Research Article

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A PROTOCOL FOR ORAL MYOFUNCTIONAL ASSESSMENT: FOR APPLICATION WITH CHILDREN

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SUMMARY

The purpose of this research was to compare Oral Myofunctional Disorder characteristics in subjects with Tongue Thrust and in subjects with no such disorder, and to suggest a protocol for Oral Myofunctional Assessment, involving the most relevant characteristics for this diagnosis. The present study used 36 subjects with various disorders enrolled in the Speech-Language Pathology Department at Health Center "Escola Professor Samuel Barnsley Pessoa". Results showed that the main characteristics differentiating subjects with Oral Myofunctional Disorders from those without it and, therefore important diagnostic considerations, are: hole in the feeding-bottle, nipple used in the feeding-bottle, breathing deviations, lips rest posture (information obtained from a person responsible for the subject), lips and tongue resting posture (information obtained from assessment), lip tonus, hard palate, swallow, breathing and occlusion.

INTRODUCTION

Oral Myofunctional Disorder has as main characteristic frontal and/or lateral tongue thrust or strong contact of the tongue with upper or lower teeth during the swallow, and inadequate lip closure and or incorrect tongue rest posture (ASHA, 1990). The term "oral myofunctional" is used for a disorder also known as tongue thrust. Several studies have established a few diagnostic "rules" in order to characterize and better pinpoint tongue thrust.

Straub (1960) describes tongue thrust by comparing it with normal swallow. He indicates the following characteristics as being present during tongue thrust: incorrect movements of the muscles of the tongue and of the neck; failure to close the teeth; tension of the facial expression muscles. According to Straub, the habit of tongue thrust can be detected and corrected at an

early stage in order to favor the development of the oral facial structures.

In 1961, Fletcher, Casteel and Bradley described tongue thrust as having the following pattern: extreme tension of the oral muscles; reduction or absence of mastigatory muscle contractions during the act of swallowing; and protrusion of tongue between the front teeth.

Among several definitions of this disturbance, Hanson, Barnard, and Case (1969) define tongue thrust as a condition in which the tongue makes contact against the anterior teeth during the swallow.

These authors presented two classifications for this definition: one conservative and the other liberal. In the conservative definition, the tongue protrudes between the upper and lower teeth, to the front or the side, during the swallow. In the liberal definition, the tongue simply makes contact with the anterior teeth during the swallow.

In 1979, Hanson revised the definition of tongue thrust, with the following defining conditions: if in the resting posture the anterior and lateral portions of the tongue make contact with more than half the area of the upper and lower teeth, or protrudes between them; and/or when, during the swallow of liquids, saliva or solids, the tongue pushes against the teeth.

Due to the studies that have been done and the establishment of criterias for assessment, modifications are being made to the oral myofunctional assessment. The intention of these modifications is to search for a more adequate form of assessment in order to make a more precise diagnosis and improve the understanding of the pathology. Several studies have approached this issue and several assessment models have been proposed.

A few authors point out that it is extremely important to check functions such as sucking, chewing, swallowing, breathing, and articulation, in relation to their origin and

development, since these are usually related to oral myofunctional disorders. Some of the authors who share this view are: Straub (1960); Fletcher et al. (1961); Straub (1961); Subtelny (1965); Garliner (1966); Hanson, Barnard and Case (1969); Padovan (1976); Pierce (1979); Pierce (1986); Hanson (1988); ASHA, (1990); Nielsen (1991); Vaidergorn, (1991); Thexton (1992); Snow (1993); Otuyemi (1994).

Garliner (1966) points out that in the diagnosis of oral myofunctional that can be considered as being symptoms: a rest posture involving open lips with tongue protrusion, mouth breathing, thumb sucking, lip sucking, rigid mentalis muscle, lisping during production of the phoneme /s/, tensing of oral facial musculature during swallowing. According to Garliner, if the majority of the symptoms mentioned above are present, the physical examination will confirm or rule out the presence of the disorder. The physical examination must include the observation of the following points: the existence of a high narrow palatal arch, highly defined rugae, malocclusion, and abnormal swallow.

In 1982, Garliner created some instrumental tests to measure the muscular force of the oral region. With these tests, it is possible to measure the movement and position of the tongue during the swallow, the extension force of the tongue, the contraction force of the masseter, the resistance force and compression of the orbicularis oris muscle and the activity of the mentalis muscle during the swallow. The instruments for these tests are a force scale, black light and myo scanner.

