

ASPECTS IN ANTERIOR OPEN BITE CORRECTION IN A GROUP OF ORTHODONTIC PATIENTS

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ABSTRACT

Aim of the study. The aim of the study was to analyse the type and the effectiveness of orthodontic treatment for anterior open bite (AOB). Material and methods. A study group of 52 patients with anterior open bite (AOB) were analysed according to age, gender, type of dentition and Angle classes of malocclusion. The type of anterior open bite, the type and treatment stages were analysed the, through descriptive statistics. Results. The anterior open bite was recorded in: 59.6% girls and (40.4%), boys, in 46,2% patients with mixed dentition and in 53.8% patients with permanent dentition and in 9.6% patients with Angle class I malocclusion, 34.6% with Angle class II malocclusion, 55.8 % patients with Angle class III malocclusion. AOB was functional in 38.5% patients and skeletal in 61.6% patients. A multitude of appliances have been used for the treatment of AOB in one (48.1%), two stages (46.2%) or combined with orthognathic surgery (5.8%). Statistically significant correlation was found between AOB and age ($p = 0.002$), type of dentition (mixed or permanent) ($p = 0.000$). Also, statistically significant correlations were obtained between type of treatment and type of dentition ($p = 0.000$) and with treatment stages and Angle classes of malocclusion ($p = 0.000$). Conclusion. The treatment of AOB requires the selection of the most appropriate treatment method in accordance with the severity of the malocclusion, the age of the patient.

Key words: anterior open bite, treatment, orthodontic appliance

INTRODUCTION

The anterior open bite (AOB), defined by Caravelli (1842) as the reduction of the vertical overlap between the upper and lower anterior teeth (1) is considered by orthodontists as a difficult malocclusion to treat. The prevalence of anterior open bite (AOB) is variable: depending on age: 4.2% at 6 years, 11%- 17% at 7-9 years. At 14 years, the reported prevalence is 2.5% considering that there is a self-correction of AOB through the disappearance of vicious sucking habits, the eruption of incisors and the maturation of oral functions (2). In order to evaluate dentofacial vertical disorders, we must know the changes that occur during the growth process, at the level of all the elements of the

dento-maxillary apparatus. Bone growth is not a one-way enlargement of superficial structures, it is achieved by cartilaginous proliferation at the level of synchondroses or by proliferation at the level of sutures, and ossification is the result of mineralization of the matrix. During the developmental process, these diverse growth mechanisms of the craniofacial skeleton are influenced by endogenous and exogenous factors (1).

Patients with anterior open bite (AOB) often show altered facial features: increase in the size of the gonial angle and the angle formed by the mandibular plane with the occlusal plane, decrease in the size of the vertical and horizontal ramus of the mandible, increase in the lower third of the face and

decrease in the size posterior, mandibular retrognathism, divergent cephalometric planes, steep anterior cranial base (3, 4). The role of non-nutritive sucking habits in producing anterior open bite has been clearly demonstrated (5). Mouth breathing has also been incriminated in producing the anterior open bite (6), but the role of breathing on facial morphology is still not very clear (5). Factors such as neuromuscular imbalance and divergent growth pattern have also been implicated in the production of AOB, but until now the mechanism of action (7) of these factors is still not very clear (8).

Also, in patients with obstructive sleep apnea (9) and mouth breathing (6), characteristic features of those with skeletal AOB (long face, increase in the anterior third of the face) have been observed, but a clear link between these conditions and AOB have not yet been established (10).

The existence of these etiological factors has led to the design of different types of treatment for AOB (11, 12) all aimed at eliminating (if possible) the etiological factors and correcting the changes products at the dentofacial level. Varied therapeutic approaches are supported by the need to find therapeutic solutions with minimal relapse (13-15) The treatment of the anterior open bite is sometimes extremely difficult, because factors such as the severity of the malocclusion or the late initiation of treatment can make the correction and stability of the open bite particularly difficult (1,15), despite the existence of different treatment methods: palatal crib, tongue spurs, dental extraction (16), temporary anchorage device and complex orthognathic surgery treatments(17).

In this context, the aim of this study was to analyse the type of orthodontic treatment used to correct the anterior open bite (dental, dento-alveolar and/or skeletal) and its effectiveness in different types of

malocclusions and moments of patient development.

