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ELECTROMYOGRAPHIC ANALYSIS OF THE MASSETER MUSCLE IN PERSONS WITH DOWN'S SYNDROME*

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ABSTRACT: An electromyographic study of the right and left masseter muscles, in various mandibular movements, was performed on 15 individuals with Down's syndrome. The results were compared with those got from the same movements in normal individuals. The data showed that: (1) significant differences were not seen in the following movements: right lateral, left lateral, protrusion, and opening of the mouth; (2) the individuals with Down's syndrome showed a decrease in the electromyographic potentials during right and left molar mastication, incisor mastication and forced centric occlusion; (3) the muscular coordination pattern in the mongolic individuals was different from the normal subjects; (4) this study also shows that a general muscular hypotony, in individuals with Down's syndrome, can be detected by electromyography.

KEY-WORDS: Electromyography; masseter muscle; Down's syndrome; hypotony.

INTRODUCTION

In normal persons, the electromyographic effects show that, when lowering, we do not have potential of action in the masseter muscle[24] but, when moving up the mandible with or without occlusal contact, KÖNING[20] and VITTI & BASMAJIAN[37] observed a great activity in the temporal and masseter muscles.

In lateral deviations of the mandible, both the medial and lateral pterygoid muscles and the superficial part of masseter muscle in the opposite side begin to act[36,37].

In the propulsion of the mandible it was found the greatest number of muscular participation, i.e., masseter, medial pterygoid, digastric, mylohyoid and geniohyoid[37].

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In the works consulted, VITTI & BASMAJIAN[36] observed that children with complete first dentition, had a similar electromyographic pattern like the adult ones.

The Down's syndrome has an incidence about 1/700 children alive according to STEWART & PRESCOTT[32] and the genetic event responsible for this syndrome happens in the phasis of gametes development (ovule or spermatozoon) or around the phasis of fecundation. There is the appearance of extra-genetic material in the chromosome 21 and this may happen in three ways: regular trissomy, mosaicist, and translocation.

There are several general anomalies, mental and craniofacial that attack this syndrome, being of interest for the actual study of the alterations of motor coordination[3].

A characteristic cited by all the authors was the occurrence of the general muscular hypotony that is defined as a reduction or absence of the muscular tonus[30].

By the electromyography of the masseter muscle in persons with Down's syndrome we aim the study of the functional conduct of this muscle, comparing the results obtained with those results in normal people.

MATERIAL AND METHODS

The masseter muscles (right and left) of 15 persons with Down's syndrome, being 7 women and 8 men, by 7 and 26 years old, and 5 normal children, being 3 women and 2 men, by 6 and 8 years old, were examined electromyographycally.

We prefered the calibration of 200 uV, that was increased sometimes up to 500 uV and speed of sweeping of the bunches was 370 miliseconds/division.

The electrodes of surfaces (Beckman) were attached to the proper adhesive disc (Electrode past and adhesive, Collars Beckman Instruments, Inc., USA) in both masseter muscle to an equidistant point of the superior and inferior insertions, being the teeth in occlusal contact, and the electromyographic registration were obtained by an equipment TECA (TECA Corporation, USA), double channel, equipped with loudpeaker and panel of reading, both with synchronic and simultaneous action.

The experimental sequence consisted in the analysis of the rest position and of the following movements:

1. Opening and closing of the mouth
2. Rapid closing of the mouth
3. Rapid closing of the mouth with occlusal contact
4. Propulsion of the mandible
5. Movement of right laterality of the mandible
6. Movement of left laterality of the mandible
7. Molar mastication of chewing gum in the right side

8. Molar mastication of chewing gum in the left side
9. Incisive mastication of chewing gum
10. Forced occlusion.

To analyse the results, the fotogrammes were enlarged ten times through an equipment of reading microfilms (Leitz Wetzlar, West Germany).

In order to establish the values of the potencials, we based on the qualitative analysis of BASMAJIAN[2] and on the quantitative values proposed by OLIVEIRA[25].

