

ARTICLE

Protocol for the functional evaluation of the stomatognathic system.

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Abstract: Alterations in breathing, chewing and swallowing are considered risk factors for functional disorders on the stomatognathic system. Thus, there is a need to have a protocol for functional evaluation that contributes to systematize the processes and procedures, unifying criteria for diagnosis. The objective of this study was to design a Protocol for the functional evaluation of the stomatognathic system for the Postgraduate Clinic of Orthopedics of the School of Dentistry of the University of Zulia, Venezuela. In a first stage, a situational diagnosis was made. In a second stage, the documentary analysis technique was used, using the search engines Pubmed, Redalyc, SciELO and ScienceDirect. The third stage consisted in the elaboration of the protocol according to the consensus of the resident postgraduate professionals and the evidence found in the review of the scientific literature. The protocol was drawn up, defining its objectives, population, institutional resources and a systematic and detailed ordering of the procedures and tests to be applied for the evaluation of breathing, chewing and swallowing. This protocol will improve the quality of the evaluations and obtain reliable records of the patient's clinical condition.

Keywords: clinical protocol, stomatognathic system, respiration, swallowing, chewing.

INTRODUCTION

The stomatognathic system (SS), is the set of organs and tissues that allow oral functions such as speaking, eating, chewing, swallowing, among others (*Iwasaki et al., 2015*). Grippaudo et al. (2016) state that mouth breathing changes the skull growth pattern causing malocclusion. Masticatory function is an important factor for the preservation of general health (*Feizi et al., 2016*), an asymmetric function during mastication with imbalance of occlusal force and muscle activity affects the balance in facial growth (*Kwak, 2014*). Atypical swallowing is a myofunctional problem that consists of an altered position of the tongue during the act of swallowing (*Podadera et al., 2013*) has also been associated with dental problems (*Silva & Manton, 2014*). Buccal breathing is associated not only with disorders of maxillary morphology, alveolar-dental and facial cranial growth, but also with infectious respiratory processes, cardiopulmonary problems, immunological and general postural alterations (*Grippaudo et al., 2016; Maspero et al., 2014; Podadera et al., 2013*).

It is necessary to comply with certain parameters to guarantee the quality of the evaluations and obtain reliable records during the diagnosis of functional alterations. Thus, the importance of having a clinical protocol that contributes to reduce the variability in practice, systematizing and ordering the processes and procedures. The protocol must be agreed among experts,



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incorporating in its structure the best evidence available in the scientific literature (García, 2015).

This research was aimed at designing a protocol for the functional evaluation of SS of children and adolescents who attend the Postgraduate Clinic of Orthopedics of the School of Dentistry of the University of Zulia, Venezuela.

MATERIALS AND METHODS

First stage: In the first stage, a SWOT 10 analysis was carried out to identify aspects that influenced the need to design a functional evaluation protocol of the SS for the Postgraduate Clinic of Orthopedics of the School of Dentistry of the University of Zulia during the period March, August 2017. The study units were constituted by specialist teachers (06) in Orthopedics and active postgraduate students (12). The sample was of census type.

Second stage: In the second stage an instrument was developed for the registration of selected information from the scientific literature. The scientific search engines Pubmed, Redalyc, SciELO and ScienceDirect were used, with key words such as oral functions, breathing, chewing, and swallowing.

Third stage: The third stage consisted of the drafting of the protocol, after consensus of the clinical criteria with teachers and residents and reviewed the best evidence available in the literature, during the period September-March 2018.

Ethics: The signing of informed consent was obtained from mothers, fathers, or caregivers of the children who participated in the functional evaluation and who illustrate the tests and techniques applied in the design of the Protocol.

The anonymity and confidentiality of the information was guaranteed according to the provisions of the Helsinki Rules 2013 (World Medical Association, 2001).

RESULTS

The SWOT analysis revealed a lack of unification of clinical criteria to perform the SS functional evaluations, absence of a protocol for the functional evaluation; and consensus among the specialists and residents of the Postgraduate Course on the need for a protocol that orders

and systematizes evaluations for children and adolescents who attend consultations.

Aims of protocol: first, to unify clinical criteria for the evaluation of SS functions in children who attend the Postgraduate Clinic of Orthopedics of the School of Dentistry of the University of Zulia, and secondly, to describe the steps of functional SS evaluations regarding respiration, mastication and swallowing.

Population: patients attending the Postgraduate Clinic of Orthopedics of the School of Dentistry of the University of Zulia.

Professionals involved: teaching staff, postgraduate residents and dental hygienists in the Postgraduate Clinic of Orthopedics of the School of Dentistry of the University of Zulia.

