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REVIEW PAPER

Evaluation protocol for frenotomy

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ABSTRACT

With the growing interest in the topic of ankyloglossia and the increasing number of frenotomies performed, the need to develop a uniform protocol for clinical management and to define objective indications for the procedure is becoming urgent. This paper presents an interdisciplinary proposal for a procedure for evaluating the indication for frenotomy, developed on the basis of an analysis of existing classifications and a review of the literature from all fields dealing with this topic. The proposed procedure for evaluating the indication for frenotomy is based on an objective and verifiable scoring system, which considers anatomical, functional, and clinical criteria. This approach enables the assessment of postoperative improvement. The suggested approach significantly reduces subjectivity in surgical decision-making. It is a universal method that can be customized to meet individual patient needs. Furthermore, it opens avenues for interdisciplinary and comparative research on ankyloglossia.

KEY WORDS:

ankyloglossia, classification of ankyloglossia, indications for frenotomy.

INTRODUCTION

Individual variability in the structure of the tongue frenulum and the presence of various compensation processes, which are the result of the body's adaptation to the short tongue frenulum, make it difficult to develop a universal classification of ankyloglossia and determine indications for frenotomy [1–6]. Such compensations for abnormal anatomical conditions occur from the first days of life of a newborn with ankyloglossia. Trying to overcome the difficulties associated with the limited motor functions of the tongue while sucking the breast, the child activates additional muscles of the masticatory apparatus. This causes the child to become tired and discouraged from sucking, and forces various types of co-movements, grimaces and parafunctions [1, 4, 6, 7]. This adaptation to abnormal anatomical conditions results in secondary functional disorders and, consequently, in abnormal craniofacial development [8–11]. The degree of shortness of the frenulum of the tongue does not always correlate with the degree of restriction of the tongue rate motion. Therefore, it is important to take into account both anatomical and functional criteria when classifying ankyloglossia [5, 6]. The speech therapy diagnostic protocol also tests the functions of the tongue, such as sucking, swallowing, biting, and chewing [7, 11, 12]. However, existing classifications are not always consistent, because they take into account different criteria or different parameters for the same feature [8, 13–15]. Unfortunately, due to the lack of standardized research methods, there are no sufficient, reliable scientific studies on the issue of short frenulum of the tongue. The most important problems are the lack of unified standards of conduct and the lack of interdisciplinary cooperation. Hence, it is critical to implement a standardized approach for diagnosis and evaluation of surgical eligibility.

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The authors developed a protocol for frenotomy based on the existing classifications and the knowledge about ankyloglossia available in the literature.

The objective of the paper is the scientific description of an optimal, interdisciplinary eligibility assessment procedure for tongue-tie surgery.

MATERIAL AND METHODS

The evaluation protocol for frenotomy was developed on the basis of a review and analysis of the available literature from all fields dealing with this issue (ENT, speech therapy, dentistry, orthodontics, physiotherapy, pediatrics). This paper focuses on analyzing several key issues related to ankyloglossia, including its classification, indications for frenotomy, and its impact on the occurrence of secondary dysfunctions. The authors examined and compared existing classifications of ankyloglossia, in particular assessing their universality and reproducibility in relation to measurements of various parameters related to frenulum status. To minimize the subjectivity of assessments, a point scale was used in the protocol, following the example of other surgical disciplines.

RESULTS

By definition, ankyloglossia is a condition of the frenulum of the tongue that limits the range of motion of the tongue and leads to disorders of tongue functions [3]. Therefore, a very important element of the tongue frenulum assessment must be not only the functional assessment of motor skills of the tongue but also the clinical assessment that is the result of secondary dysfunctions and compensations due to impaired tongue motor skills. Therefore, when evaluating the procedure, interdisciplinary cooperation is very important. It should be documented in written reports from specialists dealing with the diagnosis and treatment of a particular patient. The healthcare providers responsible for determining the appropriate treatment plan, such as an ENT specialist, dentist, or oral surgeon, should consider and incorporate the opinions of all specialists involved in the diagnostic and therapeutic process. The proposed diagnostic method is a critical synthesis and review of the literature about ankyloglossia. The authors do not impose the choice of any of the methods of anatomical and functional assessments. However, they propose an anatomical classification of Coryllos or TABBY (The Tongue-tie and Breastfed Babies) assessment tools because they are widespread and, in their opinion, the most practical [16, 17]. The innovative contribution is the use of an additional clinical criterion that takes into account secondary symptoms of limited tongue mobility and the opinions of other specialists. It is not the intention of the authors to evaluate the existing classifications but to use them in practice. The developed method is a pragmatic synthesis of the existing knowledge on ankyloglossia.

