DOI: https://doi.org/10.2298/SARH170123136S
UDC: 616.314.2-053.2

ORIGINAL ARTICLE / ОРИГИНАЛНИ РАД

Correlation between sagittal jaw position and jaw relationship in children with skeletal class III malocclusion

Zdenka Stojanović[1], Zlata Brkić[1], Predrag Vučinić[2], Predrag Nikolić[3], Marjan Marjanović[4]

[1]Military Medical Academy, Dental Clinic, Belgrade, Serbia;
[2]University of Novi Sad, Faculty of Medicine, Dental Clinic of Vojvodina, Novi Sad, Serbia;
[3]University of Belgrade, Faculty of Dentistry, Clinic for Orthodontics, Belgrade, Serbia;
[4]Faculty of Dentistry, Pančevo, Serbia

SUMMARY

Introduction/Objective The evaluation of sagittal jaw relationship is crucial in orthodontic diagnostics, orthodontic treatment planning, and monitoring of its results. A large number of parameters have been established for their assessment.

The aim of this study was to determine the significance of the correlation between the indicators of sagittal jaw relationship, ANB, AOBO, AFBF, NAPg, and OJ, one with another, and with indicators of the sagittal position of the jaws, SNA and SNB, in children with skeletal class III malocclusion.

Methods A total of 100 children with mixed dentition, of both genders, based on the profile cephalometric analysis, were divided into two equal groups: group 1 (test group) – children with skeletal class III (n = 50), group 2 (control group) – children with skeletal class I (n = 50).

Results In children with skeletal class III malocclusion, significant correlations were found among the indicators of sagittal jaw relationships ANB, AOBO, AFBF, NAPg, OJ, mutually, except between AOBO and AFBF. Significant correlations of these parameters were also found with the SNB angle, but not with the SNA angle.

Conclusion Confirmed significant correlation between tested indicators in the sagittal jaw relation indicates that, if we find skeletal jaw relationship class III, or just a simple reversed incisors overbite in children in routine application of any of the above mentioned parameters in everyday work, it should be indubitably checked and monitored using a larger number of parameters, especially those that define the sagittal position of the mandible.

Keywords: skeletal class III malocclusion; mixed dentition; children; correlation; sagittal jaw relationship

INTRODUCTION

Cephalometric assessment of the relationship of the jaws in the sagittal plane is crucial in orthodontic diagnostics, orthodontic treatment planning, and monitoring of its results, in particular during the early development of severe malocclusions like skeletal class III malocclusion, which is usually not fully clinically exposed and recognizable at that time. During the search for its most relevant indicator, a large number of more or less accepted parameters were established. Lux et al. [1] state that the first step in the description of sagittal jaw relationship was the determination of cephalometric points A and B (Downs 1948), which enabled the construction of the ANB angle by Riedel in 1952.

Pendent to ANB angular parameter is a linear parameter AOBO, or Wits appraisal, which is based on the linear distance between the normal projection of points A and B on the occlusal plane, excluding the use of point N, which is radiologically variable.

The linear parameter AFBF is the indicator of sagittal jaw relationship that excludes the use of both the occlusal plane and radiologically floating value N point. Its value is introduced as a distance between normal projection of points A and B on the FH.

Sagittal intermaxillary discrepancy, typical for skeletal class III malocclusion, has often been followed by the formation of a concave profile. Therefore, the NAPg angle, which shows the degree of severity of the facial convexity in Ricketts analysis, was also examined in this study.

One of the most commonly present skeletal characteristics of skeletal class III malocclusion is the reverse incisor overbite, which some authors believe to be caused by insufficient dentoalveolar compensation of sagittal skeletal jaw relationship mismatches [2]. In cases where this compensation is sufficiently present, the reverse incisor overbite may be absent.

Apart from these most commonly used parameters, some new indicators of sagittal jaw relationship were introduced in contemporary orthodontic practice, such as angles YEN, W, ß, μ and others [3, 4, 5]. However, modern orthodontists usually define them only as a supplement in the interpretation of ANB and AOBO parameter values [3].

Примљено • Received: January 23, 2017
Ревизија • Revised: June 22, 2017
Прихваћено • Accepted: June 29, 2017
Online first: July 4, 2017

Correspondence to:
Predrag VUČINIĆ
University of Novi Sad
Faculty of Medicine
Dental Clinic of Vojvodina
12, Hajduk Veljkova
21000 Novi Sad, Serbia
predrag.vucinic@mf.uns.ac.rs

The aim of this study was to determine whether the children with skeletal class III show a significant correlation among various indicators of sagittal jaw relations, which would indicate whether the use of only one of them may be relevant in the assessment of its development. Furthermore, we examined the correlation of these parameters with the indicators of the sagittal position of the jaw bones, in order to determine whether or not the position of each of them has equal influence on the size of the sagittal skeletal discrepancies at an early stage of development of this malocclusion, which could give clearer focus to early diagnostics.

The working hypothesis of this study reads: In patients with skeletal class III malocclusion there is significantly bigger correlation of different roentgencephalometric indicators of sagittal jaw relations and sagittal jaw position in comparison with persons with skeletal class I. This fact indicates that the specific skeletal model of the malocclusion was formed in early childhood.