According to Pierce (1986), the diagnosis of tongue thrust involves the following aspects: examination of oral structures and muscle functions; observation of the resting posture of the tongue, lips, and mandible; observation of swallowing of liquids, solids, and saliva; and assessment of associated oral behaviors, such as thumb sucking, breathing, and "eating habits". Based on the examination, the therapist must decide whether or not these factors influence occlusion and/or articulation and whether or not the patient is a candidate for therapeutic intervention.

Hanson (1988) proposes an oral myofunctional assessment which includes various aspects of the oral structures and functions. In the oral structures examination, one should consider the lips (symmetry at rest and during function, size, and posture at rest), the labial frenum, tongue (movements, articulation, and posture at rest). As for the functions, one must consider: position of the lips and tongue during chewing and swallowing and during articulation. The tongue should not make contact with the anterior teeth during production of the phonemes /t, d, l, n, s, z/.

The model of myofunctional assessment recommended by Snow (1991) consists of a written report done by the patient himself, who describes the

position and movement of lips, tongue, and teeth at rest and during the swallow. This assessment also consists of an analysis of the patient's history, taking into consideration early childhood development and establishing an etiology for the myofunctional alteration.

An alert and conscientious diagnosis must be done to determine if tongue protrusion exists both during the swallow and at rest, since their coexistence will most certainly indicate malocclusion and tongue thrust (ASHA, 1990.)

PROPOSAL

This research had as a proposal the comparison of the characteristics that identify oral myofunctional disorders in subjects with and those without this kind of alteration, as well as a proposal of an assessment protocol containing the most relevant aspects for the diagnosis of this disorder.

METHOD

Thirty - six subjects were involved in this research, 22 male and 14 female, with ages ranging from 8:1 to 9:0. These subjects attended the Speech-Language Pathology Department at Centro de Saude Escola Prof. Samuel Barnsley Pessoa (CSE) between 1989 and 1993. All subjects were divided into two groups: Group 1 (G1) with 29 subjects and Group 2 (G2) with 7 subjects. G1 had subjects with the diagnosis of oral myofunctional disorder and G2, the control group, consisted of subjects who had other speech-language pathologies (disturbance in reading and writing, articulation disorder-except for lisping, voice disorders). Although the subjects in G2 had no involvement of the oral myofunctional system, a few of them showed tongue protrusion only during the swallow of liquids. The other oral myofunctional aspects were adequate, therefore this was not diagnosed as tongue thrust. The protocols for Speech-Language Pathology and the Questionnaire were administered by students in the fourth year of Speech-Language Pathology training at Faculdade de Medicina de USP under the supervision of a teacher responsible for the department.

The Questionnaire can be found in Appendix 1 at the end of this article. From the protocols for Speech-Language Pathology, the only parts used were those dealing with the assessment of the oral myofunctional system (OMS).

Those items can be found in Appendix 2.

RESULTS

After collecting the information found in the Questionnaire and in the protocol of OMS Assessment, regarding the subjects in G1 and G2, two studies were done. In the first, the data was tabled in absolute numbers and in the form of percentages in order to describe the Oral Myofunctional characteristics found in the subjects.

In the second study a comparison was made between the observed characteristics to determine if differences existed in the subjects with oral myofunctional disorder and making it possible to propose a protocol containing only relevant information for a precise diagnosis. This comparison was tabled in absolute number and analyzed statistically through the Chi-Square Test (X^2), verifying the validity of this comparison.

In the X^2 test, the established level of significance in all the comparisons made was of 5% (0.05). The established hypothesis refers to the presence of evidence that shows that one group differs from the other. For each comparison the value of X^2 (n) was calculated, (Bussad, W.O. and Morretin, P.A.; 1987), the value of X^2C was found (critic Chi-Square); after that, the hypothesis was rejected ($X^2 < X^2C$) or not ($X^2 > X^2C$).

In all, a total of twenty-four comparisons using X^2 were made uniting all items in the Questionnaire (Appendix 1) and in the Assessment (Appendix 2). Only six of the twenty-four comparisons were statistically significant.

The verification of the characteristics that showed differences in the comparison of the subjects in G1 and G2 revealed the items that should be found in the new protocol of Oral Myofunctional Assessment and in the Questionnaire. A few of these items did not show a statistically significant difference. This fact can be related to the number of subjects found in G1 and G2. Therefore, and also based on the literature, a few of them were considered important for the diagnosis and for this reason should be found in the Assessment Protocol.

In the comparison made based on the items related to the Questionnaire, statistically significant differences were found between both groups on the following aspects: kind of hole in the feeding-bottle ($X^2=6.21$; $X^2C=5.991$) and breathing deviations ($X^2=13.34$; $X^2C=3.841$).