TONGUE FRENULUM EXAMINATION

VISUAL DIAGNOSIS

Assessment of the resting position of the tongue

The position of the tongue relative to the floor of the mouth and palate is assessed. It is checked whether the tongue lies on the floor of the mouth or is "glued" to the palate (correct position).

The correct resting position (vertical-horizontal) is defined as follows: the tongue rests against the hard palate, touching the tip of the incisive papilla and the edges of the upper alveolar arches. The entire dorsal surface of the tongue adheres to the palate, creating support for it in a shape resembling braces [4–7, 12, 18–20].

Examination technique: While the child is sleeping, the examiner gently opens the child's mouth by pressing their index finger against the jaw. In older children and adults, craniofacial imaging studies are performed during orthodontic diagnosis, where the position of the tongue at rest can be seen.

Assessment of the tongue's range of motion

The tongue's range of motion is examined: lifting, forward, and lateral extension. An important part of this assessment is to observe the movement of the mandible during tongue movements, as the mandible should then be stable [4, 5, 20–22]. According to Zaghi, an indicator of the range of tongue movement is the measurement of TRMR – tongue range of motion ratio [5]. Unfortunately, this method does not work when applied to young children. In children, an assessment of the motor skills of the tongue is carried out by a speech therapist.

Pathological signs include:

- a longitudinal furrow in the midline of the body of the tongue (Figure 1),
- a "heart sign" (Figure 1),
- a bowl-shaped depression in the body of the tongue (Figure 2).

PALPATION

Instruction with passive tongue elevation

The tongue is to be elevated by applying gentle pressure on the tissues of the floor of the mouth with the middle finger, while the index fingers of both hands are positioned underneath it.

The following aspects should be evaluated:

- the thickness and translucency of the frenulum,
- the length of the frenulum between both attachments,
- the length of the free part of the tongue (from the tip of the tongue to the upper attachment),
- the locations of the frenulum attachments (upper and lower),

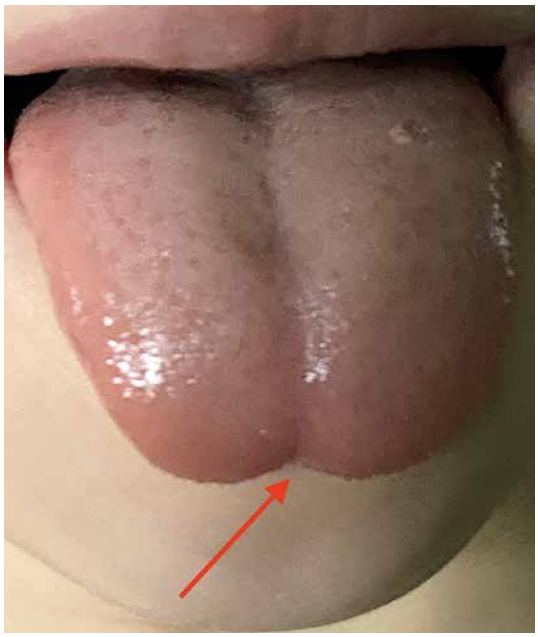

FIGURE 1. A longitudinal furrow in the midline of the body of the tongue

FIGURE 2. A bowl-shaped depression in the body of the tongue

- the degree of tension of the surrounding anatomical structures when lifting the tongue,
- the presence of a sign of tissue pallor (anemization) in the area of the frenulum attachment sites during the tongue elevation.

