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ORIGINAL ARTICLE

Elastodontic treatment with oral bio-activators in young children

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ABSTRACT

BACKGROUND: Elastodontic therapy can correct bad oral habits and malocclusions in young patients by guiding jaw growth, eliminating functional disorders, and improving tooth position. The aim of this study was to assess the effects of bio-activator therapy on the presence of atypical swallowing with tongue thrust in growing patients. METHODS: A retrospective study was conducted. Data regarding the early orthodontic treatment of 40 consecutive patients with atypical swallowing and tongue thrust (23 males and 17 females) were assembled from January 2019 to January 2020. All patients (≥7 and ≤15 years of age) were monitored for 1 year in a private practice in Isernia, Italy. RESULTS: The mean age at commencement of orthodontic treatment was 8.5 years (range=7.1-14.9 years), and the mean total duration of therapy was 1 year (range=11 months–1 year). Final lateral radiographs demonstrated a mean of improvement of 8° for upper and lower incisor proclination (I/SN) and 3.5° for incisor mandibular plane angle (IMPA) in 36 patients, and 5° of I/SN and 2° of IMPA in the remaining 4 children after 1 year of treatment. CONCLUSIONS: Bad oral habits in younger patients must not be ignored. The duration of treatment can differ depending on the severity of the open bite and the patient's cooperation. This study demonstrates the short-term efficacy of these myofunctional appliances in the treatment of atypical swallowing. In order to quickly eliminate factors which endanger healthy development of dento-skeletal structure, it is important to closely monitor patients during their development phase.

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In the modern orthodontics, there are several appliances to treat atypical swallowing including the Bionator,¹ the Fraenkel,² eruption guidance appliances, lingual spurs,³ fixed grids,³ speech therapy,⁴ and myofunctional treatment. Except for the Bionator⁴ there are a lack of longitudinal studies which describe the use of these devices to correct atypical swallowing. Speech therapy is an efficient form of treatment,⁴ but requires a longer treatment time, a higher level of patient

compliance, and it is not effective in 3-4 year old children compared to labio-therapy.⁵

A physiological swallowing consists of positioning the tip of the tongue at the level of the incisive papilla when the dental arches are in contact. Atypical swallowing is a pattern characterized by the tongue thrust between the dental arches.⁴ Elastodontic therapy has an important role in correcting malocclusions in young patients by guiding jaw growth, eliminating func-

tional interferences, and improving the tooth position.⁶⁻¹² This approach offers many advantages for interceptive orthodontics starting from primary dentition, when the skeletal and dental structures are still highly plastic and adaptable, by removing the endangering factors that can cause malocclusions.¹³⁻¹⁵

A new appliance, the A.M.C.O.P. Bio-activator (the name derives from the Italian acronym for Cranial-Occlusal-Postural Multifunctional Harmonizer) is a myofunctional appliance that, when positioned between the teeth, prevents bilabial contact, stimulates muscular training, compels the tongue in a correct position, and guides a correct swallowing pattern. Other indications for this appliance include upper transversal contraction with posterior crossbite, deep or open bite, increased or slightly negative overjet (OVJ), parafunction, and oral breathing.

Etiopathogenesis of malocclusions includes not only genetic but also environmental features, since craniofacial growth is stimulated by functional actions such as breathing, chewing, sucking, and swallowing.¹⁶ According to the literature, the most important risk factors are non-nutritive sucking habits, which are often associated with anterior open bite, increased OVJ, class II relationship, and mouth breathing.¹⁷⁻¹⁹ According to Gugino and Dus,¹⁶ elastodontic therapy is based on the achievement of correct balance between "form and function." If the function is modified, through behavioral re-education, the form will consequently be changed.

Orthodontic treatment alone is not enough to solve bad oral habits.^{20, 21} Rather, the correct way is a multidisciplinary approach which is based on orthodontic and myofunctional therapies to obtain optimal short- and long-term results. Functional education addresses altered habits by neutralizing them in the growth phase by creating an ideal occlusion on an individualized basis.²⁰ A significant association between bad oral habits and increased OVJ and open bite have been found.²¹ Mouth breathing is closely related to increased and reduced OVJ, anterior or posterior crossbite, open bite, and displacement of contact points.^{20, 21}This treatment preferably takes place in preschool children, while in adolescent patients functional education will inevitably have a lower efficacy and narrower time margins, which are dependent upon how well-established the anomalies are and the severity of dysfunctional factors. The aim of the current work was to assess the effects of A.M.C.O.P. Bio-activator therapy on the presence of atypical swallowing with tongue thrust in growing patients.

