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Original articles

Speech disorders related to alterations of the lingual frenulum in schoolchildren

Alterações de fala relacionadas às alterações do frênulo lingual em escolares

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ABSTRACT

Purpose: to characterize and compare speech alterations related to the lingual frenulum alterations in schoolchildren from 8;6 to 10;11 years old among the control and research group.

Methods: 52 school children were evaluated (8;6 to 10;11 years old) both genders, regularly enrolled in private institutes divided into two groups: control group (without lingual frenulum alterations) and research group (with lingual frenulum alterations). These children were initially evaluated through the Assessment in Orofacial Motricity Protocol MBGR in a school clinic, through pictures used in this assessment. The tests used for the statistical analysis were *"Fisher Test", "Qui Square" and "Anova"*, as significant level 5% ($p<0.05$).

Results: from the 52 children, 26 (50%) presented lingual frenulum alteration. From these 26 children, 21 (80.8%) presented diminished lingual tonus, 20 (76.9%) presented low tongue in the oral cavity and 16 (61.5%) presented articulation alteration. Regarding the other evaluated items, there were no statistically significant differences among the groups.

Conclusion: the short frenulum prevailed over the other lingual frenulum alterations classifications. The research group presented statistically significant alterations when compared with the group control, in the following items: tongue tonus, low tongue posture in the oral cavity and articulation. In the other items, although there is no statistically significant difference among the groups, there was a tendency of major alteration in the research group. It was not possible to determine if alterations in phonetics speech are the same regarding the different lingual frenulum alterations.

Keywords: Tongue; Muscle Tonus; Lingual Frenulum; Child

RESUMO.

Objetivo: caracterizar e comparar as alterações de fala relacionadas às alterações do frênulo lingual em escolares, dos 8;6 anos aos 10;11 anos entre grupo controle e pesquisa.

Métodos: avaliou-se 52 crianças em idade escolar (8;6 anos a 10;11 anos), de ambos os gêneros, regularmente matriculadas em Instituto privado, divididas em: grupo controle (sem alteração do frênulo lingual) e grupo pesquisa (com alteração do frênulo lingual). As crianças foram avaliadas por meio do Protocolo de Avaliação em Motricidade Orofacial utilizado em uma Clínica Escola e por meio das figuras utilizadas no Protocolo de Avaliação em Motricidade Orofacial, *MBGR*. Os testes utilizados para a análise estatística foram "*Teste de Fisher"*, "*Qui Quadrado"* e "*Anova",* adotando-se como nível de significância 5% ($p<0,05$).

Resultados: das 52 crianças avaliadas, 26 (50%) apresentaram alteração do frênulo lingual. Destas, 21 (80,8%) apresentaram tônus de língua diminuído, 20 (76,9%) apresentaram língua baixa na cavidade oral e 16 (61,5%) apresentaram problemas de articulação. Quanto aos demais itens avaliados, não foram observadas diferenças estatisticamente significantes entre os grupos.

Conclusão: o frênulo curto prevaleceu sobre as demais classificações da alteração do frênulo de língua. O grupo pesquisa apresentou alterações estatisticamente significantes quando comparado ao controle, nos seguintes itens: tônus lingual, postura de língua baixa na cavidade oral e articulação. Nos demais itens, apesar de não haver diferença estatisticamente significante entre os grupos, houve uma tendência de alteração maior no grupo pesquisa. Não foi possível determinar se as alterações de fala fonética são iguais para as diferentes alterações do frênulo lingual.

Descritores: Língua; Tônus; Frênulo; Criança

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INTRODUCTION

Speech is the motor act performed by the organs of the stomatognathic system that express language, i.e. the motor representation of language[1-3].

In order for speech to be properly produced, it is essential that there exist an anatomical balance of the stomatognathic system allowing the articulators to perform the movements required for its production[4]. Furthermore, the individual must learn the physical aspects to it, which correspond to the phonetics and organizational or structural aspects of a language's system of sounds and are part of its phonology[5].

The lingual frenulum is a fold of mucosa connecting the tongue to the floor of the mouth.Its attachment is closely related to the performance of tongue movements and consequently the functions performed by this organ[6-10].

In order for the lingual frenulum attachment to be classified as normal, it needs to extend from halfway on the sublingual face down to the floor of the mouth[10-12].

When its attachment is otherwise modified, the lingual frenulum is then said to be altered.It is thus classified either as short (correct attachment, albeit with a smaller than usual size), as having an anteriorized attachment (normal size, but attached to a point located on the front half of the sublingual face, or even near the apex), or short having an anteriorized attachment (corresponding to a combination of the two previous types)[13].