Instruction without tongue elevation

The presence of a midline vertical obstruction indicating shortening of the frenulum of the tongue can be assessed by placing the index finger underneath the freely lying tongue, using the one-hand finger test.

EVALUATION PROCEDURE FOR SHORT FRENULUM CORRECTION

Anatomical, functional, and clinical assessments should be performed after physical examination of the oral cavity and an assessment of the frenulum of the tongue.

Assign the patient a certain score for each of the three assessments. The result obtained should be compared with Table 1.

TABLE 1. Classes of recommendation for frenotomy. Based on 2021 ESC guidelines [30]

Classes of recommendations	Points	Recommendations
Class I	9–8	Is recommended or is indicated
Class II		
IIa	7–6	Should be considered
IIb	5–3	May be considered
Class III	2–0	Is not recommended

ANATOMICAL ASSESSMENT

Anatomical assessment: see above – "Tongue frenulum examination" and Figure 3 based on the Coryllos [16] and TABBY [17] classifications.

The degree of ankyloglossia (anatomical assessment) (Figure 3):

- there is no shortened frenulum – 0 points,
- shortened frenulum to a low extent – 1 point,
- shortened frenulum to a moderate extent – 2 points,
- shortened frenulum to a to a considerable extent – 3 points.

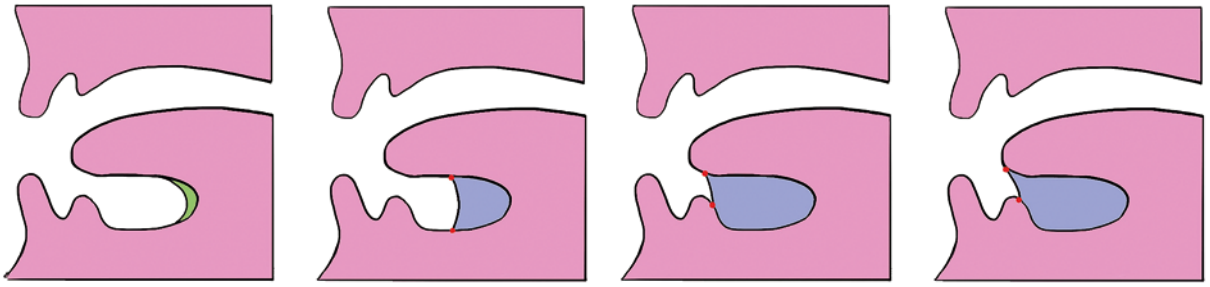

FIGURE 3. The degree of ankyloglossia (anatomical assessment)

Low extent – the tongue-tie is attached to the mid-tongue and the middle of the floor of the mouth and is usually tighter and less elastic.

Moderate extent – the tongue-tie is 2–4 mm behind the tongue tip and is attached to or just behind the alveolar ridge.

FUNCTIONAL ASSESSMENT

Functional assessment [4, 5, 7, 12, 18–21, 23] – opinion of speech therapy:

- normal tongue mobility – 0 points;
- slight limitation of tongue mobility –1 point:
  - decreased range of tongue extension,
  - the tip of the tongue is able to lick the lips;
- moderate limitation of tongue mobility – 2 points:
  - the frenulum visibly restricts all movements of the tongue,
  - the mandible follows the movements of the tongue,
  - the presence of tissue pallor (anemization) in the areas of frenulum attachments when the tongue is elevated;
- significant limitation of tongue mobility – 3 points:
  - inability to lift the tongue.

CLINICAL ASSESSMENT

Clinical assessment (presence of ankyloglossia symptoms listed below):

- no clinical symptoms – 0 points,
- 1 symptom present – 1 point,
- 2 symptoms present – 2 points,
- more than 2 symptoms present – 3 points.

Difficulties with breastfeeding: the child sucks the breast ineffectively, gets tired, stops eating to rest, swallows air, incorrectly grasps the mother's nipple, injuring it with the gums, causing pain to the mother (opinion of a neonatologist and a lactation consultant) [1, 3, 12, 24–26].