Materials and methods

A retrospective study was conducted. Data regarding the early orthodontic treatment of 40 consecutive patients with atypical swallowing and tongue thrust (23 males and 17 females) were assembled from January 2019 to January 2020 (Table I). All patients (\geq 7 and \leq 15 years of age) were monitored for 1 year in a private practice in Isernia, Italy. Informed consent was obtained in writing by parents or a child's legal guardians. All data was assembled by the same clinician who assessed the patients' records. The exclusion criteria were: previous orthodontic treatment; periodontal problems; craniofacial deformities; the presence of adenoid disorders; otorhinolaryngological diseases; and allergies.

Before and after (1 year) lateral radiographs (Figure 1, 2) of 40 patients treated with A.M.C.O.P. Bio-activators were obtained, along with the patients' initial and final intraoral and extraoral photos, panoramic radiographs, and impressions (Figure 3, 4, 5, 6). The size of the Bio-activators, the duration of their wear, and the number of orthodontic appointments attended were registered. With regards to the arch shape, it was possible to choose among 4 different designs according to arch perimeter, form, and width that were based on the initial impressions of the patients. Specifically, form C was used for a wide and rounded dental arch, form S for an oval one, form 0S for a squared shape, and form

TABLE I.—Demographics of 40 patients treated with A.M.C.O.P. Bio-activators for the presence of atypical swallowing with tongue thrust.

		 A.M.C.O.P. Bio-activators		
		 N. %	Age	Range
Gender	Female Male	23 (57%) 17 (42%)	10.7 9.7	7-15 6-14
Total		40		

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Figure 1.—A) Initial lateral radiograph showing upper and lower incisor proclination and an increased overjet (OVJ); B) lateral radiograph after 1 year of treatment showing an improved upper and lower incisor proclination, and a good OVJ and overbite.



Figure 2.—A) Initial lateral radiograph showing an open bite due to upper and lower incisor proclination and an increased overjet (OVJ); B) lateral radiograph after 1 year of treatment showing the correction of the open bite, an improved upper and lower incisor proclination, and a good OVJ.

F for a triangular form, and various dimensions exist for each category according to the patient's age. All devices display a small letter in their lower section for patients to correctly position the device. The following parameters were recorded for each patient: upper and lower incisor proclination (I/SN)>83°; incisor mandibular plane angle (IMPA)>85°; hyper-divergent pattern (SnGoGn>32°); overbite (OVB) <0 mm or >2 mm; OVJ>3.4 mm; and good quality lateral radiographs.

According to the hyperdivergent skeletal pattern, all patients were presented an individual and specific chewing plan ideal for dento-skeletal open bite. Patients were asked to wear the appliances for 2 hours during the daytime plus overnight in the active phase, and then only at night for 6 months to ensure stability and recovery of muscle function. The beginning of myofunctional treatment was defined as when the appliance was first fitted. The total number of appointments (routine and emergency) were recorded. The morphological features of the face, lips, tongue, and cheeks were clinically observed every 5-6 weeks during the year. A patient's cooperation was estimated by the change of color of the appliance according to the number of hours it had been used.

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Figure 3.—Initial orthodontic records and Xrays.



Figure 4.—Intraoral and extraoral photos of a patient after 1 year of elastodontic therapy. The A.M.C.O.P. Bio-activator worn by the patient is also shown.

Statistical analysis

Obtained data was coded and entered into Microsoft Excel and then subjected to statistical analysis. Gender and sex distribution were analyzed, and mean and range duration of appliance wear were calculated. The results were expressed in percentage. Data were analyzed using the statistical package SPSS Software, Version 14, Chicago, IL, USA. A P-value smaller than 0.05 was considered to be statistically significant.

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Figure 5.—Panoramic and lateral X-ray after 1 year of elastodontic therapy.



Figure 6.—Impressions before and after 1 year of elastodontic treatment.

Results

From the initial cohort of 45 patients, 5 patients were excluded from the study because they immediately showed an unsatisfactory compliance and did not meticulously adhere to the prescribed protocol. Sex and gender did not differ significantly among the participants (P>0.05).

At 6 months into the study, 80% of patients (32 out of 40 children) showed good compliance and had a corrected swallowing pattern. Of the remaining 8 children, 4 (10%) obtained an early correction after 4 months, 2 (5%) after only 3 months, and 2 (5%) after 5 months. Therefore, there was 100% treatment success in compliant patients.

