlusions such as : audition and respiratory problems.

Planas demonstrates very well that it is possible to diagnose, prematurely or in any stage of development, an established bad circuit or one in a establishing process. He shows how to correct it and, very important and prophylactic, how to maintain a favourable situation[26]. Our task should be to watch the entire development process, avoiding or correcting the problems as they appear, or even, should it be the case, preserving a good development.

The functional orthopedic techniques work in the mouth facing it as a whole. Therefore, when we intercept a lesion, we do it aiming to correct it entirely. Our purpose is not to merely improve the waiting conditions for a corrective treatment using maintainers of space in a certain ares. When there is a space to be maintained, we check beforehand the wrong circuits of mandibular posture and any possible lack of correct neural excitation in the rest of the system, regardless of age or presence of permanent dentition. The decisive factors are : the treatment right for the specific patient, his biotype, his possibilities of recovery—in one word what matters is the diagnosis. If the diagnosis indicates the treatment, it can start immediately intercepting and correcting the lesion, avoiding further complications. The casuistic shows that use of orthopedic appliances in precocious stages if based on a good diagnosis (at the right moment and according to the problem), does not increase the treatment's duration. On the contrary, it prevents the patient from reaching an age when the solutions are frequently more difficult, sometimes requiring more time, with questionable results. The basic characteristic : precocious treatment is specially important for cleft palate and progenic patients.

3 rd. Characteristic : "Extraction Percentage"

"The functional orthopedic appliances substantially reduce the extractions

percentage''.

Considerations

The use of functional orthopedic appliances in no way excludes the possibility of extractions. However, the necessity to extract teeth to complement the treatment is greatly reduced.

Any therapeutic method with a high percentage of extractions cannot be considered as functional orthopedic. No well applied functional orthopedic therapy allows this to happen. Reanalysing the fundamental principles and basic characteristics, and specially bearing in mind that the treatment can be executed in precocious stages, confirms that the functional orthopedic appliances offer, in numerous cases, better oportunities of reaching a sufficient development to avoid extractions and, equally, to accomplish the equilibrium of the masticatory system[1)12)26)] which prevents relapses.

IV. Conclusion

We believe that any appliance which is not in accordance with the two fundamental principles in its making and application, cannot be considered as functional orthopedics.

As to the three last enunciations, they are merely basic characteristics to any functional orthopedic technique. These characteristics were not considered as fundamental principles because they cannot be faced as absolute, since :

1) orthopedic appliances are also used in adults;
2) occasionally, dental support is used; and, finally,
3) there are treatments which require extraction.

The considerations were concise enough just for preliminary clarifications of the enunciations.

Our intention here was to try to present, in a didactic way, what the use of a functional orthopedic technique fundamentally means, in order to avoid misisinterpretations. The matter is a serious one and should be seriously considered before any adventure on the patient.

Bibliography

1) Autissier-Beltrami : Données récentes en anthropologie; en anatomie comparée et leurs rapports avec l' Orthopédie dento-faciale. Orth. Franç., Vol. 20, pg. 297, 1949.
2) Aubert, M. et al. : Données expèrimentales récentes sur la sensibilité de l' appareil manducateur. Actualités Odonto-Stomatologiques, 112 : 635-649, 1975.
3) Albe-Fessard, D. et al. : Somatosensory System- Ed. by Ainsley Iggo-14 and 9, 1973.
4) Balters, W : Guia de la tecnica del Bionator. Ed. Circulo Argentinode Odontologia, Buenos Aires-2 : 15-16 and 5 : 66-68.

5) Blau, Fred : La méthode Fcntionnelle en Orthopédie dento-faciale. Ed. Julien Prélat, Paris.

6) Bimler, H. P. : Estomatopedia na teoria prática. Ed. Maranus, Porto. 1965, 19. p.

7) Carlier-Goudaert : A propos de quelques troubles fonctionnels provoqués par déformation des maxillaires et leur traitement chez l' adulte. Orth. Franc. Vol. 20, pg. 66, 1951.

8) Chateau, M. et Petit, H. : Orthopédie dento-faciale et Paradontopathies. Rapport dc XXXIV^{e} Congrés de la SFODF, 1961.