Difficulties with swallowing, mastication, and biting due to abnormal tongue mobility. As a result, it is harder to prevent diet expansion (opinion of a speech therapist, a dentist, and a pediatrician) [2, 3, 7, 8, 12].

Excessive drooling of the child, whooping, coughing, vomiting reflexes when extending the tongue (exclusion of other causes by relevant specialists).

The incorrect resting position of the tongue (opinion of a speech therapist and an orthodontist or the result of a craniofacial CT scan in frontal and sagittal projections or oral MRI) [5, 8, 9, 18–20].

Articulation disorders associated with ankyloglossia and no improvement after speech therapy (opinion of a speech therapist with justification for frenotomy) [3, 6, 7, 27, 28].

Malocclusion associated with ankyloglossia (orthodontist opinion) [8–11, 21].

Temporomandibular joint dysfunction caused by excessive muscle tension due to ankyloglossia (opinion of a physiotherapist, an oral surgeon, and an osteopath) [5, 29].

Abnormal facial expressions with the presence of co-movements, grimaces of the orofacial region caused by limited tongue mobility [12].

Other dysfunctions caused by ankyloglossia – diagnosed and documented.

After the entire procedure, add up the number of points collected and compare with Table 1 [30].

Before obtaining consent for the procedure, it is necessary to discuss the entire procedure with the patient or the caregiver. All relevant arguments, such as the degree of dysfunction, the presence of contraindications to the procedure, the child's general and psychological condition, comorbidities, the risks of the procedure, alternative procedures, and perioperative procedures should be considered before making a final decision on frenotomy. At this stage it is important to determine the type of anesthesia for the procedure. If possible, the procedure should be performed comprehensively, i.e., if there is coexistence of, for example, hypertrophy of the pharyngeal tonsil, both procedures should be performed simultaneously under general anesthesia. When deciding on a frenotomy, it should be considered that a disorder of tongue mobility leading to an abnormal swallowing mechanism predisposes to other conditions, such as OMS (secretory otitis media) or tooth decay. The coexistence of these conditions tilts the argument in favor of performing the procedure comprehensively under general anesthesia. Nowadays, adequate patient preparation (myofunctional therapy) is the standard [5, 15, 22, 31]. This requires the cooperation of a multidisciplinary team. Prevention of adhesions is also important for optimal surgical outcomes. However, this topic requires a separate and more extensive discussion.

Contraindications to frenotomy: Pierre-Robin syndrome, retrognathia**,** micrognathia neuromuscular diseases, decreased muscle tone in the orofacial space, macroglossia (relative), disorders of the blood coagulation system.

DISCUSSION

Evaluation of the frenulum of the tongue should be an integral part of the oral examination performed routinely by specialists in various fields of medicine. In Poland, guidelines for neonatologists in this regard were established in 2012 [25]. In Brazil, the Neonatal Tongue Screening Test (NTST) was introduced in 2014 [32]. Every newborn baby is screened for ankyloglossia according to a protocol for evaluating the frenulum of the tongue. The premise of the program is early detection of ankyloglossia and preventive frenotomy to avoid secondary consequences of abnormal tongue mobility. In recent years, there has been a growing interest in ankyloglossia and an

increase in the number of frenotomies performed [3, 6, 8, 14, 21]. Authors Walsh *et al.* [33], Wei *et al.* [34], Lisonek *et al.* [35], Dixon *et al.* [36], and Halle *et al.* [37] stated that some of the operated patients could and should have avoided this procedure, as the expected improvement was not achieved. Therefore, in order to minimize the risk of making a wrong decision, the issue of proper selection for surgery is very important. To date, no universal diagnostic tool has been developed to objectively evaluate the frenulum of the tongue and select for surgery only those patients likely to show postoperative improvement.