So, the disposition of the values was fixed in this way calibration of 200 uV:

± (negligible activity)	: When the mean amplitude of the registry reached from 0.8cm to 1.59cm.
+ (slight activity)	: When the mean amplitude of the registry reached from 1.6 cm to 3.19cm.
++ (moderate activity)	: When the mean amplitude of the registry reached from 3.2cm to 4.79cm.
+++ (marked activity)	: When the mean amplitude of the registry reached from 4.8cm to 6.39cm.
++++ (very marked activity)	: When the mean amplitude of the registry reached from 6.4cm to 8.0cm or more.

RESULTS

The electromyographic results of the masseter muscles (right and left) obtained during the different movements effected by people with Down's syndrome are summarized in the Histogram 1, and for mongoloid people, normal children and adults in Histogram 2, for comparison[37].

Some pictures of significant electromyographies of different movements of the mandible are presented to illustrate the most habitual results in people with Down's syndrome.

DISCUSSION

The hipotony of a muscle may be presented with numerous morphologic variations in a great variety of sistemic disorders, and it depends on the degree of malignity with the muscular tissue is submitted. The number of these basic morphologic reactions is produced by a great variety of etiologies, of which we may mention since a temporary imobilization, passing through a denervation to a strong bad nutrition[14]. Electrocardiographic abnormalities indicate that morphologic changes occurred in the muscular cardiac fibers[29].

The electromyography is accepted by some authors as an important test to determine the presence of some neuromuscular disturbance[9,26,33].

Although there is a study in children as an electromyographic pattern of the movements of the mandible, we decided to make again five sessions of electromyographyc in normal children and compare the results to those obtained by VITTI & BASMAJIAN[36]. The five electromyograms showed results very similar to the obtained by the refered authors.

In order to analyse the electromyographic registrations, we chose the method used by OLIVEIRA[25] with photograms obtained during all the experiment, because the direct analysis of the oscilloscope of the equipment, the identification of the side where the movements were done, the observation of the movement and the concomitant establishment of the reached values become difficult, mainly in children with Down's syndrome.

During the opening of the mouth, there were no activity in the masseter muscle in both sides, but in the closing movement, the activity of these muscle was observed[1,10,20,21,23,27,36,37,40] and there was no significant difference in the potentials among normal and Down's syndrome persons.

In the movements of rapid opening and closing of the mouth and rapid closing with occlusal contact (Fig. 1), the studies of several authors[1,10,20,27,36,37,39,40] showed a strong activity in the right and left masseter muscles in the phasis of closing. But the people with Down's syndrome presented a moderate and slight activity (Histogram 1) also observing a minor speed, and comparing to the normal one, there is not a period of bright silence between a contraction and another (Fig. 1 – MAS). This demonstrates that, when we demand quickness in the movements, the hipotonic people present a minor potential of muscular action and minor distance between the periods of contraction. This may be justified by a decrease of the number of the receptors (mechanoreceptors) in the periodontal membrane, articular capsule, disc of the TMJ and muscle, that are responsible for the capture and afference of proprioceptive stimulus towards the trigemical nucleus of the encephalic trunk in normal people[5,8,17,18,19,35]. Another hypothesis should be related a disablement of motor coordination as a responsible to this muscular behavior.

In the propulsion of the mandible the persons with Down's syndrome had some difficulty in making that movement so it was impossible to observe if the propulsion

was done with or without occlusal contact separately, although they presented similar electromyographic potentials, according to the observations of some authors[7,12,20,36,39].

In the movement of right laterality and left laterality the results were similar in normal and mongolic people (Histogram 1,2) according to the discoveries of CARLSÖÖ[7], JARABAK[16], KÖNIK[20] and VITTI & BASMAJIAN[37] for normal people (Histogram 2).