The evaluation of the frenulum is indispensable when the lingual mobility and orofacial functions are abnormal. The speech therapist assesses the frenulum's condition by means of visual inspection, checking the tongue's mobility and usual position, as well as the articulatory production of speech[8,10,14].

Consequently, due to the alteration in the lingual frenulum, the tongue may be prevented from normally articulating with other stomatognathic structures, which may, therefore, result in a phonetic speech disorder, since this, according to the literature, is the orofacial disorder most frequently found in the presence of an altered frenulum[7,15,16].

A study by Cuestas et al. in 2014 reported that in preschool and school age, alterations in the lingual frenulum manifest as difficulties in articulating phonemes for which the apex of the tongue must come in contact with the incisive papilla and/or palate (/l/, /n/, /r/, /t/, /d/, /s/, /z/)[17].

Speech disorders, in general, have a negative impact on the children's social and school life, influencing their relationship with the environment and even their self-image. They may suffer discrimination for not speaking correctly.These reasons can jeopardize the child's health and quality of life.It is therefore essential that the etiological agent(s) causing such changes be diagnosed early so that their negative interference in the individual's life can be eliminated and/or reduced by means of a precise intervention, which can reduce or eliminate even minor changes, such as those of a psychological nature, for instance[5,17].

Therefore, the objective of this study was to characterize and compare speech disorders related to alterations of the lingual frenulum in schoolchildren, from 8;6 to 10;11 years of age, between the control and the study groups.In addition, the specific objectives of the study were:to phonetically characterize the speech of schoolchildren; to identify whether there is a relationship between the phonetic speech disorders and altered lingual frenulum, and whether the phonetic speech disorders are the same for the different alterations in the lingual frenulum.

METHODS

This is a prospective, cross-sectional, qualitative and quantitative study conducted at the José de Paiva Netto Educational Institute (IEJPN), approved by the institution's Research Ethics Committee from Medical Sciences College of the Santa Casa of São Paulo (CEP-FCMSCSP) (number 771, 481/2014).

We conducted preliminary assessments in all children with ages between 8;6 and 10;11 years, in order to determine those who had lingual frenulum alterations. Therefore, besides photographing the cardinal points on the tongues of schoolchildren and their lingual frenulum, the maximal mouth opening and the opening with the apex of the tongue against the incisive papilla were measured (a relation between the two measurements, when <50% suggests alterations in the lingual frenulum).

Out of a total of 89 children evaluated, 26 showed alterations in their lingual frenulum, whereas a total of 26 children had no alteration.Thus, the sample consisted of 52 schoolchildren (aged from 8;6 to 10;11 years), of both genders, and divided into two groups:

- *Study Group (SG)*consisting of 26 children with alterations in the lingual frenulum;
- *Control Group (CG):*consisting of 26 children with no alteration in the lingual frenulum;

Inclusion criteria for both groups were: to be a school-age child (aged between 8;6 and 10;11 years),

and show no sign of phonological disorders. Exclusion criteria for both groups were: to have undergone speech therapy in the area of Orofacial Motricity; to have performed frenectomy and/or lingual frenotomy; to present neurological disorders or any physical or cognitive disorder that might interfere in the speech and audiological assessment; and to show anatomical-functional alterations.

After the Voluntary and Informed Consent Form (VICF) and the Voluntary and Informed Assent Form (VIAF) were signed by the parents and/or guardians of all children and by the children themselves, the participants were evaluated in a private room at the educational institution, initially by using the Orofacial Motricity Assessment Protocol developed by the Faculty of Medical Sciences at Santa Casa de São Paulo (FCMSCSP). This protocol provides open- and closed-ended questions, through which all structures, muscles and orofacial functions are evaluated.

The items from the Adult Clinical Examination Protocol used are as follows:

Facial measurements were taken with the aid of a 6", 0-150mm, digital caliper (Hardened Stainless), manufactured in China, to check the maximum mouth opening and opening with the apex of the tongue against the incisive papilla and to verify whether or not there were alterations in the lingual frenulum.

Subsequently, the following photographs of seated subjects were taken with a digital camera SteadyShot (Sony) fixed onto a tripod: the face in the usual posture; teeth occluded; cardinal points of the tongue (4 photographs); with the mouth open; with the mouth open and tongue elevated (inside the mouth/frenulum).

Three aspects of the tongue were assessed while wearing disposable gloves and with the aid of a disposable wooden spatula: morphology, tonus, and mobility; and also, the type of lingual frenulum (normal; anteriorized; short; short and anteriorized).