METHODS

The study included 100 children with mixed dentition, 6–12 years of age, who had a need for orthodontic treatment and who had not previously been treated orthodontically. The study did not include children with congenital anomalies, clefts, and hypodontia. Model casts, panoramic radiographs and lateral cephalometric radiographs (the natural position of the head, the position of maximum intercuspation) were made for all children. Duplicate determinations were also carried out for all variables. The measurements were undertaken two weeks apart and no significant differences were found for any of the hard or soft tissue variables in the two data sets. Dividing these children into two equal groups was based on gnatometric and cephalometric analysis. Group 1 (test group) consisted of children with dental and skeletal class III malocclusion ($n = 50$), ANB $\leq 0°$. Group 2 (control group) consisted of children with dental and skeletal class I ($n = 50$), normal values of angles SNA = 80–82°, SNB = 78–80°, and ANB = 2–4° (Figure 1). Each group was represented by an equal number of male (M) and female (F) subjects (M = 25, F = 25).

The skeletal sagittal jaw relationships were evaluated using the parameters of ANB, AOBO, AFBF, NAPg, and OJ (Figure 2), after which correlations between their values with each other and in relation to indicators of the sagittal position of the maxilla (SNA angle) and mandible (SNB angle) were examined. The values of all parameters were determined in both groups. We used multiple comparisons and Brown–Forsythe test to determine the significance of differences in obtained values between groups. To test the correlation relationships among the individual parameters within each group we used the Pearson correlation test. Statistical interpretation in all analyses was accepted on the probability NS – not significant difference, $p < 0.05$ – significant difference, $p < 0.01$ – highly significant difference.

We did not address the analysis of the vertical jaw relationship in this study. SNPP, PPMP, SNMP, and Bjork polygon parameters values, which have been tested in

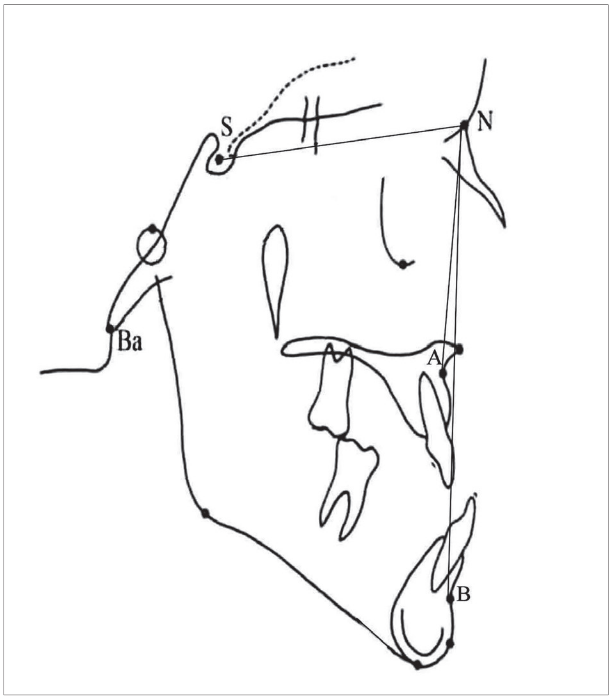

Figure 1. Angular cephalometric measurements for selection into groups used in the study; SNA – angle of sagittal maxillary position in relation to the cranial base anterior; SNB – angle of sagittal mandibulary position in relation to the cranial base anterior; ANB – angle of sagittal jaw relationship

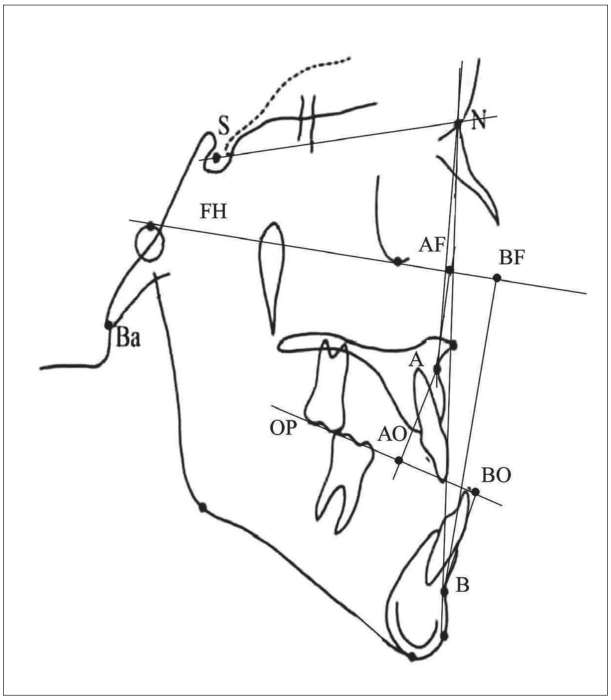

Figure 2. Cephalometric angular and linear measurements for assessment of sagittal jaw relationships; FH – Frankfort plane; AO – normal projection of point A on the occlusal plane of; BO – normal projection point B on the occlusal plane; AF – normal projection of point A on the FH; BF – normal projection of point B on the FH; ANB – angle of sagittal jaw relationship; AOBO, AFBF – linear indicators of sagittal jaw relationship; NAPg – facial convexity angle; OJ – overjet

the previous research conducted on the same population, showed no significant differences between the examined groups [6, 7].