MATERIAL AND METHODS

We performed a retrospective study using the orthodontic files of a group of 1218 orthodontic patients (670 girls and 548 boys), aged between 6 and 29 years (mean age 10.11 ± 2.97 years), who requested orthodontic treatment in the Department of Orthodontics, University of Medicine and Pharmacy. "Grigore T. Popa" Iasi, in the period 2017-2023. Based on the information entered in these files, patients who previously presented open bite (AOB) were extracted and the data were used to compile the study database. All patients included in the study were Caucasian and had no history of orthodontic treatment, no syndrome or craniofacial malformation. Informed consent was obtained from each patient who participated in the study. All data required for the study were collected from the patients' orthodontic files. The selection of cases was done randomly, patients with files without complete data, as well as those with previous orthodontic treatments, were excluded from the study. The patients' medical files included the clinical observation sheet and mandatory complementary examinations (study models, orthopantomographies and frontal, profile and intraoral photographs). Patients' orthodontic records were analysed and patients with a clinical or radiological anterior open bite were extracted and formed the study group. The group of patients with anterior open bite was divided according to age, sex, type of dentition (mixed or permanent) and Angle classes of malocclusion (Class I, II, III). In the studied group, the following variables were analyzed: the morphological type of AOB (functional or skeletal), the type of treatment instituted and the devices used for the treatment of AOB, as well as the stages of treatment used and then, between the studied

variables, statistical correlations were made. The statistical analysis of the data obtained from the patient files was performed using IBM SPSS version 26 (IBM, Armonk), through descriptive statistics; Pearson's Chi-square test was used for data comparison with a $p \leq 0.05$.

RESULTS

Of the 1218 patients analysed, 52 (4.26%) patients were diagnosed with anterior open bite based on the absence of frontal overlap: 31 (59.6%) girls and 21 (40.4%), boys), aged between 7 and 27 years (mean age 13.44 ± 5.88 years) (Chart 1), Depending on the type of dentition, AOB was observed in 24 patients with mixed dentition (46.2%) and in 28 (53.8%) patients with permanent dentition (Chart 2). According to Angle classes of malocclusion, AOB was observed in 5 (9.6%) patients with Angle class I malocclusion, 18 (34.6%) patients with Angle class II malocclusion, 29 (55.8 %) patients with Angle class III malocclusion (Chart 3). Functional anterior open bite was recorded in 20 patients (38.5%), while 32 (61.6%) patients had skeletal anterior open bite. In the study group, the AOB treatment was performed in 25 (48.1%) patients in a single stage of treatment, in 24 (46.2%) patients in two stages of treatment, and in 3 (5.8%)

patients correction of AOB required a stage of orthognathic surgery. In the study sample, for the treatment of anterior open bite we applied: removable orthodontic appliances in 13 (25%) patients, fixed orthodontic appliances in 26 (50%) patients and combined orthodontic treatments in 13 (25%) patients: in 6 (11.54%) patients fixed appliances and surgical treatment, in 3(5.77%) patients, maxillary expansion, face mask protraction and fixed appliances, in 3(5.77%) patients, maxillary expansion and fixed appliances and in 1 (1.92%) patients maxillary expansion and face mask protraction.

The AOB was statistically significantly correlated with the age of the patients ($p=0.002$), the type of dentition (mixed or permanent) ($p = 0.000$) (Table1), as well as the type of treatment instituted ($p = 0.000$) and the number of necessary treatment stages ($p = 0.047$). No significant differences were found by gender ($p=0.074$) and Angle classes of malocclusion ($p=0.057$). Also, statistically significant correlations were obtained between the type of treatment instituted for the correction of AOB and the type of dentition ($p = 0.000$), as well as between the number of treatment stages required for the correction of AOB and Angle classes of malocclusion ($p = 0.000$).

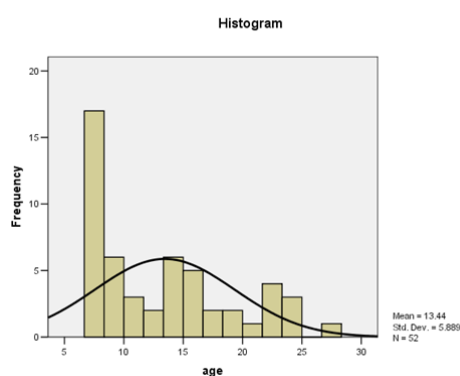


Chart 1. Frequency of AOB according to the age

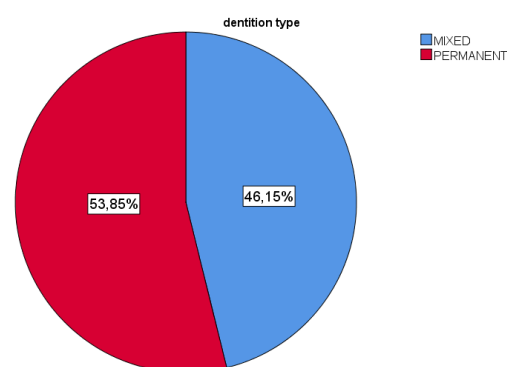
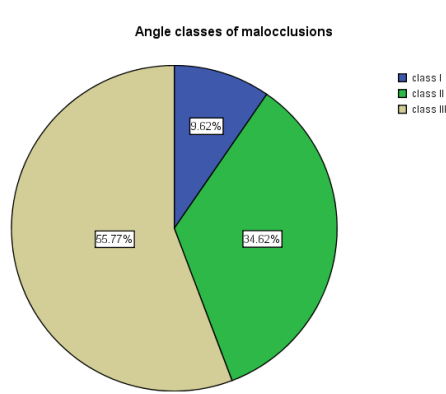
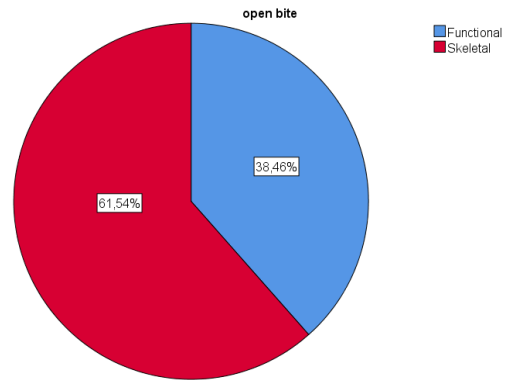