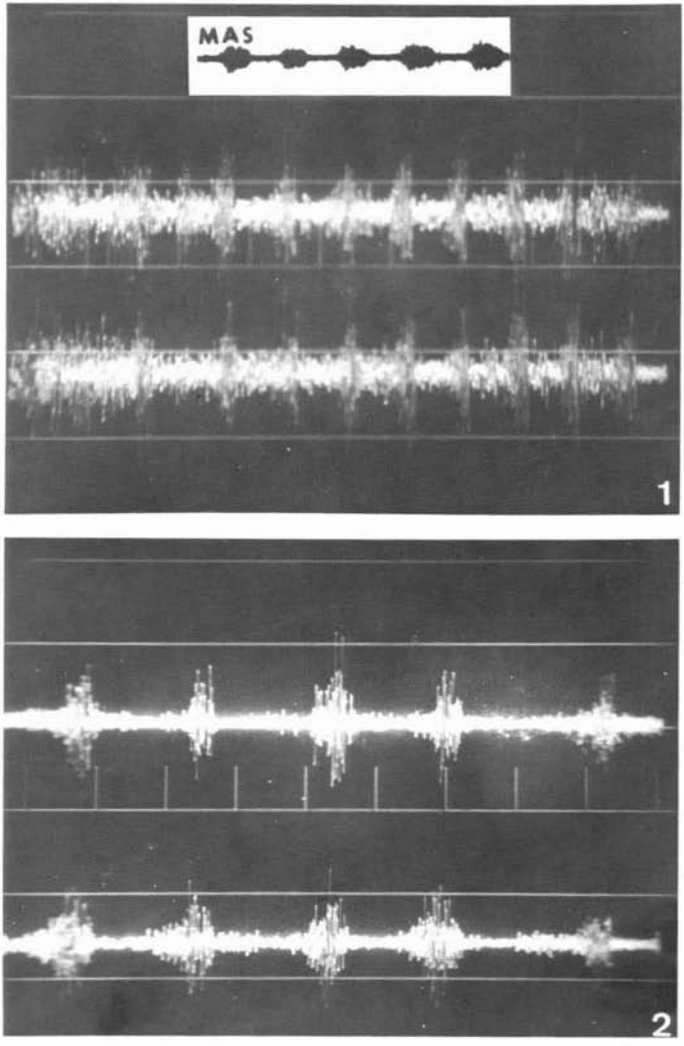
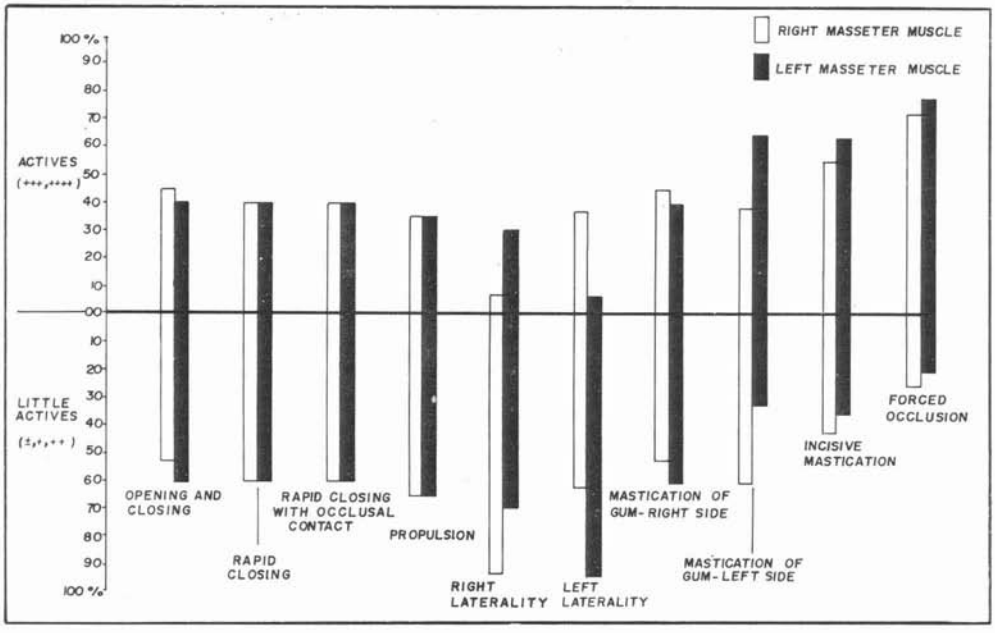