Institutional and material resources: clinical area, dental chair adapted to position the patient seated with the head horizontally, supplies, materials and equipment such as gloves, camera and video, lip separators, mirrors, hard and dry foods, glass with water, syringes demographic crayon.

Before starting the evaluations, the operator must comply with biosafety regulations and obtain informed consent. Observe the patient when entering the clinical area, (*without being aware that he is being observed*); this will provide additional information, such as the lordotic posture characteristic of the mouth breather. These data will be recorded in the clinical history.

General procedure: sit the patient in the dental chair with the head upright, under fluorescent white light or sufficient natural light, then the operator will sit in front of the patient, and clearly explain and how many times the steps in each test are necessary, informing the patient who will be recorded or photographed during each of the tests.

Anamnesis: record patient information on age, mother's pregnancy, delivery, breastfeeding or not, time and type of breastfeeding, age of onset of semi-solid foods, use or not of pacifier or bottle, condition and evolution of nasopharyngeal problems, presence of parafunctions such as digital suction, labial suction, onicofagia and bruxism, physical performance, presence of fatigue with little effort, school performance.

Evaluation of Breathing Function Extraoral and intraoral clinical examination: observe the patient's

facial characteristics to determine their correspondence with adenoid fascia proper to the mouth respirator, narrow nostrils, dry and cracked lips, labial incompetence. At the intraoral clinical examination verify gingival state, dental surface, transversal development of the jaws, position of the teeth, position of the tongue. (Simoes, 2015)

Diagnostic tests for Breathing: Rosenthal test (Figure 1): Ask the patient to remain with his mouth closed until indicated otherwise, observe respiratory movements and count twenty full breaths, inadvertently, as it would unintentionally modify his breathing rate. Repeat indication of closed mouth. With the tip of the thumb positioned under the right nostril obstruct the air passage of the patient (*gently so as not to produce deviations of the nasal septum*) leaving the left nostril free, observe counting twenty breaths. Repeat indication of closed mouth. Position the fingertip under the left nostril to obstruct the patient's airway leaving the right nostril free to observe and count twenty breaths. Record the evaluation through three videos (one for each step of the evaluation), positioning the video camera in front of the patient. Record results in the clinical history (Carasusán, 2014; Villanueva, 2014).



Figure 1: Diagnostic Tests for Mouth Breathing: Rosenthal Test.

Gudin Nasal Reflex (Figure 2): Indication of closed mouth. Compress the wings of the nose with the index fingers and thumb for brief seconds, release quickly, and observe whether or not dilatation of the wings of the nose occurs. (Pereira et al., 2017; Villanueva, 2014).



Figure 2: Diagnostic Tests for Mouth Breathing Gudín Nasal Reflex.

Glatzel test (Figure 3): before starting this test verify that the patient is free of any nasopharyngeal process, otherwise exclude it from this evaluation. The operator located behind the patient's head, placing the mirror horizontally below the nostrils, indicates that he breathes normally. The measurement of the respiratory condensation marks will be made according to the size of the vapor spot made by the patient and whether there is symmetry or not. Register the evaluation through video. Write results. (Carasusán, 2014; Mora et al., 2015; Argüello et al., 2018).



Figure 3: Diagnostic Tests for Mouth Breathing Glatzel Test.

Evaluation of Chewing (Figure 4): Place lip separator of adequate size to the patient's mouth. Then indicate that occlude in position of maximum intercuspation (PMI); in this position in a frontal plane the first photograph with a digital camera is taken. (Figure 4-A).



Starting from this position, indicate the patient to move the mandible to the right side until the vertex of the right upper canine is approached with the vertex of the right lower canine (if one or more canines are not present, the lateral incisors can be used as references), This position in a frontal plane take the second photograph. (Figure 4-B). Indicate the patient to return to the PMI position (Jiménez-Silva et al., 2016).



Starting from PMI indicate that move the jaw to the left side until contact the vertex of the left upper canine with the vertex of the lower left canine (if one or more canines are not present can be used as lateral incisive references), take the third photograph. (Figure 4-C). The photographs are printed in color, side by side without distorting the original image, evaluating the Minimum Vertical Dimension (MVD) through the evaluation of the functional masticatory angle Planas (AFMP). Record results in the clinical history (Jiménez-Silva et al., 2016).



Direct Observation Technique: Mark the patient's facial midline on both lips with the help of a demographic pencil or similar. (Figure 4-D). Deliver a food, indicating chewing freely and naturally. (Figure 4-E). Record this phase for more than a minute then analyze the video at slow speed to identify the chewing side in each cycle. Record the results. (Simoes, 2015; Tiwari et al., 2017).