Clinical evaluation of the 40 patients showed that 80% of patients (32 out of 40 children) presented a regularization of facial mimicry after 6 months. For 8 patients, despite the normalization of swallowing, a residual variation of the facial mimicry was still present after 6 months, although considerably reduced compared with the beginning of treatment. Furthermore, final lateral radiographs demonstrated a mean of improvement of 8° of I/SN and 3.5° of IMPA in 36 patients, and 5° of I/SN and 2° of IMPA improvement in the remaining 4 children after 1 year of treatment. The mean duration of treatment varied according to the patients' cooperation and the severity of atypical swallowing and ranged from 9 months to 1 year. The mean age at orthodontic treatment initiation was 8.5 years (range=7.1-14.9 vears) and the mean total duration of orthodontic treatment was 1 year (range=11 months-1 year). Generally, patients attended on average of 24 appointments with the orthodontist during the year (range=12-38 appointments), with 20 supplemental emergency appointments (range=15-30 appointments) (Table I).

Discussion

Our findings highlight positive findings obtained with 40 patients after 1 year of myofunctional therapy with A.M.C.O.P. Bio-activators. All final lateral radiographs showed good values of OVJ and OVB due to an improved incisor proclination and a better control of bad oral habits. Compared to other elastodontic devices.^{20, 21}A.M.C.O.P. Bio-activators do not have indentations so the teeth are not subjected to force and are merely positioned within the guides. This favors tooth eruption within a correct bone-tooth ratio during maxillary and mandibular growth and also addresses agenesis, transpositions, and number anomalies.

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The elastodontic space represents the ideal area between the tongue's muscle (centrifugal force) and the lips (centripetal force) within which the movement of teeth can take place. A.M.C.O.P. devices are elastic and made of a flexible thermoplastic elastomer without latex or phthalates, and their vestibular and lingual flanges leave the central area free to accommodate the teeth without constraint or restriction and they are connected to each other by an occlusal guide to keep the two arches in a class I relationship with effects of propulsion and retropulsion. With this design it is possible to guide the tongue into the correct position on the palate to assist nasal respiration. It also relaxes oral and facial muscles allowing a significant improvement of respiratory and phonetic function. Compared with the other appliances¹⁻⁴ used to correct atypical swallowing, these devices require a lower level of patient compliance.

Habits are based on an involuntarily pattern progression of muscle contraction with various features. A repetitive behaviour is usual in infancy, but if it regularly starts and stops naturally then it is considered abnormal over 3 years of age. The persistence of damaging parafunctions can alter both tooth position and the inter-arch relationship, leading to interference with the normal growth of the jaws and with the orofacial musculature, and thereby causing a negative effect on child health.^{5, 22, 23} Therefore, it is essential to monitor and timely intercept endangering factors for dento-skeletal development to avoid worsening health outcomes.

Orthodontic treatment alone is not sufficient to solve bad oral habits, and it is necessary to combine it with myofunctional rehabilitation to obtain permanent results.¹⁸ According to one study²¹ and also observed here, the masticatory muscles respond positively to treatments with elastodontic appliances when they are used to bring the patient from a compensatory response to an orthological balance. In work by Fellus *et al.*, it was reported that myofunctional therapy is based on a patient's attention to tongue tip^{5, 22, 23} and A.M.C.O.P. Bio-activators also reinforce the tongue's posterior portion, inhibiting its elevation, and places the tongue tip in its correct physiological position. In a recent study²⁴ myofunctional treatment has been described as a valid treatment option for correcting atypical swallowing in compliant adolescents and young adults. With regards to the mechanism of action, these activators function in agreement with the functional orthopedic treatment shown in the research of Soulet and Besombes.²⁵⁻³⁴ In our view, the advantages of the A.M.C.O.P. Bio-activator are that it concentrates the key features of all existing functional activators into one device, it allows for easy patient monitoring and reduced required daily usage time, and there is no need for parental involvement throughout the treatment. Further clinical and scientific research are required to support these findings.

Limitations of the study

The present study has some limitations: the absence of an untreated control group and the absence of a long-term follow-up to verify the stability of the results.

Conclusions

A.M.C.O.P. Bio-activators resulted in effective improvement of upper and lower incisor proclination by achieving better values for OVJ and OVB, by positively modifying the tongue position, and by showing positive clinical results in growing patients as shown by post-treatment lateral radiographs. This therapeutic approach promotes the harmonious growth of the craniofacial system of patients and simplifies subsequent orthodontic treatment when needed.

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Conflicts of interest.—The authors certify that there is no conflict of interest with any financial organization regarding the material discussed in the manuscript.

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