FIG. 1 – Rapid closing of the mouths with occlusal contact in person with Down's syndrome (200 uV) and masseter muscle (MAS) in normal person (500 uV).
FIG. 2 – Incisive mastication of chewing gum in person with Down's syndrome (200 uv).



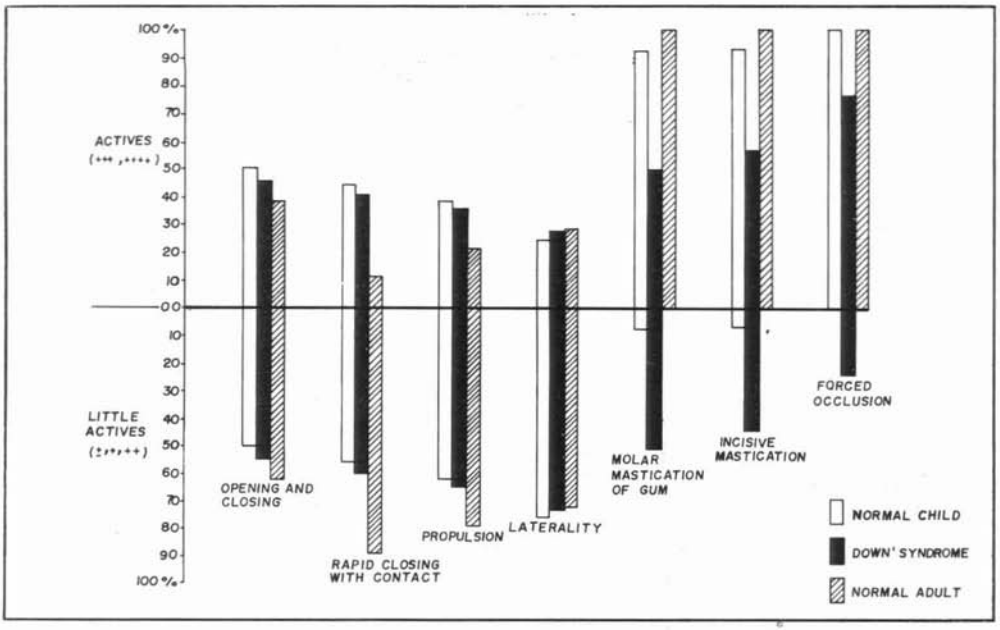
HISTOGRAM 1 – Relative to medial values of electromyographic potentials of the right and left masseter muscles in persons with Down's syndrome.

In movements for incisive, right and left molar mastication with chewing-gum (Figs. 2,3,4) the people with Down's syndrome still showed signs of minor potential of muscular action.

From people with Down's syndrome the results about 56.7% of strong and very strong answers (Histogram 1) while in normal people percentage goes up from 85% to 100%[1,20,36,37,40] also with active answers to right and left molar mastication of chewing-gum (Histogram 2). In incisive mastication, the results showed strong and very strong activity of the masseter muscle in people with Down's syndrome (Histogram 1).

We know that the masseter muscle participates actively during the movements of the mastication. This was confirmed by the authors[37] obtained 100% of active answers in 29 patients the same movements.