The palatine tonsils were evaluated by means of clinical observation.

Speech was phonetically evaluated in order to observe the absence or occurrence (unsystematic or systematic) of omission, replacement and/or acoustic distortion of the phones, locked articulation, jaw deviation, low and anteriorized posture of the tongue on the floor of the mouth, lips, and associated movements of lips and cheeks, by means of shooting with the aid of a digital Sony SteadyShot camera of the lower-third of the face using the following questions:*"Say your name and how old you are"; "Say what you do for living (study, work)"; "Count from 1 to 20 and say the months of the year"; "Tell us about a trip (tour) you have taken and enjoyed".*

Finally, the participants were asked to name the pictures used in the Orofacial Motricity Assessment Protocol, *MGBR* [18], to complete the phonetic speech assessment.

For a descriptive analysis, the results were tabulated in a database, and a statistical analysis conducted, using Fisher's Test, Chi-Squared Test, and ANOVA, with a significance level of 5% ($p<0.05$).

RESULTS

Table 1 shows the relationship between the presence of alterations in the lingual frenulum and alterations in the lingual tonus.

In Table 2, the relationship between alterations in the lingual frenulum and the low posture of the tongue within the oral cavity is seen, during the articulatory production.

Table 3 correlates the alterations in the lingual frenulum to changes in the articulation, characterized as a locked one.

Table 4 shows the relationship between phonetic speech disorders and alterations in the lingual frenulum.

Table 5 shows the relationship between phonetic speech disorders and alterations in the lingual frenulum.

Table 1. Distribution of the subjects in the group with no alteration in the lingual frenulum and in the group with alterations, according to lingual tonus.

Lingual Tonus	Alteration In The Lingual Frenulum				p – Value
	No		Yes		
	N	%	N	%	
NORMAL	14	53.8	5	19.2	0.02
REDUCED	12	46.2	21	80.8	
TOTAL	26	100	26	100	

p <0.05 = statistically significant
The statistical test used was Fisher's Test, with a 5% (p<0.05) significance level.

Table 2. Distribution of the subjects in the group with no alteration in the lingual frenulum and in the group with alterations, according to a low tongue within the oral cavity.

Low Tongue Within The Oral Cavity	Alteration In The Lingual Frenulum				p – Value
	No		Yes		
	N	%	N	%	
NO	15	57.7	6	23.1	0.02
YES	11	42.3	20	76.9	
TOTAL	26	100	26	100	

p <0.05 = statistically significant
The statistical test used was Fisher's Test, with a 5% (p<0.05) significance level.

Table 3. Distribution of the subjects in the group with no alteration in the lingual frenulum and in the group with alterations, according to locked articulation.

Locked Articulation	Alteration In The Lingual Frenulum				p – Value
	No		Yes		
	N	%	N	%	
NO	20	76.9	10	38.5	0.01
YES	6	23.1	16	61.5	
TOTAL	26	100	26	100	

p <0.05 = statistically significant
The statistical test used was the Chi-Squared Test, with a 5% (p<0.05) significance level.

Table 4. Distribution of the subjects in the group with no alteration in the lingual frenulum and in the group with alterations, according to the phonetic alterations.

Phonetic Alterations	Alteration In The Lingual Frenulum				p – Value
	No		Yes		
	N	%	N	%	
NO	25	96.2	20	76.9	0.05
YES	1	3.8	6	23.1	
TOTAL	26	100	26	100	

p <0.05 = statistically significant
The statistical tests used were the Chi-Squared Test and ANOVA, with a 5% (p<0.05) significance level.

Table 5. Relationship between speech disorders and the type of alteration in the lingual frenulum.

Lingual Frenulum	Speech Disorder	
	N	%
SHORT	18	75.0
SHORT AND ANTERIORIZED	4	16.7
ANTERIORIZED	2	8.3
TOTAL	24	100

p <0.05 = statistically significant
The statistical test used was the Chi-Squared Test, with a 5% (p<0.05) significance level.

DISCUSSION

Speech therapists have increasingly received patients with complaints related to alterations in the articulation of speech sounds. They may often be associated with an altered lingual frenulum, which may be either the cause or the aggravation of such difficulties[7].

With regard to the lingual frenulum, the role of the speech therapist entails assessing its conditions by means of a visual inspection and verification of the lingual movements, as well as evaluating stomatognathic functions, including speech. When deemed necessary, the speech therapist suggests the assessment be carried out by yet another professional, surgical intervention or speech therapy to eliminate and/or reduce the alterations found[12].