RESULTS

In regard to the ANB angle in group 1, statistically significant ($p \leq 0.01$) positive correlation was found with the AOBO, AFBF, OJ, NAPg parameters, and negative correlation with SNB ($p \leq 0.01$). There was no significant correlation with the parameter SNA ($p > 0.05$).

In group 2, ANB had a value which is significantly different from its value in group 1 ($p \leq 0.01$). There were significant positive correlations with parameters AOBO, AFBF, OJ ($p \leq 0.05$), NAPg, and SNA ($p \leq 0.01$). There was no significant correlation with the SNB parameter ($p > 0.05$) (Table 1).

In group 1 there were significant positive correlations of AOBO with parameters ANB, OJ ($p \leq 0.01$), NAPg ($p \leq 0.05$), and negative with the SNB ($p \leq 0.05$), while with parameters SNA and AFBF there was no significant correlation determined ($p > 0.05$).

In group 2, the AOBO parameter had a value which was significantly different ($p \leq 0.01$) from its value in group 1. Significantly positive correlations were found with the parameters OJ ($p \leq 0.01$) and ANB ($p \leq 0.05$), while with the parameters SNA, SNB, AOBO, AFBF, and NAPg there was no determined significance of correlations ($p > 0.05$).

The AFBF parameter in group 1 had significant positive correlations with parameters ANB, OJ, NAPg ($p \leq 0.01$) and negative ones with SNB ($p \leq 0.01$), while with the parameters of SNA and AOBO it did not show the significant correlations ($p > 0.05$) (Tables 2 and 3).

The values of the AFBF parameter in group 2 were significantly different from those in group 1 ($p \leq 0.01$). A significant positive correlation was found only with the ANB parameter ($p \leq 0.05$).

In group 1, in regard to the NAPg angle, significant positive correlations were found with the parameters ANB, AFBF, OJ ($p \leq 0.01$), and AOBO ($p \leq 0.05$), and negative ones with the SNB ($p \leq 0.01$), while with the SNA parameter, correlation significance was not established ($p > 0.05$).

In group 2, the measured values of NAPg angle were significantly different from those identified in group 1 ($p \leq 0.01$). A significant positive correlation was found only with the parameter ANB ($p \leq 0.01$).

In regard to the horizontal incisal overbite, OJ, in group 1, significant positive correlations were found with the parameters ANB, AOBO, AFBF, NAPg ($p \leq 0.05$), and SNA ($p \leq 0.01$), and negative ones with parameter SNB ($p \leq 0.01$).

In group 2, the parameter OJ had a value which is significantly different from those in group 1 ($p \leq 0.01$). Positive correlations with the parameters AOBO ($p \leq 0.01$) and ANB ($p \leq 0.05$) were determined as significant, while with the parameters SNA, SNB and NAPg, the significance of correlations was not determined ($p > 0.05$).

Regarding the value of the SNA angle in group 1, significant positive correlation was established with the SNB parameter ($p \leq 0.01$), while with the indicators of sagittal intermaxillary relations (ANB, AOBO, AFBF, NAPg, and OJ), correlation significance was not established ($p > 0.05$).

In group 2, the SNA angle had normal values which was significantly different ($p \leq 0.01$) from the values in group 1. Significant positive correlations were found with the parameters SNB and ANB ($p \leq 0.01$), while with the parameters of AOBO, AFBF, NAPg, OJ, correlation significance was not established ($p > 0.05$).

The SNB angle in group 1 had significant negative correlation with the parameters ANB, AOBO, AFBF, OJ, NAPg ($p \leq 0.01$).

Table 1. The values of measured parameters (Mann–Whitney, Wilcoxon test)

Parametar	Group	Min.	Max.	X ± SD	p
SNA (°)	1	70	84	77.36 ± 3.58	0.00
	2	80	82	80.78 ± 0.93	
SNB (°)	1	70	90	79.46 ± 3.91	0.12
	2	78	80	78.36 ± 0.66	
ANB (°)	1	-9	0	-2.1 ± 2.07	0.00
	2	2	4	2 ± 0.73	
AOBO (mm)	1	-16	6	-6.92 ± 3.63	0.00
	2	-8.5	3	-3.05 ± 2.35	
AFBF (mm)	1	-13	8	-0.8 ± 3.86	0.00
	2	1	8	4.6 ± 1.93	
NAPg (°)	1	-19	2	-6.14 ± 4.68	0.00
	2	0	13	3.74 ± 2.83	
OJ (mm)	1	-10	3	-0.6 ± 2.20	0.00
	2	0.0	5	1.53 ± 1.19	

SNA – angle of sagittal maxillary position in relation to the cranial base anterior; SNB – angle of sagittal mandibulary position in relation to the cranial base anterior; ANB – angle of sagittal jaw relationship; AOBO, AFBF – linear indicators of sagittal jaw relationship; NAPg – facial convexity angle; OJ – overjet