(Figure 1: Type of Hole in the Feeding Bottle)

As for the Kind of Hole in the feeding-bottle, in G1 the majority of the subjects had had the hole of their feeding-bottle enlarged, however a considerable number of subjects in this same group had had a normal size of hole. In G2 most of the subjects had used a normal size of hole in the feeding-bottle (Figure 1). This result confirms the data found in the literature, pointing out that an inappropriate kind of hole can contribute to the presence of tongue thrust.

(Figure 2: Breathing Disruption)

As for the Breathing Disruptions, all subjects in G1 and only 25% of the subjects in G2 showed this kind of problem (Figure 2). Here again the data agrees with what is found in the literature, showing that a correlation between tongue thrust and breathing deviations exists (Hanson, Barnard and Case, 1969).

As for the other analyzed items, no statistically significant differences were found; however percentile differences related to the type of nipple used in the feeding-bottle ($X^2=5.62$; $X^2C=5.991$) and the lips resting posture ($X^2=2.54$; $X^2C=3.841$) did exist.

(Figure 3: Feeding Bottle Nipple Type)

(Figure 4: Resting Posture of the Lips)
Questionnaire

The item related to the type of nipple used in the feeding bottle was also analyzed (Figure 3). It was found that in G1, 84% of the subjects used the standard type of nipple and the other 16% used the orthodontic type. In G2, it was found that the number of subjects who used the standard type of nipple (50%) was smaller than in G1 and the number of subjects who used the orthodontic type (33.33%) was larger. The literature points out that the use of the non-orthodontic nipple is related to tongue thrust (Straub, 1960). his study supports this relationship. As for the lips resting posture, in G1 most of the subjects maintained the lips open in the resting posture and in G2 most of the subjects kept their lips closed (Figure 4).

No percentile or statistically significant differences were found in the analysis of the remaining Questionnaire items: Breast Feeding ($X^2=0.272$; $X C=3.841$), length of time a pacifier was used ($X^2=4.91$; $X C=9.488$), Type of pacifier ($X^2=0.092$; $X^2 C=3.841$); Existence of oral habits other than the use of the pacifier ($X^2=1.875$; $X^2 C=3.841$).

As for the comparison between G1 and G2 of the items related to the Oral Myofunctional Assessment, statistical differences were found in the following aspects: Lips resting posture ($X^2=8.006$; $X^2 C=3.841$); Lips tonus ($X^2=13.75$; $X^2 C=5.991$); Swallow ($X^2=10.23$; $X^2 C=3.841$); Breathing ($X^2=3.82$; $X^2 C=5.991$).

(Figure 5: Resting Posture of the Lips)
Assessment

Taking into consideration the aspect related to the Lips Resting Posture (Figure 5), most of the subjects in G1 rested with their lips open and in G2 they rested with

their lips closed, showing that the incorrect lips posture is associated with tongue thrust, as presented in the literature (Garliner, 1966; Pierce, 1986; Snow, 1993).

(Figure 6: Lip Tonus)

Looking at the Lip Tonus (Figure 6), it was found that most of the subjects in G1 either showed an increased or a weak muscle tone; however in G2 a majority of the subjects had an adequate musculature. It seems, therefore, that the Lips Posture and the Inadequate Muscle Tone are related to Oral Myofunctional Disorder.

(Figure 7: Swallow)
Tongue Position

As for the Swallow (Figure 7), all subjects in G1 showed tongue thrust during this function, whereas in G2, tongue thrust was observed in only a few subjects, the remainder keeping their tongue on the papilla during the swallow. The literature mentions the position of the tongue during the execution of several functions, the swallow being one of them, pointing out that an incorrect position can result in a disorder (Hanson, Barnard, Case, 1969; Hanson, 1979, 1988; ASHA, 1990.)

(Figure 8: Breathing)

In the item related to the Breathing (Figure 8), it was observed that the adequate pattern prevailed in G2. In G1 it was found that the majority of subjects showed either oral or mixed breathing. Here again, and also according to the literature, a relationship between incorrect breathing pattern and Oral Myofunctional Disorder seems to exist (Hason, Barnard and Case, 1969)

(Figure 9: Occlusion)

Statistically significant differences ($X^2=5.45$; $X^2C=7.815$) between G1 and G2 were not found when analyzing the Occlusion (Figure 9). However, percentile differences did exist revealing that in G2 a majority of the subjects had normal occlusion and in G1 most of them had some kind of alteration. The literature relates this item to Oral Myofunctional Disorder (Garliner, 1966), and for this reason, it has great importance for the diagnosis.