The subjects' average age in this study was 9.78 years in the study group (with alterations in the lingual frenulum) and 9.63 years in the control group (with no alteration in the lingual frenulum). With respect to gender, 15 (57.7%) girls were observed to have alterations in the lingual frenulum, in agreement with a study that found that 53.6% of the individuals evaluated were females[19]. Another study[20] reports that alterations in the lingual frenulum are more prevalent in males.This difference can be explained by the fact that, in the current study, there are a greater number of females.

The results of this study showed a statistically significant difference between the groups with regard to the tonus of the tongue, considering that 21 (80.8%) children with alterations in the lingual frenulum presented alterations to the lingual tonus, characterized by a decrease in it. This is consistent with two studies that found that the percentage of individuals with an altered lingual tonus is higher among individuals identified as having alterations in the lingual frenulum and that their evaluation aids in reducing the doubts as to the normal lingual frenulum[20,21]. A study conducted in 2009 found that, in most of the sample with alterations in the lingual frenulum, the tonus of the tongue was also reduced[12].

According to the literature, there may be a relationship between alterations in the lingual frenulum and lingual tonus[22]. When the lingual frenulum is altered, the function of the tongue at rest will present at the floor of the mouth due to difficulties in maintaining the apex against the incisive papilla, which may, therefore, even result in a decreased tonus. It is noteworthy that, in this study, out of the 26 (50%) children with alterations in the lingual frenulum, the usual posture of the tongue (rest) was unobservable, because, in order to determine the

posture the tongue occupies when at rest, the mouth must be open and/or slightly open and, at the time of evaluation, all of the children had their lips occluded.

With regard to the classification of the alterations in the lingual frenulum, there was no statistical difference across the types of lingual frenulum. However, the short frenulum showed to prevail over the other types. Out of the 26 (50%) altered lingual frenula, 19 (73.1%) are short, 5 (19.2%) are short and anteriorized, and only 2 (7.7%) are anteriorized. This finding is in line with a study[19] in which, out of the 1,402 patients evaluated, 21 (16.5%) were classified as having predominantly short frenula. In another study[12], a predominance of short frenula (60%) over the other classifications was also found. Nevertheless, there is a discrepancy between this study and the literature cited, since the next most prevalent alteration in this study is the short and anteriorized frenulum, whereas, in those, it is the anteriorized frenulum. This may be related to the difference between the number of individuals evaluated, which was small in this study when compared to that of other studies, the use of different parameters for visual inspection, and also the existing subjectivity when trying to discern one type of alteration from the others, considering the subtlety among them.

With regard to speech disorders, although there were no statistically significant differences between the groups, it was observed that out of the 26 (50%) children with alterations in the frenulum, 24 (92.3%) had some sort of speech disorder. In the study conducted in 2009, speech disorders were found in 72% of 18 subjects with alterations in the frenulum[12]. Another study reports that, out of the 127 individuals with alterations in the lingual frenulum, 62 (48.8%) were presented with speech disorders[19].

In order for speech to be properly produced, a balance between all the anatomical-functional structures of the stomatognathic system and motor bases involved in its production is essential[4]. Hence, when there is an alteration in the lingual frenulum, lingual mobility may be impaired and is likely to result in impairment of the orofacial functions, with speech being the function mostly influenced by alterations in the lingual frenulum.

In correlating the types of alterations of the frenulum with speech disorders, it was observed that the short frenulum prevailed over the other 18 (75%) types, followed by the 4 (16.7%) short and anteriorized ones, and then by the 2 (8.3 %) anteriorized ones. These data oppose those observed in a study where the relationship between speech disorders and an anteriorized frenulum was larger[7]. As the sample evaluated in this study exhibited a higher prevalence of short frenulum, the fact that this type of alteration in the lingual frenulum has greater involvement in speech in relation to the anteriorized frenulum is justified.

When considering the types of speech disorders, there was a statistically significant difference between the groups with regard to the posture of the tongue at the time of speech production. Out of the schoolchildren with alterations in the lingual frenulum, 20 (76.9%) exhibited a low tongue within the oral cavity. A study describes that one of the most frequently encountered symptoms in speech that suggests alteration in the lingual frenulum is the tongue whose posture is in the mouth floor[16]. Such posture is expected, given that the tongue will be prevented from moving freely by alterations to the attachment and/or length of the frenulum, which will consequently cause it to be low within the oral cavity during the articulation of speech sounds.