Figure 4: Evaluation of Chewing.

Evaluation of Swallowing (Figure 5): Give the patient a glass of water. Indicate that you take a small sip and do not swallow until requested. Gently place the thumb on the patient's thyroid cartilage and indicate that it swallows the water, just as the larynx rises, separate the lips, breaking the lip seal. Tell him to facilitate this operation. Atypical swallowing will be diagnosed when normal patterns are not followed between the type of swallowing and the patient's dentition stage. Record results in the clinical history (Nayak et al., 2016).

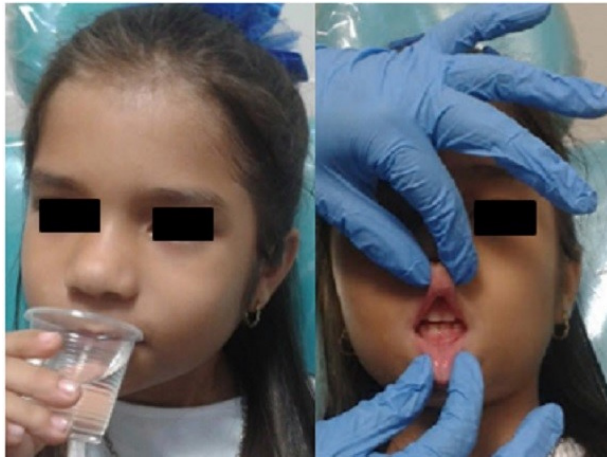


Figure 5: Evaluation of Swallowing: Free Observation of Swallowing with liquids.

DISCUSSION

Clinical protocols arise from the need to describe in a systematic, sequential, clear, unified and with the best possible scientific evidence the most suitable way of all clinical practice. Protocols facilitate and reduce the time to establish diagnoses, also guaranteeing their reliability during research and successful treatments, which undoubtedly contributes to the quality of care and positively impacts the patient's health.

Several protocols have been reported, (*Mora et al., 2015; De Felício, 2017; Scarponi et al., 2018*) which record various methods to perform the functional evaluation of the SS. Melo et al. (2015) found that there is heterogeneity in the use of equipment and materials for the evaluation of the respiratory mode, concluding that there is still no consensus in the evaluation and diagnosis of patients with mouth breathing.

In this protocol, the applications of the Rosenthal Test (*Nayak et al., 2016; De Felício et al., 2017*), the Gudin Nasal Reflex (*Pereira et al., 2017; World Medical Association, 2001; Carasusán, 2014*) and the Glatzel mirror (*Carasusán, 2014, Mora et al., 2015; Argüello et al., 2018*) were assumed and described, being the most used according to the scientific literature to assess respiration; These clinical tools are easy and quick to apply, helping to guide more accurately the decision to refer the patient to other specialties

For the diagnosis of mastication, the evaluation of the MVD16-18 and the Direct Observation technique were selected (*Simoës, 2015; Tiwari et al., 2017; Nayak et al., 2016*) because they are simple and non-invasive methods for the patient, allowing an adequate analysis of the performance and side of masticatory preference, which generates important information that allows to guide the treatments. Schott et al. (2010) argue that there is no unified method for measuring masticatory performance and multiple methods have been developed using various materials (*natural or artificial foods*) with different processing systems, which have evolved with advances in technology.

Regarding swallowing, its evaluation is proposed by means of free observation with liquids, simple technique of zero cost and easy application which generates reliable data for the diagnosis of this functional alteration.