Currently, there are many classifications of ankyloglossia that take into account various parameters. For example, Kotlow [38] evaluates the length of the free tip of the tongue and divides ankyloglossia into 4 classes, supplementing the evaluation with functional tests. Ruffoli *et al.* [39] measures and compares maximum oral opening with the tongue on the floor of the mouth and with the tongue positioned on the incisive papilla. Most classifications, however, only assess the frenulum among newborns and infants [16, 17, 24–26]. The most widely used is the Hazelbaker Assessment Tool for Lingual Frenulum Function (HATLFF) scale, which, however, does not take into account the correlation of the child's age with the length of the tongue frenulum, making assessment difficult among older children [24]. In clinical practice, the protocol is complicated and time-consuming. Similarly, there are no established guidelines among speech therapists for the management of ankyloglossia [3, 6, 7, 12]. In evaluating the frenulum of the tongue, they place great emphasis on examining all functions related to the motor function of the tongue. The activities of the tongue that occur before the appearance of speech are called primary activities, as opposed to speech, which is itself called a secondary activity [7, 12]. These include sucking, swallowing, biting, micturition and others. The latest functional definition of ankyloglossia (Zaghi *et al.*, published in 2020) is based on assessment of tongue range of motion using the tongue tip extended towards the incisive papilla (TIP) [5]. The authors recommend modification to assess TRMR while the tongue is held in suction against the roof of the mouth in lingual-palatal suction (LPS). Validation of this method confirmed that TRMR-TIP and TRMR-LPS measurements reflect patients' subjective feelings of the extent of tongue movement. An important limitation of this classification is the difficulty in applying it to children. So far, none of the existing classifications have included the symptoms of ankyloglossia as a diagnostic tool. Existing classifications propose various types of measurements. Some evaluate the impaired function, but none take into account interdisciplinary cooperation, even though ankyloglossia is a problem at the intersection of several disciplines. Thus, the diagnostic protocol presented here is a novel approach, as it takes into account the clinical symptoms resulting from the sequelae of ankyloglossia and the opinions of relevant specialists. The authors based this method on three criteria: anatomical, functional and clinical. In the proposed diagnostic protocol, the presence or suspicion of specific deficits associated with ankyloglossia requires consultation and a written opinion from an appropriate specialist. The doctor referring a patient for surgical treatment does not always have sufficient knowledge to differentiate whether, for example, a child's malocclusion may be the result of ankyloglossia, or whether the articulation disorder is the result of abnormal tongue mobility. Similarly, breast-sucking problems are not always due to ankyloglossia, and in accordance with the "*primum non nocere*" principle, other causes should be ruled out before deciding for surgery [1, 3, 24–26]. The proposed method allows for additional verification of the opinions of specialists suggesting the need for a frenotomy.

Currently, the assessment of the frenulum of the tongue and its function is unfortunately subjective. Therefore, a scoring scale has been proposed to minimize this bias. It allows verification of the decision regarding the procedure and allows comparison of the patient's condition before and after frenotomy, which to a large extent makes this method more objective. It also creates a much safer environment in legal terms – clear, verifiable evaluation criteria. The proposed method makes it possible to objectively determine when the procedure is recommended, when it can be performed, and when it is needed (Table 1). The extreme decision options for frenotomy are universally agreed upon. Borderline cases are the most difficult. This fact was pointed out by Hattami, who, based on a very broad analysis of the available classifications, concluded that none of them can determine the risk of failure and lack of improvement after surgery [14]. The scoring scale that has been developed largely minimizes these uncertainties. It also provides a basis for legal protection for the doctor in case of possible claims. This publication is the result of an in-depth analysis of the literature on the subject and its collective summary, useful for practitioners. An important, precursor element of the method is considering the clinical assessment that takes into account the opinions of other specialists, which gives the method a universal and interdisciplinary dimension.

CONCLUSIONS

The proposed method of evaluation of ankyloglossia for frenotomy is an objective interdisciplinary point-based scoring diagnostic method. It increases the accuracy of the decision and can largely eliminate the risk of lack of improvement after the procedure. It also makes it possible to assess the effectiveness of treatment. Minimizing the subjectivity of assessments creates the conditions for further interdisciplinary research on the impact of ankyloglossia on the presence of secondary dysfunctions.

DISCLOSURE

The authors declare no conflict of interest.

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