Table 2. The p-values of correlations between the measured parameters in group 1 (Pearson correlation test)

	SNA	SNB	ANB	AOBO	AFBF	OJ	NAPg
SNA	1	0.85	n.s.	n.s.	n.s.	n.s.	n.s.
SNB	0.85	1	-0.42	-0.29	-0.54	-0.46	-0.36
ANB	n.s.	-0.42	1	0.38	0.75	0.59	0.93
AOBO	n.s.	-0.29	0.38	1	n.s.	0.54	0.29
AFBF	n.s.	-0.54	0.75	n.s.	1	0.56	0.68
OJ	n.s.	-0.46	0.59	0.54	0.56	1	0.47
NAPg	n.s.	-0.36	0.93	0.29	0.68	0.47	1

SNA – angle of sagittal maxillary position in relation to the cranial base anterior; SNB – angle of sagittal mandibulary position in relation to the cranial base anterior; ANB – angle of sagittal jaw relationship; AOBO, AFBF – linear indicators of sagittal jaw relationship; NAPg – facial convexity angle; OJ – overjet

Table 3. The p-values of correlations between the measured parameters in group 2 (Pearson's correlation test)

	SNA	SNB	ANB	AOBO	AFBF	OJ	NAPg
SNA	1	0.63	0.71	n.s.	n.s.	n.s.	n.s.
SNB	0.63	1	n.s.	n.s.	n.s.	n.s.	n.s.
ANB	0.71	n.s.	1	0.3	0.33	0.3	0.48
AOBO	n.s.	n.s.	0.3	1	n.s.	0.44	n.s.
AFBF	n.s.	n.s.	0.33	n.s.	1	n.s.	n.s.
OJ	n.s.	n.s.	0.3	0.44	n.s.	1	n.s.
NAPg	n.s.	n.s.	0.48	n.s.	n.s.	n.s.	1

SNA – angle of sagittal maxillary position in relation to the cranial base anterior; SNB – angle of sagittal mandibulary position in relation to the cranial base anterior; ANB – angle of sagittal jaw relationship; AOBO, AFBF – linear indicators of sagittal jaw relationship; NAPg – facial convexity angle; OJ – overjet