In this study, it was found that, out of the schoolchildren who had a low posture of the tongue on the floor of the mouth during speech production, 4 (20%) had a short and anteriorized frenulum, 2 (10%), an anteriorized frenulum, and 14 (75%), a short frenulum. This finding is in agreement with two other studies reporting that tongues with an altered length of the frenulum, i.e. with a short frenulum, are clinically low, on the floor of the mouth, which increases the possibility of articulatory imprecision[12,16]. With regard to the anteriorized and the short and anteriorized frenula, the study states that in addition to the fact that the tongue is low on the floor of the mouth, the more anteriorly the frenulum is attached, the more limited the tongue movements will be, i.e., greater the impact on speech[12]. Importantly, as the larger sample in this study did not comprise anteriorized and/or short and anteriorized frenula, it becomes clear that these alterations did not have greater repercussions for speech.

In terms of speech articulation, there was a statistically significant difference between the groups. Of the schoolchildren with lingual frenulum alterations, 16 (61.5%) showed locked articulation. According to the literature, locked articulation is another symptom often found in speech that suggests alteration in the lingual frenulum[16]. In a study conducted in 2009, despite the absence of a statistical association across the groups evaluated, locked articulation was observed as one of the most frequent features accompanying speech disorders[12].

Locked articulation is a compensation resulting from reduced lingual mobility, for, in an attempt to properly produce the phones, i.e., to produce the articulation points in a correct fashion, the speaker reduces the space between the jaws during the articulation of speech sounds. Locked articulation is among the causes of articulatory imprecision and often affects speech as a whole[12].

In linking the alterations in speech articulation with the types of alterations in the lingual frenulum, it was observed in this study that among the schoolchildren with locked articulation, 4 (25%) have a short and anteriorized frenulum and 12 (75%) have a short frenulum. Clinically, mouth opening is observed to occur to a lesser extent in individuals with a short frenulum. In this study, no schoolchildren presented with locked articulation and alterations in the lingual frenulum at the same time[16]. The literature does not describe what kind of alteration in the lingual frenulum has greater repercussion for speech articulation.

In respect of phonetic speech disorders, there was a statistically significant difference between the groups. It was found that among the schoolchildren with alterations in the lingual frenulum, 6 (23.1%) have some phonetic speech disorder.

The phonetic speech disorder is the most frequently found orofacial disorder in the presence of an altered lingual frenulum. Usually, alterations in the lingual frenulum impair the articulation of a group of sounds classified as alveolar [t], [d], [n], [l], and [r]. This occurs because the anterior third of the tongue, necessary for the articulation of these phones, is prevented from rising up to the alveolar region, due to the mechanical hindrance caused by the shortening and/or alteration in the lingual frenulum attachment[23].

In this study, the alterations found were those involving the substitution of the alveolar liquid phoneme [l] with [r] and a systematic acoustic distortion in the consonant clusters with [r], more specifically [tr] and [dr], mild [r] and unsystematic distortion of [s] and [z]. It was also observed that, except for the acoustic distortion of the phones [s] and [z], all other acoustic alterations were found in the presence of a short lingual frenulum and the distortions in [s] and [z], in the presence of an anteriorized lingual frenulum. This finding is in agreement with what was observed in studies in 2003, 2009 and 2010[12,16,19].

The phones that most frequently altered (by omission or distortion) in the presence of an altered lingual frenulum were: the alveolar flap, consonant clusters composed of [r] and or [l], and the alveolar fricatives [s] and [z][16,24]. A study published in 2013 shows that, in Brazil, issues related to the restriction of movements of the tip of the tongue are quite common (48.9%) and affect speech, particularly the alveolar flap [r] and alveolar fricative phonemes[25].

The other items evaluated in speech, with no significant differences between the study groups, were: Phonetic alterations, jaw deviation, low and anteriorized posture of the tongue, lips and associated movements of the lips and cheeks. It was not possible, in this study, to determine whether the phonetic speech disorders are the same for the different alterations in the lingual frenulum.

The continuity of studies addressing issues involving the tongue frenulum and its relationship and involvement with orofacial functions constitutes an increasingly important aspect in the field of Orofacial Motricity.

CONCLUSION

In this study, it was observed that the short frenulum prevailed over the other classifications of alterations in the lingual frenulum.

The study group (with alterations in the lingual frenulum) showed speech disorders that were statistically significant when compared to the control group, with respect to the following items: low posture of the tongue within the oral cavity and locked articulation. With regard to the other items, there was a trend towards greater alterations in the study group.

There was also a statistically significant relationship between lingual tonus and worse results in the group presented with alterations in the lingual frenulum.

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