In the movements of forced centric occlusion (Fig. 5), we also obtained differences in the potentials of action among normal and Down's syndrome persons. Studies[11,28,37] showed that there is a very strong activity of the masseter muscle in this movement[11,28,37] (Histogram 2). In persons with Down's syndrome, we obtained the potential of action moderate degree (++) in about 23.3% of the cases (Histogram 1), which demonstrated that the people with syndrome show a decrease of the muscular tonus electromyographically when the muscle is required in its greatest

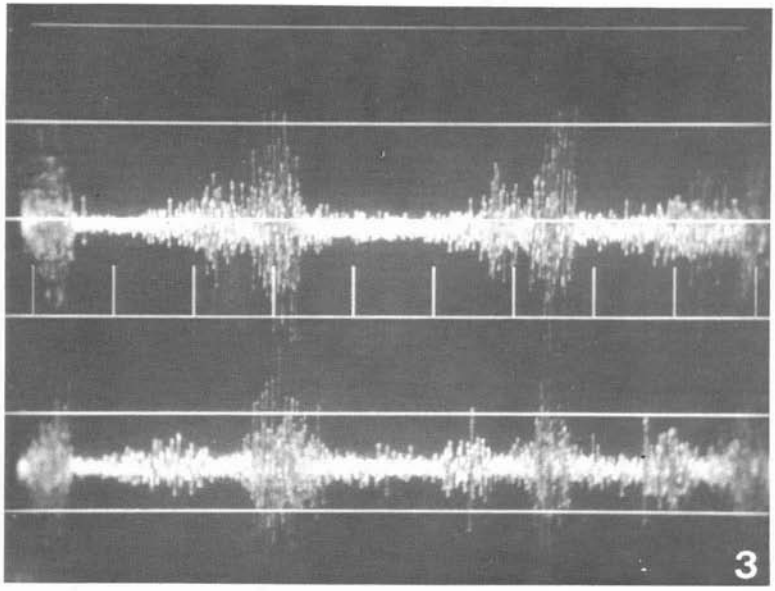


HISTOGRAM 2 – Relative to the medial values of the electromyographic potentials of the masseter muscles in normal children, normal adults and persons with Down's syndrome.

plenitude, considering that[4,16,22,31] proven that the superficial part of the masseter muscle and the medial pterygoid muscle in normal people are more involved when the mandible has to overcome the resistence as in masticatory movements.

WHITE & SACKLER[38] showed that there is a functional reduction in the musculature of patients with muscular dystrophy, mainly in the lips and the cheeks and still more in the musculature of the tongue. They still emphasize that the presence of bad occlusion results in a reduction of the function of some groups of muscular, due the degeneration of muscular fibers. Some authors refer to a structural disorganization in the masticatory system, when there is a progressive muscular dystrophy[6,13]. In electromyographic studies made in patients with muscular dystrophies, TAIZO *et alii*[34], although they do not identify the fraction and degree of damage in the masticatory muscle, suggest a damn in their functions.

Although there were alterations in the value of the electromyographic potentials, the ampliation of the registrations also permitted to check that pattern of coordination, i.e., the beginning and the end or duration of the period of the muscular contractions in persons with Down's syndrome were not similar to the pattern in normal persons. These facts suggest that the neuronal mechanisms of