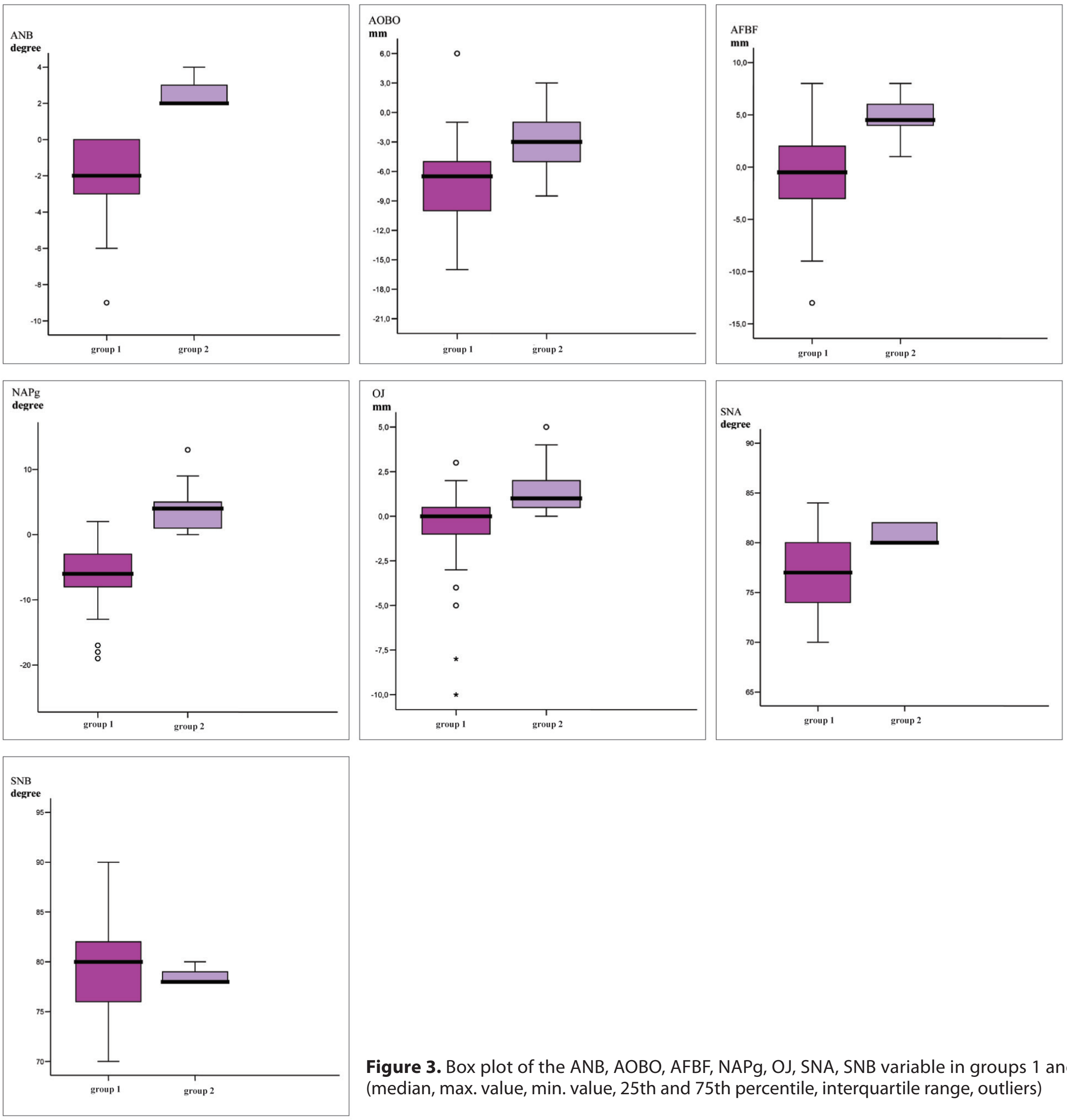

Figure 3. Box plot of the ANB, AOBO, AFBF, NAPg, OJ, SNA, SNB variable in groups 1 and 2 (median, max. value, min. value, 25th and 75th percentile, interquartile range, outliers)

The values of the SNB angle for group 2 were in the normal range and did not differ significantly from the value of this angle in group 1 ($p > 0.05$). A significant positive correlation relationship with the parameter SNA ($p \leq 0.01$) was determined, while significant correlation was not established ($p > 0.05$) with the indicators of sagittal intermaxillary relations (ANB, AOBO, AFBF, NAPg, OJ) (Figure 3).

The relevance of gender differences was not determined for all values of measured parameters ($p > 0.05$).

DISCUSSION

Starting from the fact that each indicator of sagittal jaw relationships has its own flaws, in this study they were tested using a large number of parameters – skeletal ANB, AOBO, AFBF, NAPg, and dental OJ. Measured average values of all these parameters in children with skeletal class III malocclusion were significantly different from those in the group of children with skeletal class I, which is in accordance with the results of other authors.

The ANB parameter quickly became the most widely used parameter in orthodontics. According to the same author, in the following years, a great number of publications were published, which was indicated by the influence of geometrical factors on the value of the ANB angle (Taylor, 1969; Freeman, 1981; Pancherz and Sack, 1990; Oktay, 1991), and resulted in numerous suggestions for its correction (Ferrazzini, 1976; Panagiotidis and Witt, 1977; Gebauer, 1979; Hussels and Nanda, 1984; Järvinen, 1986). In 1975, Jacobson also recognized the potential problems that may arise from the use of cranial points far from maxilla and mandible for their mutual assessment of sagittal position. This is why he introduced the use of Wits appraisal, based on the functional occlusal plane, which is much closer to the dental bases and A and B points. In 1987, Chang recommended the use of AFBF distance for the assessment of sagittal jaw relationships, applying the concept of use of FH as a reference plane, which was previously suggested by Luder in 1978 [1].

ANB angle, however, remained the most commonly used indicator of sagittal jaw relationships. Normal value of this angle amounting to 2° to 4° was one of the criteria for selecting activities in group 2 in our study. Its decreased value is the basic characteristic of skeletal class III malocclusion, and this is why it was the main criterion for selecting activities in the test group.

A study of children of Chinese origin at the time of deciduous dentition, as well as studies carried out on Korean children of the same age, show that the value of the ANB angle was significantly lower in children with skeletal class III than in children with skeletal class I [8, 9]. The results of the study of Syrian children with skeletal classes I and III provided very similar information [10]. Reyes, in his study of children of Caucasian origin, divided according to their age into groups from six to 16 years, found that the value of this angle in all age groups was significantly lower in children with skeletal class III than in children with skeletal class I [11]. Similar results were found also by Chen et al. [12] in a longitudinal study conducted within Japanese girls aged 8–14 years.

Some authors believe that Wits appraisal is a better indicator of sagittal jaw relationships than ANB angle, for several reasons. AOBO distance excludes the use of point N, which is radiologically variable. Unlike the ANB angle, whose value during the prepubertal and pubertal development decreases due to the domination of the sagittal mandibular growth, Wits value remains stable [1, 13].

However, due to the dependence on the vertical distance between points A and B in patients with skeletal class III malocclusion, mandibular growth with a horizontal rotation and a flatter occlusal plane, Wits appraisal is a less valid parameter in determining the sagittal jaw relationships compared to the ANB angle [1, 14]. Roth [15] and Sherman et al. [16] describe even an age-dependent positive cumulative effect of increasing the vertical distance between points A and B and the occlusal plane angulation changes due to its horizontal rotation, which results in an increase in the value of Wits appraisal with age, with no real changes in sagittal relationship between points A and B. Lux et al. [1] found that reliability of the AOBO parameter in assessing sagittal jaw relationships is often limited in children with incomplete overgrown incisors, due to insufficiently precise occlusal plane construction. In adults with normal occlusion, Wits values range from -1 mm to 0 mm, and according to some authors, estimate of Wits 0 ± 2 mm represents the appropriate value in all age groups and for both men and women [1].