Chart 2. Frequency of AOB according to the type of dentition



Graph 3. Frequency of AOB according to the type of malocclusion



Graph 4. Distribution of types of AOB

Table 1. AOB: Pearson Chi-Square Tests

		gender	age	dentition type	Angle classes	treatment type	treatment stage
AOB	Chi-square	3,195	36,892	14,981	5,716	22,154	6,095
	Sig.	,074	,002	,000	,057	,000	,047

Table 2. AOB treatment type: Pearson Chi-Square Tests

		age	gender	dentition type	Angle classes	treatment stage
AOB treatment type	Chi-square	88,018	6,577	32,036	16,033	14,868
	Sig.	,253	,254	,000	,099	,137

Table 3 AOB treatment stage: Pearson Chi-Square Tests

		gender	age	dentition type	Angle classes
AOB treatment stage	Chi-square	,281	42,237	,737	20,718
	Sig.	,869	,106	,692	,000

DISCUSSION

In the studied group the prevalence of anterior open bite was 4.26%. This type of malocclusion has been estimated to affect 0.6% of people in the United States. The prevalence of dental anterior open bite in American children is approximately 16% in the black population and 4% in the white population (2), with a prevalence of simple anterior open bite, which decrease until adolescence (1). All children present with transient AOB during tooth change period, with little disturbance in oral physiology during this period, which may last for 1 - 2

years. Many anterior open bite correct by gradual closure without treatment, and transient anterior open bite, which account for most simple anterior open bite, have insignificant consequences. Complex anterior open bite, and those that do not correct by the end of the growing period, can pose particular problems. Numerous studies have associated morphological aspects of AOB with TMJ dysfunction (18). Williamson examined patients between the ages of 6 and 16 before orthodontic treatment and found that 72% of those with pain symptoms due to malocclusion had anterior open bite or deep occlusion (19).

Treatment of AOB has ranged from simple habit control procedures to complex orthognathic surgery interventions (20, 21). In cases with increased vertical dimension, this is the last problem to be corrected (13). In our study group for some patients, one stage treatments are effective and sufficient for 25 (48.1%) of the patients but 24 (46.2%) patients required two stages of treatment, and 3 (5.8%) correction of AOB required a stage of orthognathic surgery, this treatment being extremely demanding for patients.

Early treatment aimed at educating and re-educating the functions of the dento-maxillary apparatus and was accomplished in 13(25%) patients with removable appliance with palatal cribs. The re-education of the disturbed functions lead to the establishment of a balance of pressures on the dento-alveolar arches during the contractions of the "oral-facial matrix" (4) Early treatment suppressed oral breathing and re-educated respiratory function by using simple devices, muscle re-education, deconditioning vicious habits (10,13). Late treatment was achieved with fixed orthodontic appliances in 26 (50%) patients and had different purposes: preventing tooth eruption and controlling vertical growth and reducing or redirecting skeletal growth in the vertical direction.

In the treatment of AOB, it was necessary to identify harmful oral habits and factors that may interfere with treatment for achieve therapeutic stability and success. The choice of treatment method was made after analyzing factors such as the patient's age,

skeletal maturation, facial profile and growth pattern.

Orthodontic appliances used to correct AOB are associated with devices to break vicious habits that are often the etiological factors.

When there is a minor skeletal component, fixed appliances are used, but these should also be combined with devices for deconditioning vicious habits (9).

The effective treatment of anterior open bite is based on a correct diagnosis, with the most thorough identification of the etiology and the use of an individualized therapy. The stability of the treatment is critical, and therefore to prevent relapse, orthodontists must also pay a lot of attention to the retention stage. Long-term studies of post-treatment changes and stability are needed.

CONCLUSIONS

1. The correction of anterior open bite requires a selection of treatment methods in relation of important factors: the age of the patient, the etiological factors, the type and severity of the malocclusion, associated malocclusions.
2. The complexity of anterior open bite is associated with the multitude of therapeutic options that clinicians approach and, to the same extent, with the variability of patients' response to these treatments.

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