REFERENCES

- Argüello P, Bedoya N, Torres M, Sánchez I, Téllez C, Tamayo J. Implementación de la terapia miofuncional orofacial en una clínica de posgrado de Ortodoncia. *Rev Cubana Estomatol.* 2018; 55(1):14-25.
- Carasusán L, Donato G, Ventosa Y. Herramientas para la evaluación de las disfunciones orofaciales. Barcelona: Col·legi de Logopedes de Catalunya, 2014.
- Melo AC, Gomes Ade O, Cavalcanti AS, Silva HJ. Acoustic rhinometry in mouth breathing patients: a systematic review. *Braz J Otorhinolaryngol.* 2015; 81(2):212-218.
- De Felício CM, Ferreira M, Magalhães Ana, Lima J. Orofacial Myofunctional Evaluation Protocol for older people: validity, psychometric properties, and association with oral health and age. *CoDAS.* 2017; 29(6).
- Feizi A, Keshteli AH, Khazaei S, Adibi P. A new insight into masticatory function and its determinants: a latent class analysis. *Community Dent Oral Epidemiol.* 2016 Feb;44(1):46-52.
- Grippaudo C, Paolantonio EG, Antonini G, Saulle R, La Torre G, Deli R. Association between oral habits, mouth breathing and malocclusion. *Associazione fra abitudini viziate, respirazione orale e malocclusione. Acta Otorhinolaryngol Ital.* 2016;36(5):386-394.
- Iwasaki LR, Gonzalez YM, Liu H, Marx DB, Gallo LM, Nickel JC. A pilot study of ambulatory masticatory muscle activities in temporomandibular joint disorders diagnostic groups. *Orthod Craniofac Res.* 2015 Apr;18 Suppl 1:146-55.
- Jiménez-Silva A, Peña-Durán C, Lee-Muñoz X, Vergara-Núñez C, Tobar-Reyes J, Frugone-Zambra R. Patología temporomandibular asociada a masticación unilateral en adultos jóvenes. *Rev Clin Periodoncia Implantol Rehabil Oral.* 2016;9(2):85-216.
- García C. Elaboración y evaluación crítica de las guías de práctica clínica. *Radiología.* 2015; 57 (2):38-43.

Kwak YY, Jang I, Choi DS, Cha BK. Functional evaluation of orthopedic and orthodontic treatment in a patient with unilateral posterior crossbite and facial asymmetry. *Korean J Orthod.* 2014 May;44(3):143-53.

Maspero C, Prevedello C, Giannini L, Galbiati G, Farronato G. Atypical swallowing: a review. *Minerva Stomatol.* 2014 Jun;63(6):217-27.

Mora K, Pedriquez D, Soto K, Quirós O. Prevalencia de Respiración Bucal en niños de 4to Grado de Educación Básica del Colegio Cervantes y su efecto en el rendimiento escolar. *Rev Latinoam Ortodon Odontopediatr.* 2015: 2.

Nayak UA, Sharma R, Kashyap N, Prajapati D, Kappadi D, Wadhwa S, Gandotra S, Yadav P. Association between Chewing Side Preference and Dental Caries among Deciduous, Mixed and Permanent Dentition. *J Clin Diagn Res.* 2016; 10(9): ZC05-ZC08.

Pereira TS, Oliveira F, Cardoso M. Association between harmful oral habits and the structures and functions of the stomatognathic system: perception of parents/guardians. *CoDAS.* 2017;29(3):e20150301.

Podadera Z, Flores L, Rezk A. Repercusión de la respiración bucal en el sistema estomatognático en niños de 9 a 12 años. *Rev Cienc Med.* 2013;17(4):126-13.

Ponce H. La matriz FODA: alternativa de diagnóstico y determinación de estrategias de intervención en diversas organizaciones. *Enseñ Invest Psicol.* 2007; 12 (1) 113-130.

Silva M, Manton D. Oral habits--part 2: beyond nutritive and non-nutritive sucking. *J Dent Child (Chic).* 2014 Sep-Dec;81(3):140-6.

Simoes N. Respiración bucal diagnóstico y tratamiento ortodóntico interceptivo como parte del tratamiento multidisciplinario. Revisión de la literatura. *Rev Latinoam Ortodon Odontopediatr.* 2015: 30.

Scarponi L, de Felicio CM, Sforza C, Pimenta Ferreira CL, Ginocchio D, Pizzorni N, Barozzi S, Mozzanica F, Schindler A. Reliability and Validity of the Italian Version of the Protocol of Orofacial Myofunctional Evaluation with Scores (I-OMES). *Folia Phoniatr Logop.* 2018; 70(1):8-12.

Schott S, Ocaranza D, Peric K, Yévenes I, Romo F, Schulz R, Torres-Quintana MA. Métodos de evaluación del rendimiento masticatorio: Una revisión. *Rev Clin Periodoncia Implantol Rehabil Oral.* 2010; 3(1): 51-55.

Tiwari S, Nambiar S, Unnikrishnan B. Chewing side preference - Impact on facial symmetry, dentition and temporomandibular joint and its correlation with handedness. *J Orofac Sci.* 2017; 9:22-7.

Villanueva P. PIAHO: Una herramienta para la prevención de hábitos orales deletéreos (protocolo de incorporación apropiada de hábitos orales). *Rev CEFAC.* 2014;16(4):1326-1339.

World Medical Association (AMM). Helsinki Declaration. Ethical principles for medical research involving human subjects. *Assist Inferm Ric.* 2001 Apr-Jun;20(2):104-7.