Searching for the parameters whose value in prepuberty age could indicate the need for orthognathic surgery after growth, Schuster et al. [2] define the Wits appraisal as one of the most valued foreseeing parameter and constitutes subclassification into the surgical and non-surgical group of patients. From all the indicators of sagittal jaw relationships, Zentner et al. [17] considers the values of AOBO the most valid in assessing the performance of the correction of malocclusion of skeletal class III. The results of AOBO parameter examination in children at the time of deciduous dentition show that there is a statistically significant difference in its value in children with skeletal class I and the children with skeletal class III malocclusion, in which negative values were present [8, 9, 12, 14]. A similar finding exists in children aged 5–12 years, where in the group with skeletal class III malocclusion, the value of Wits estimates were significantly lower than those in the group with skeletal class I [10].

According to the findings of Chen et al. [12], the values of AOBO and ANB parameters are fairly stable between eight and 14 years of age. The AOBO distance does not depend on the cranial base length or on jaw rotation to the cranial base, which significantly affects the value of ANB angle [18]. In this manner, the AOBO distance indicates the sagittal relationship between the upper and lower jaw, where this relationship does not depend on the relationship to the cranial base, but it is very dependent on the vertical intermaxillary relation. For these reasons, the results of sagittal jaw relationships tested by linear parameters may be different from the results tested through angular parameters [11, 14].

Optimal distance between normal projection of points A and B on the FH for men is 3.87 ± 2.93 mm, while in women it is 3.87 ± 2.63 mm [3]. This distance, in subjects with good occlusion, observed from the seventh to the 15th year, is fairly stable, with a slight decrease in length [1]. According to Chang [8], taking into account all deficiencies of the ANB angle, the AFBF parameter allows a much more precise determination of sagittal relationship between the maxilla and mandible. However, Luder himself, who first proposed the use of this parameter, put the objection to this method of measurement due to the difficulties related to the construction of FH [1].

In one study, significantly lower values of AFBF were found in children with primary dentition and skeletal class III compared to children of the same age with skeletal class I [8].

Although the measured average values of all indicators of sagittal jaw relationships in children with skeletal class III malocclusion differed significantly from those in the group of children with skeletal class I, they were not always in mutual consent.

The value of the ANB angle from 2º to 4º, which was a basic parameter for the selection of the control group with skeletal class I, was not always in accordance with the values of Wits parameter for skeletal class I, which is consistent with the findings of other authors [11, 14]. Also, in the group with skeletal class III malocclusion, the assessment of skeletal jaw relationship using these three parameters was not always matched, but there was a significant positive correlation between the ANB angle values and the values of the AOBO and AFBF parameters. In contrast, a significant correlation for AOBO and AFBF values has not been established. This finding could be related to the problem of defining the occlusal plane in children with mixed dentition. In addition, significant correlations of the mentioned indicators of sagittal jaw relationships with the value of the OJ parameter were recorded.

In the facial skeletal morphology of skeletal class III malocclusion, as mentioned, there is often a concave profile present, and the values of convexity are reduced. This finding is also recognizable at the time of deciduous dentition, which is also confirmed by the results of the studies in children with skeletal classes III and I, indicating a highly significant statistical difference in the values of this angle between them [8, 9]. The results of this study also indicate the existence of significant differences in facial convexity of children with skeletal class III malocclusion and children with skeletal class I. In children with skeletal class III malocclusion, the significant positive correlations of NAPg angle with other parameters that define the sagittal jaw relationships, ANB, AFBF and AOBO, OJ, were established. In the group of children with skeletal class I, a significant positive correlation was found only with the ANB parameter.

In their research, Bošković-Brkanović and Nikolić [19] examined correlations between selected indicators of sagittal jaw relationships, which included children aged 7–12 years, with all three classes of malocclusion, and found a high correlation between the ANB angle, Wits values, and NAPg.

Children with skeletal class III malocclusion had the average value of OJ lower than the normal value of OJ and a significantly lower value than the control group. By the analysis of test results of OJ correlations with the selected parameters, significant positive correlations with all tested parameters that define the sagittal jaw relationships – ANB, AFBF, AOBO, and NAPg – were determined. In the control group, a significant correlation of this parameter was noted only with the parameters AOBO and ANB.

In a study of children at the age of deciduous dentition, Chang [8] found a statistically significant difference in the size of OJ between children with skeletal class III malocclusion and children with skeletal class I [8]. For children aged 5–12 years, Mouakeh [10] provided similar results.

It is known from earlier studies, and modern research confirms it, that the skeletal jaw relationships in the sagittal plane do not always correspond to dental relationships [20]. The overbite value is not always a realistic rate of sagittal jaw relationships, particularly in patients with skeletal class III malocclusion [14, 18]. However, with or without overlap of these values, early correction of inverted overbite, in the opinion of many authors, is of great clinical importance for maintaining the early corrected skeletal jaw relationships [21].