Listed below are the items in the OMS Assessment where no percentile or statistical differences were found, that is, both groups showed the same characteristics: tongue resting posture ($X^2=0.789$; $X^2C=5.991$), hard palate ($X^2=0.018$; $X^2C=3.841$), lip mobility ($X^2=0.869$; $X^2C=3.841$), tongue mobility ($X^2=2.28$; $X^2C=3.841$), lingual frenum ($X^2=1.436$; $X^2C=5.991$), dental hygiene ($X^2=0.62$; $X^2C=5.991$), movement of the mandible ($X^2=0.0722$; $X^2C=3.841$), contraction of the masseter ($X^2=0.768$; $X^2C=3.841$) and contraction of the temporis muscle ($X^2=2.82$; $X^2C=3.841$). Two of the items, soft palate mobility and absence of teeth, could not be analyzed using the Chi-Square Test since these characteristics were not observed in G2.

It was observed, when considering the item Tongue Resting Posture, that in both groups most of the subjects kept their tongue on the floor of the mouth, therefore, there is no evidence of percentile or statistically significant differences ($X=0.789$; $X C=5.991$). However, the percentage of subjects who kept their tongue on the papilla during rest was larger in the subjects who did not have the disorder (G2). The literature, on the other hand, points out that a strong relationship between the lip and tongue resting postures and oral myofunctional disorder does exist (Garliner, 1966; Pierce, 1986; Snow, 1993); therefore this item is considered as having great importance in the diagnosis of oral myofunctional disorders.

DISCUSSION AND CONCLUSIONS

In the sample involved in this study, it was possible to identify the items that characterize the Oral Myofunctional Disorder in this sample and are, therefore, fundamental in the diagnosis of this kind of disorder.

As for the Type of Hole and the Type of Nipple used in the feeding bottle (Questionnaire) a big difference between G1 and G2 was found, confirming their influence on oral myofunctional disorder, i.e., the presence of enlarged holes seems to contribute to the disorder. This fact agrees with the literature which also relates the use of inappropriate nipples (enlarged holes) to tongue thrust (Straub, 1960; Hanson, Barnard and Case, 1994).

In the items Breathing Deviations (Questionnaire) and Breathing Assessment (Assessment), a larger number of alterations were observed in the subjects with OMS Disorder (G1). Again this data agrees with the information found in the literature, since a few authors show that upper respiratory/breathing problems (mouth breathing, allergies) are frequently found in children with tongue thrust (Hanson, Barnard and Case, 1969).

Another aspect mentioned frequently in the literature relates to the resting position of the lips and tongue. Studies show the relationship between the resting posture and oral myofunctional disorder (Garliner, 1966; Pierce, 1986; Snow, 1993), pointing out that an inappropriate posture (open lips and protruded tongue) can lead to the development of the disorder. In this study it was found that subjects in G1 showed inadequate lip resting posture in the OMS Assessment as well as in the Questionnaire. On the other hand, most of the subjects in G2 had closed lips in the resting posture (adequate posture).

The inappropriate resting posture can lead to a mobility and tonus alteration of the lips and tongue. This study found that the majority of the subjects in G1 had inadequate lip tonus (increased or diminished muscle tone) and in G2 the tonus was adequate in most subjects.

After analyzing the item Malocclusion, it was verified that most of the subjects with tongue thrust had occlusion disruptions; in G2 most of the subjects had adequate occlusion. The literature points out a relationship between dental malocclusion and oral myofunctional disorders (Straub, 1961; Subtelny, 1965; Garliner, 1966; Pierce, 1986; Hanson, 1988; Nielsen, 1991; Otuyemi, 1994).

Generally, it was verified in the present sample that only a few items in the questionnaire and in the protocol of OMS assessment had statistically significant differences: size of hole in the nipple of the feeding-bottle, breathing deviations, lip resting posture (assessment), lip tonus, swallow, and breathing. A few items not showing statistical significance, possibly due to the

number of subjects compared (G1=29 and G2=7), but showing percentile differences, are: type of nipple used in the feeding bottle, lip resting posture (information obtained from a person responsible for the subject), occlusion, tongue resting posture, hard palate.

At the end of this research, it was possible to suggest that the characteristics mentioned above, the ones that differentiate one group from the other, are fundamental for the diagnosis of Oral Myofunctional Disorder.

After verifying the relevant criterias for the diagnosis, a protocol for oral myofunctional assessment was formulated (Figure 10). This protocol was proposed with the intention of making the diagnosis of the population used in the sample easier, as well as making the assessment quicker and more efficient, including only the main delineators.

