

**Introduction**

Swallowing is already present in prenatal age in the form of ingestion of small quantities of amniotic liquid [Ferrante, 1995]. In the infant, the tongue completely fills the oral cavity, interposing between the edentulous alveolar processes; moreover, in order to obtain a good labial seal, a contraction of lips and cheeks around the tongue occurs.

After weaning, the situation changes: the tongue pulls back behind the dental arches, its tip lies at the incisive papilla level, its body touches the hard palate, and no contraction of the perioral muscles takes place. At times, this physiologic maturation of the swallowing mechanism has not fully developed; an infantile swallowing pattern, called “atypical deglutition”, persists beyond the physiologic limit. In such cases, during swallowing, a forward tongue thrust takes place, usually at the level of the palatal surfaces of the upper incisors, or the tongue interposes itself between the dental arches, accompanied by a contraction of the mimic muscles, in particular of the orbicular muscle of the mouth and of the mentalis muscle, where skin folds and dimples confer to the chin the appearance of a golf ball.

Atypical swallowing has a multifactorial aetiology [Cozza et al., 1992; Levrini, 1977; Levrini A, 1988]; in fact bad habits [Garattini, 1991; Garattini, 1990], environmental and hereditary factors, oral and allergic diseases could be involved in the onset of atypical swallowing [Proffit, 1985; Garliner, 1974].

The relationship between atypical deglutition and malocclusion is controversial, and, in the light of the variability of the neuromuscular behaviour of every individual, and the existence of different clinical conditions, atypical swallowing can be either cause or consequence of dentomaxillary dysmorphoses [Garliner, 1968]. The persistance of atypical swallowing is a problem not to be underestimated, because it can negatively affect the development of the maxillary bones during growth, and can determine malocclusion and the following aesthetic and functional alterations [Petit et al., 1986].

Many cases of atypical swallowing are connected to malocclusion [Cozza et al., 1995]. The dentomaxillary alterations most linked to the anomalous tongue pressure are [Riccioli 1972; Emmerich et al., 2004]: distocclusion with protrusion of the upper frontal teeth, dentomaxillary regression of the upper arch and protrusion of the frontal lower teeth, open bite
CORRECTION OF ATYPICAL SWALLOWING: A LONGITUDINAL STUDY

(anterior, posterior, mono- or bilateral) according to the anomalous placement of the tongue, which goes beyond the vestibular faces of the front or lateral teeth [Verrastro et al., 2006; Jeanmonod, 1988].

The persistence beyond the physiologic limit of infantile swallowing requires therefore a functional reeducation. The origin of myofunctional therapy can be traced back to Alfred Paul Rogers [Rogers, 1918]; in the past, myofunctional therapy was based on the use of tools such as Rogers’ rubber band from which, probably, the button exercise used for labial hypotonia derives. In 1982 the publication of Myofunctional Therapy in Dental Practice by Daniel Garliner led to the modern concept of myofunctional therapy.

The aim of the study is to analyze the prevalence of anomalous function of the orofacial muscles and their aetiologic factors in a small sample of pediatric patients, to evaluate the correlation between anomalous functions of the orofacial muscles and malocclusions, and finally to verify the effects of a myofunctional protocol, composed of a series of exercises aimed at correcting the anomalous function and position of the tongue.

Materials and methods

The diagnostic and therapeutic protocol which is used in this study is a revision of the methods of diagnosis and orofacial myofunctional therapy proposed by Daniel Garliner [1974] and Aurelio Levini [1977]. Once the protocol was revised, we set the goal of treating children with atypical deglutition. In the following three years, 57 children, of which 31 were males (aged 5 to 13, mean age 8.2) were followed at the Department of Paediatric Dentistry of the Dental Clinic of the University of Pisa; the children were not orthodontic patients. Each patient underwent a preliminary examination in order to evaluate the dental class, the periodontal status, the eruption of the teeth, malocclusion and phonation. For each patient a file that included all relevant data was recorded. The record was filed by asking questions directly to the child, in order to establish a good patient-doctor relationship; the questions were asked to the parents only when the child was unable to provide an answer.

A preliminary observation was carried out in order to evaluate the type of swallowing, labial and lingual posture, presence of hypertrophic adenoids and/or tonsils, dentomaxillofacial dysmorphoses, lingual frenulum, bad habits, sensibility and mobility of the tongue, and dyslalia. The therapeutic protocol consisted of eight sessions, although this number was sometimes changed according to the condition of the patient. The exercises were repeated at least four or five times per day. The patient was checked one week after the first session, and after then, once a month. After every session, every change regarding labial and lingual posture, breathing, mobility and sensibility of the tongue, swallowing and perioral contraction was added to the patient's file. After every session, written instructions describing in detail the exercises were given to the patient. The exercises have the aim of reeducating lingual posture and functionality, increase sensibility and obtain a physiologic swallowing. Patients showing a severe II Class were treated with a functional appliance as well, using a bionator.

To increase sensibility, the patient followed an identification exercise through tongue contact. A “brushing”, executed with a flat, small, firm brush on the sides of the tongue, from base to tip, was carried out in order to increase tongue sensibility and reduce flabbiness. This was only performed during the first two months of therapy, and was then replaced by lateral pressure on the tongue edges, which produces the same effects but also stimulates deeper receptors. In the following sessions different types of pressure were added: dorsal pressure, modified dorsal pressure, and inferior pressure. For dorsal pressure, the patient gently tap on the dorsum with the blunt edge of a pencil; the response is usually a backward movement of the tongue. After a month of dorsal pressure the reflex decreases in intensity and the tongue has to be moved slightly forward and rested on the lower lip; this is called “modified dorsal pressure”. During the seventh session, inferior pressure was added, which is performed pressing with a finger just under the tongue, at the level of the geniohyoid muscle. After removing finger pressure, the patient must immediately swallow, and the tongue spontaneously moves higher up in the palate.