Also, Zupančič et al. [18] were involved in examining the correlations between OJ and indicators of sagittal jaw relationships, ANB, AOBO, and NAPg, in children with I, II, and III skeletal class. The results of their research were consistent with the results of this study. There were significant correlations between OJ and the examined parameters, and in the highest degree so with AOBO, which the authors associated with the use of the same reference plane (occlusal) for their evaluation. Using the method of linear regression, the same study found that neither in patients with skeletal class I nor in patients with skeletal class III can OJ be considered a reliable factor in the assessment of sagittal skeletal jaw relationships. This finding speaks in favor of the known facts that evaluated skeletal and dental sagittal jaw relationships may not be matched, and often two cases of malocclusion with reverse incisal overbite can look very similar, but after careful cephalometric analysis the basic problem with them is very different [18]. However, the results of this study, which showed significant correlation of this dental indicator of jaw relationships with a skeletal indicator, show that the correction of the reverse overbite, as a consequence of their wrong inclination, is an important segment of orthodontic treatment. This correction can be carried out independently, or in combination with other corrections of irregularities related to the skeletal class III malocclusion [22]. Especially important is the early correction of negative OJ, in many cases a stable correction, which ensures the creation of favorable conditions for the development of the maxilla [23].

In children with skeletal class III malocclusion, the analysis of the results of measurement parameters of the sagittal position of the maxilla indicated the presence of maxillary retrognathism, with a significant difference compared to the values measured in group 2. The determined values of parameters of the sagittal position of the mandible are greater than the average value in group 2, but without statistical significance. Despite such findings, when examining the correlations, we found more significant correlations of all indicators of sagittal jaw relationships with the SNB than with the SNA, and more significant correlation of sagittal jaw relationships with the position of the mandible than with the position of the maxilla. This finding may be associated with greater variability of sagittal position of the mandible in the examined age. This increase in variability of the patient may be expected to be even more pronounced, considering the intense mandibular growth.

CONCLUSION

Based on the results of this study, it can be concluded that in children with skeletal class III malocclusion, in the period of mixed dentition there is a significant correlation among the indicators of sagittal jaw relationships, ANB, AOBO, AFBF, NAPg, OJ, while for the AOBO and the AFBF, the significance of the correlation has not been established. More significant correlations were established between the SNB parameter and all examined indicators of sagittal jaws relationship than with the SNA angle.

This fact indicates that the specific skeletal model of malocclusion is formed in early childhood, which is why there are grounds to consider this malocclusion a syndrome. Due to the established relevance of the correlation, a recommendation follows that if in application of any of the above mentioned parameters in everyday course of work we find class III skeletal jaw relationships in children, regardless of the common absence of characteristic clinical expression, this should be indubitably checked by using a larger number of parameters, because defining each one of them has its flaws and limitations, especially in the period of dynamic development of occlusion. This is evidenced by the lack of significance of the correlation between the AOBO and AFBF parameters, which, although have common reference points A and B, still do not always have congruent values, probably as a consequence of the difficulty in defining the FH (more precisely, the point Po) and the occlusal plane in mixed dentition. Early diagnostics of this serious dental–facial anomaly, which often leads to reserving extensive orthognathic surgical procedures after the completion of growth, would leave more room for early orthodontic and orthopedic therapy, with the aim of diverting craniofacial growth model within the individual genetic potential.