(Figure 10)

Also the filling out of the items was simplified in order to differentiate a characteristic which was not observed from a characteristic that the subject does not have. Several items of the protocol used in this research had no information— one did not know if the examiner did not verify the characteristic or if the subject did not have it—so a few items could not be used.

In the new protocol, the items involving isometric abilities (lip and tongue mobility, soft palate mobility), the aspects related to the dentition (hygiene, caries, absence of teeth), and items relating to the anatomy of the lingual and labial frenums are not present, since they were not altered in the subjects with oral myofunctional disorder. These items correspond to a few of the characteristics found in most of the assessment protocols, since they were considered important to the diagnosis of oral myofunctional disorder. However, this study found they do not seem to be related to the disorder found in the studied population.

Although the articulation was not analyzed in this study, it is of great importance that an assessment of this item be done in the subjects with oral myofunctional disorder, because, as mentioned in the literature, a relationship between oral myofunctional disorder and articulatory disruptions does exist.

The next step of the present research will be the verification of the validity of the proposed myofunctional assessment protocol. The authors emphasize the importance of a comprehensive myofunctional assessment but are searching for one which will involve only the most relevant aspects of the pathology's diagnosis to make it a faster and more precise procedure.

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APPENDIX 1: Questionnaire

Name: _____

Date of birth: _____ Age: _____

Address: _____

Date of Exam: _____

Name of the mother: _____

Name of the father: _____

Nursing: _____

Breast _____ For how long: _____

Had fissures in the nipple? _____

Feeding-bottle: _____ Type: _____

Size of the hole: _____

Thick-liquids: _____

Started eating puree at _____ months

Had good acceptance? ()yes ()no

Solids:

Started eating solids at _____ months

Meat _____ Grains (rice, beans) _____

Has or had any of these habits:

Pacifier: ()yes ()no Until _____

Type of pacifier: _____

Sucks finger: ()yes ()no Until _____

Bites nail: ()yes ()no Until _____

Nibbles or bits other objects:

()yes ()no Which _____

Licks or bites the lips: ()yes ()no

APPENDIX 1: Questionnaire Cont'd...

Had or has any kind of allergy:

()yes ()no What kind: _____

Has or had disorders of the breathing tract, such as:

()Rhinitis ()Sinusitis ()Otitis

()Pharyngitis ()Laryngitis ()Bronchitis

Usually stays with the lips open during: ()the day ()the night

This happened since _____ years Until _____ years

Spoke first words at what age? _____

Was understood by whom? _____

Nowadays is understood by everyone? ()yes ()no

APPENDIX 2: Assessment Protocol

Name: _____

Date of birth: _____ Age: _____

Date of exam: _____

1. Rest Posture:

Lips: _____

Tongue: _____

2. Mobility

Lips: () protrusion () lateral retraction Right (R) () Left (L)

() simple lateral retraction () vibration () contraction

Tongue: () internal lateralization R () L () External R () External L

() protrusion with tongue tip () retraction () elevation

() lowering () vibration.

3. Labial tonus: () decreased () increased () adequate

4. Frenum:

Lingual: () adequate () long

Labial: () adequate () long

5. Hard Plate: () adequate () high () narrow

6. Soft palate and uvula:

() Adequate appearance () disrupted

Mobility () yes () no

APPENDIX 2: Assessment Protocol cont'd...

7. Dentition:

Hygiene: () good () regular () bad

Caries: () yes () no

8. Occlusion: () adequate () inadequate

9. Mastication:

Mandible: () rotation () opening () closing

Masseter contraction: () strong () weak

Temporalis: () strong () weak

Preferential use of one side: () right () left

10. Swallow

	Tongue Thrust	Participation of the facial muscles	Masseter contraction
<i>Liquid:</i> a) isolated () swallow	()	()	()
b) in sequence ()	()	()	()
<i>Saliva:</i> ()	()	()	()
<i>Solids:</i> ()	()	()	()

Figure 10: ASSESSMENT PROTOCOL

Name: _____

Date of Birth: _____ Age: _____

Date of assessment: _____

1, Rest posture:

Lips: () open () closed () not verified

Tongue: () mouth floor () front tongue thrust () side tongue thrust
() pressuring the incisive teeth () papilla () not verified

2. Lip tonus:

() adequate () diminished () increased () not verified

3. Hard Palate

() adequate () high () narrow () not verified

4. Occlusion

() adequate () inadequate () not verified

5. Swallow

	Tongue Thrust	Tongue pressuring the Incisors	Papilla
<i>Liquid:</i>	()	()	()
<i>Saliva:</i>	()	()	()
<i>Solids:</i>	()	()	()

6. Breathing

() oral () nasal () mixed () not verified