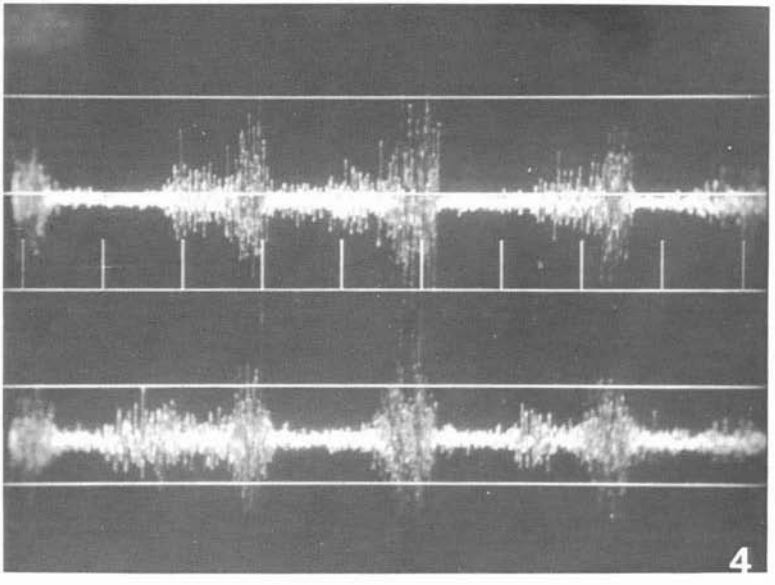


FIG. 3 – Molar mastication of chewing gum in the right side in person with Down's syndrome (200 uV).
FIG. 4 – Molar mastication of chewing gum in the left side in person with Dwn's syndrome (200 uV).

transport of the regulator impulses of the muscular contractions may have maintained its basic pattern of discharges of afference of its rythmicity and, probably the degree of recruitment of muscular fibers was changed.

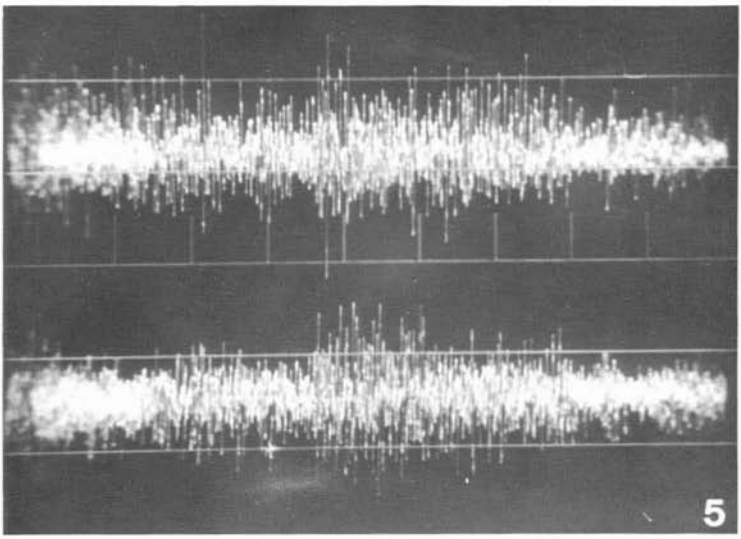


FIG. 5 – Forced occlusion in person with Down's syndrome (200 uV).

CONCLUSION

According to our studies, we belive that the privation of motor coordination in persons with Down's syndrome was the main responsible for the obtained results. These results show the necessity of new studies and examinations, because we think that if we train mongoloid person to make the proposed mandibular movements, the results may be approximate to the results obtained for normal persons.

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NICCOLI FILHO. W. D. *et alii* – Análise electromiográfica do músculo masséter em indivíduos portadores da Síndrome de Down. **Rev. Odont. UNESP,** São paulo, **18:** 293-304, 1989.

RESUMO: Foram analisados eletromiograficamente os músculos masséter direito e esquerdo em 15 indivíduos portadores da Síndrome de Down, em vários movimentos mandibulares, e comparados os resultados com aqueles de indivíduos normais. Os dados obtidos demonstraram que: 1) nos movimentos de abertura da boca, propulsão, lateralidade direita e esquerda da mandíbula não houve diferenças significantes nos resultados eletromiográficos entre indivíduos normais e os portadores da Síndrome de Down; 2) nos movimentos de mastigação molar direita e esquerda, incisiva e oclusão cêntrica forçada houve redução dos potenciais eletromiográficos para indivíduos portadores da Síndrome de Down, quando comparados aos indivíduos normais; 3) o padrão de coordenação dos indivíduos portadores da Síndrome de Down foi diferente daquele observado em indivíduos normais; 4) a "hipotonia" presente nos indivíduos portadores da Síndrome de Down pode ser detectada pelo exame eletromiográfico.

UNITERMOS: Electromiografia; músculo masséter; Síndrome de Down; hipotonia.

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