REFERENCES

1. Lux CJ, Donald Burden D, Conradt C, Komposch G. Age-related changes in sagittal relationship between the maxilla and mandible. Eur J Orthod. 2005; 27(6):568–78.
2. Schuster G, Lux JC, Stellzig-Eisenhauer A. Children with class III malocclusion: development of multivariate statistical models to predict future need for orthognathic surgery. Angle Orthod. 2002; 73(2):136–45.
3. Singh A, Jain A, Hamsa PR, Ansari A, Mishra V, Savana K, et al. Assessment of sagittal discrepancies of jaws: a review. Int J Adv Health Sci. 2015; 1(9):29–34.
4. Sadeghian S, Hajiahmadi M, Khorrami L, Moshkelgosha H. Comparing the range of µ and ß angles in 6-17-year-old children of Isfahan with normal occlusion. Dent Res J (Isfahan). 2014; 11(1):39–44.
5. Sharma R, Sharma K, Mathur A, Preethi N, Agarwal V, SinghSatija S. Comparison of W Angle with Different Angular and Linear Measurements in Assessment of Sagittal Skeletal Relationship in Class I and Class II Patients in Jaipur Population - A Cephalometric Study. OHDM. 2015; 14(3):155–60.
6. Stojanović Z. Rani pokazatelji razvoja III skeletne klase [Master thesis]. Beograd: Vojnomedicinska akademija; 2008.
7. Stojanović Z. Kefalometrijska procena kranio-facijalnog modela III skeletne klase u doba mešovite denticije [dissertation]. Beograd: Stomatološki fakultet, Univerzitet u Beogradu; 2013.
8. Chang HP. Craniofacial pattern of Class III deciduous dentition. Angle Orthod. 1992; 62(2):139–44.
9. Choi HJ, Kim JY, Yoo SE, Kwon JH, Park K. Cephalometric Characteristics of Korean Children with Class III Malocclusion in the Deciduous Dentition. Angle Orthod. 2010; 80(1):86–90.
10. Mouakeh M. Cephalometric evaluation of craniofacial pattern of Syrian children with Class III malocclusion. Am J Orthod Dentofac Orthoped. 2001; 119(6):640–9.
11. Singh GD. Morphologic Determinants in the Etiology of Class III Malocclusions: A Review. Clin Anat. 1999; 12(5):382–405.
12. Chen F, Terada K, Wu L, Saito I. Longitudinal Evaluation of the Intermaxillary Relationship in Class III Malocclusions. Angle Orthod. 2005; 76(6):955–61.
13. Thilander B, Persson M, Adolfsson U. Roentgen-cephalometric standards for a Swedish population. A longitudinal study between the ages of 5 and 31 years. Eur J Orthod. 2005; 27(4):370–89.
14. Iwasaki H, Ishikawa H, Chowdhury L, Nakamura S, Iida J. Properties of the ANB angle and the Wits appraisal in the skeletal estimation of Angle's Class III patients. Eur J Orthod. 2005; 24(5):477–83.
15. Roth R. The Wits appraisal – its skeletal and dentoalveolar background. Eur J Orthod. 1982; 4(1):21–8.
16. Sherman SL, Woods M, Nanda RS. The longitudinal effects of growth on the Wits appraisal. Am J Orthod Dentofac Orthop. 1988; 93(5):429–36.
17. Zentner A, Doll GM, Peylo SM. Morphological parameters as predictors of successful correction of Class III malocclusion. Eur J Orthod. 2001; 23(4):383–92.
18. Zupančič S, Pohar M, Farčnik F, Ovsenik M. Overjet as a predictor of sagittal skeletal relationships. Eur J Orthod. 2008; 30(3):269–73.
19. Bošković-Brkanović T, Nikolić Z. Correlation between five parameters for the assessment of sagittal skeletal intermaxillary relationship. Serbian Dental J. 2007; 54:231–9.
20. Al-Hamlan N, Al-Eissa B, Al-Hiyasat AS, Albalawi FS, Ahmed AE. Correlation of Dental and Skeletal Malocclusions in Sagittal Plane among Saudi Orthodontic Patients. J Contemp Dent Pract. 2015; 16(5):353–9.
21. Chong YH, Ive JC, Artun J. Changes following the use of protraction headgear for early correction of Class III malocclusion. Angle Orthod. 1996; 66(5): 351–62.
22. Stamenković Z, Raičković V. Fränkel Functional Regulator in Early Treatment of Skeletal Distal and Mesial Bite. Chapter 17. In: Virdi MS, ed. Emerging Trends in Oral Health Sciences and Dentistry. Vienna: InTechOpen; 2015. p. 363–86.
23. Hägg U, Tse A, Bendeus M, Bakr A, Rabie M. A Follow-up Study of Early Treatment of Pseudo Class III Malocclusion. Angle Orthod. 2004; 74(4):465–72.

Корелације сагиталног положаја вилица и међувиличних односа код деце са малоклузијом III скелетне класе

Зденка Стојановић[1], Злата Бркић[1], Предраг Вучинић[2], Предраг Николић[3], Марјан Марјановић[4]

[1]Војномедицинска академија, Клиника за стоматологију, Београд, Србија;
[2]Универзитет у Новом Саду, Медицински факултет, Одсек за стоматологију, Нови Сад, Србија;
[3]Универзитет у Београду, Стоматолошки факултет, Клиника за ортопедију вилица, Београд, Србија;
[4]Стоматолошки факултет, Панчево, Србија

САЖЕТАК

Увод/Циљ Процена сагиталних међувиличних односа од кључног је значаја у ортодонтској дијагностици, планирању ортодонтског лечења и праћењу његових резултата. За њихову процену установљен је велики број параметара.

Циљ овог рада био је да утврди значајност корелација између показатеља сагиталних међувиличних односа, *ANB*, *AOBO*, *AFBF*, *NAPg* и *OJ*, међусобно и са показатељима сагиталног положаја вилица, *SNA* и *SNB*, код деце са малоклузијом III скелетне класе.

Методе Укупно 100 деце са мешовитом дентицијом, оба пола, селекционисано је на основу кефалометријских анализа профилних телерендгенских снимака на две једнаке групе: група 1 (испитна група) – деца са малоклузијом III скелетне класе ($n = 50$), група 2 (контролна група) – деца са I скелетном класом ($n = 50$).

Резултати Код деце са малоклузијом III скелетне класе утврђене су значајне корелације између свих испитиваних показатеља сагиталних међувиличних односа (*ANB*, *AOBO*, *AFBF*, *NAPg*, *OJ*), осим између *AOBO* и *AFBF*. Значајне корелације ових параметара остварене су, такође, и са углом *SNB*, док са углом *SNA* нису.

Закључак Утврђена значајна корелација између испитиваних показатеља сагиталних међувиличних односа указује да уколико се у свакодневном раду рутинском применом било ког од поменутих параметара код деце утврди скелетни међувилични однос III класе или само једноставан обрнут преклоп секутића, треба га обавезно проверити и пратити применом већег броја параметара, посебно оних који дефинишу сагитални положај мандибуле.

Кључне речи: малоклузија III скелетне класе; мешовита дентиција; деца; корелације; сагитални међувилични односи