9) Fränkel, R. : Ortopedia Funcional de Los Maxilares, 3 : 95, 96, 1962 (transl. Dr. Frederico Rosenmeyer, Ed. Beta S. R. L.).

10) Fernex : Quelques considérations sur l'importance de l'articulationtemporo-maxillaire. Orth. Franc., Vol. 9, 1948.

11) Guardo, A. F. y Guardo, C. R. : Manual de Ortodoncia, XXXI : 385-426, 1967.

12) Held : Les principes de l'equilibration fonctionnelle par meulage Paradontologie, 2, 106, 1958.

13) Hotz, R. : Ortodoncia en la practica diaria. Ed. Cientifico-Médica, Barcelona I-IV and VII-VIII, 1974.

14) Kawamura, Y. and Takata, M. : The role of trigeminal afferents in the control of Masseter Motoneuron activity, Oral-Facial Sensory and motor mechanisms. Ed. by Dubnenn & Y. Kawamura, Appleton-Century Crofts, N. Y., pp 333, 1971.

15) Kawamura, Y. : Recent advances in the Physiology of Mastication. Oral Physiology, Ed. by N. Emmelin Y. Zottermann, Pergamon Press Oxford & N. Y., pp 163, 1972.

16) Korkhaus : Les stades initiaux des dysmorphoses dans la denture temporaire. Orth. Franç., Vol. 22, 1951.

17) Korkhaus : L'influence de l'hérédité et du milieu sur l'architecture du crâne facial. Orth. Franc., Vol. 23, 1952.

18) Lagworthy, O. R. : The sensory Control of posture and movement. lst. Ed. by The Williams & Wilkins Co., Baltimore, 1 and 4 : 3-6, 1970.

19) Maronneaud, P. L. : La ortopedia Estomatologica infantil. Ed. Vitae, Buenos Aires, 1961, 344 p.

20) Matzke, H. A. y Foltz F. M. : Sinopsis de Neuroanatomia. 2 nd. Ed. Fournier S. A., Mexico, 1-9. 1972.

21) Moutcastle, Vernon B. et al. : Medical Physiology, 13 th. Ed. by Vernon B. Moutcastle, Saint Louis, Part I-II and IV, 1974.

22) Merton, P. A. : Position sense of effort. In "Homeostasis and feedback mechanism"-Symp. Soc. Exp. Biol., 18 : 387-400, 1964.—How we control the contraction of our muscles. In "Scientific American; 226 (5) : 30-37, May 1972.

23) Marsden, C. D., Merton, P. A. Morton. H. S. : Servo action and stretch reflex in human muscle and its apparent dependence in peripheral sensation. Journal of physiology 216 : 21-22, 1971.

24) Petit, H. : Paradontologia. Ed. Toray-Masson S/A, Barcelona. 266-369 and 346-359, 1971.

25) Planas, P. : AS Leis de Planas, pistas Planas e o Equiplan. O incisivo XV : 4 and 5 (transl. Wilma A. Simões, C. D.), 1975.

26) Planas, P. : Génesis de la Rehabilitation neuro-oclusal. lst. Ed., México, 397 p, 1972.

27) Squier, C. A. and Meyer, J. : Current concepts of the Histology of oral Mucosa. Ed. Charles C. Thomaz, Springfield, 16 : 250-361, 1977.

28) Stein, D. G. and Rosen, J. J. : Basic Structure and function in the Central Nervous System. Ed. Macmillan Publishing Co., Ind. N. Y.—I and II, 1974.

29) Simões. W. A. : Propriocepção, Exterocepção e aparatologia de Bimler, Fränkel e Planas. Revista da Sociedade Paulista de Ortodontia, S. P., Brasil, 7 (2) : 153-161, Mai./Ago. 1974.

30) Takata, M. : Post-tetanic potentiation in Masseter Motoneuron. Oral, Physiology. Ed. by N. Emmelin and Y. Zottermann. Pergamon Press Oxford N. Y., pp 205, 1972.

31) Tamar, Henry : Principles of Sensory Physiology. Ed. Charles C. Thomaz, USA., Part II and III, 1972.