A very important exercise performed during the study is cooling, which consists in a thermal stimulation carried out by putting a wet cotton stick on the incisive papilla. The aim of this exercise is to produce a reflex which leads the tongue tip to touch the papilla. The cold stimulus application also allows an improvement of posture, muscle tone and mucosal sensibility.

To correct tongue posture, orthodontic intermaxillary rubber bands were used; the bands were placed on the tip of the tongue, to bring it at the level of the incisive papilla. During the third session, the exercise was performed with two rubber bands; during the fourth, with three.

Once the patient had obtained a correct lingual
posture, it was necessary to transform swallowing from a voluntary to a spontaneous act. This was obtained through autosuggestion and the use of memoranda.

**Results**

The children of the sample studied showed anomalous function of the orofacial muscles; in particular 65% of them showed a low posture of the tongue, and 49% difficulty to perform some lingual movements. Forty-nine percent of the children also showed a reduced sensibility of the tongue; 62% of the children had labial incompetence, and needed specific exercises for the lips.

This study shows that there are many different aetiological factors of atypical swallowing in our study sample; in particular dentomaxillary dysmorphoses and oral breathing are the most frequent aetiological factors.

The results of this study also show a correlation between the anomalous functions of the orofacial muscles and malocclusions; 95% of the patients had a malocclusion, and 33% of these had an Angle’s Class II, div. I, while 21% had a Class I, or II with open bite (Fig. 1).

Only 14% of the patients combined orthodontic bionator treatment with myofunctional therapy, because of a severe Angle’s Class II.

Finally the results show the beneficial effects of the myofunctional protocol that was used.

After the treatment, 54% of the patients with a low posture of the tongue achieved a correct position, mostly during the 3rd session (Fig. 2).

The recovery of the physiologic mobility of the tongue, after the treatment, was obtained in 74% of the children with difficulty in performing lingual movements, between the 2nd and the 5th session (Fig. 3).

Eighty-nine percent of the children with a reduction of lingual sensibility showed an improvement, mostly in the second session.

Thirty-eight percent of the patients with labial incompetence showed improvement after performing labial exercises (Fig. 4).

The correct mechanism of swallowing was understood by 32% of the children by the 5th session (Fig. 5). In conclusion, after the treatment, 47% of the children obtained a physiologic swallowing, mostly in the 7th session (Fig. 6); 62% of the patients treated with bionator and myofunctional therapy obtained a correct swallowing as well.

**Discussion**

Many aetiological factors can cause alterations of the orofacial muscles, dentomaxillary malpositions, and persistence of infantile swallowing. Malocclusion, in particular, can be either cause or consequence of atypical deglutition.

Forty-seven percent of the patients, who carried out our work schedule carefully, performed a correct and physiologic swallowing.

Sixty-two percent of the patients treated with bionator and myofunctional therapy obtained a correct swallowing.

An explanation of the failure in obtaining a correct swallowing, lingual posture and mobility of the tongue can also be given. These are all patients that drop the therapy, or neglected exercises or the use of bionator. There are also factors that hinder the reaching of the final goal, such as: macroglossia, short lingual frenulum, anterior or posterior open bite, an Angle’s II Class div. 1, and labial incompetence. In these situations an orthodontic treatment is necessary.

Sixty-two percent of the children with labial incompetence and treated with labial exercises did not
show any improvement. In fact some of these patients had a short lingual frenulum, or muscle hypotonicity, or malocclusions, such as open bite; moreover some patients dropped the therapy, or had persistence of bad habits, such as oral breathing, sucking of thumb, lips, cheeks and objects, and prolonged use of dummy. Patients with severe malocclusion need orthopaedic and orthodontic treatment before myofunctional therapy. This allows the balance of the oral muscles, and the correct position of the tongue during swallowing.

In patients with slight dento-maxillary alterations it is possible to perform lingual reeducation before orthodontic treatment, or simultaneously. In this situation the myofunctional therapy can remove the anomalous forces of the tongue and of the muscles.

**Conclusion**

The results show the benefits of myofunctional therapy in the treatment of children with abnormal swallowing.

The main factors for a successful treatment are: motivation of the child and his/her parents, a good patient-doctor relationship, elimination of all bad habits, a correct procedure of treatment (orthodontic treatment before myofunctional therapy, or after myofunctional therapy, or simultaneously), and the intervention of other medical specialists, such as surgeons, speech pathologists, otolaryngologists, when needed.

To obtain a successful treatment, the collaboration of the child and of his parents is also needed. Children that are very busy because of school or sports engagements usually show less collaboration. The children of parents with a low cultural level usually show less motivation, and the treatment can fail.

The dentist has to motivate and inspire confidence to the child, and has to show the differences between the physiological and the atypical swallowing in an understandable way. He also has to show great interest in the everyday life, problems and personality of the patient in order to obtain his/her collaboration.

In conclusion, it can be stated that a correct myofunctional and orthodontic treatment can provide rewarding results at both the professional and the human levels.


References


Riccioli GA. Certain cases of atypical deglutition The tongue is an important factor in the etiopathogenesis of many dento-maxillary abnormalities. Mondo Odontostomatol 1972 May-Jun;14(3):461-5.

