

DENTOFACIAL FEATURES OF CHILDREN DIAGNOSED WITH SCOLIOSIS AND SCHEUERMANN'S DISEASE

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REZUMAT

Objective: Scopul acestui studiu epidemiologic este de a arăta corelațiile dintre diversele vicii de postură și deformări ale coloanei vertebrale cu anomalii dentofaciale identificate prin examen clinic ortodontic. **Material și metodă:** Au fost luați în studiu 23 de copii cu boală Scheuermann (vârsta medie: 14 ani și 8 luni, DS: 1 an și 8 luni) și 28 cu scolioză (vârsta medie: 14 ani și 7 luni, DS: 2 ani și 3 luni). Am utilizat protocoale de screening ortodontic standardizate pentru a evidenția relațiile ocluzale în plan sagital, vertical și orizontal, relațiile spațiale dintre segmentul frontal maxilar și mandibular, starea articulațiilor temporomandibulare și asimetriile faciale. **Rezultate:** S-au observat diferențe semnificative ($p < 0,05$) între valorile obținute la grupurile de pacienți examinați pentru următoarele măsurători: overjet și overbite, devierea liniei mediene superioare și inferioare, spațierea mandibulară frontală, simptomele patologice și caracteristicile funcționale ale articulației temporomandibulare, precum și frecvența asimetriilor faciale. **Concluzii:** Un mare procent dintre pacienții cu deformări prepubertare ale coloanei vertebrale prezintă și anomalii dentofaciale. Majoritatea acestor anomalii sunt prezente la cei care au boala Scheuermann. Tratatamentul precoce al malocluziilor asociate acestor vicii de postură minimizează progresia anomaliilor dentofaciale, fiind necesar un screening ortodontic cât mai precoce al acestor pacienți.

Cuvinte cheie: scolioză, boala Scheuermann, anomalii dentofaciale

ABSTRACT

Objective: The objective of the current epidemiological study is to show the correlation of various postural abnormalities and spinal deformities with the clinically identifiable dentofacial anomalies by orthodontic examination. **Materials and methods:** We enrolled in the study 23 children with Scheuermann's disease (mean age: 14 Y, 8 M; SD: 1 Y, 8 M) and 28 with scoliosis (mean age: 14 Y, 7 M; SD: 2 Y, 3 M). Standardized orthodontic screening protocols were used to map the occlusal relations in the sagittal, vertical, and horizontal dimensions, space relations of the maxillary and mandibular frontal segment, the temporomandibular joints (TMJ) status, and the facial asymmetries. **Results:** Statistically significant differences ($p < 0.05$) were found between the values of the examined groups of patients for the following measurements: incisal overjet and overbite, the upper and lower midline deviation, the mandibular frontal spacing, TMJ pathological symptoms and functional characteristics, and the frequency of facial asymmetries. **Conclusions:** A large percentage of patients with prepubertal developments of spinal deformities have various dentofacial anomalies. The majority of these anomalies are present in patients suffering from Scheuermann's disease. The early treatment of the malocclusions closely correlated to postural disorders should minimize the progression of the dentofacial anomalies, making necessary as soon as possible performed orthodontic screening for these patients.

Key Words: scoliosis, Scheuermann's disease, dentofacial anomalies

INTRODUCTION

The literature exploring the reasons for the development of malocclusions gives great importance to the connections with different postural anomalies.

It highlights mainly those postural anomalies that could contribute to the development of the different dentofacial anomalies and later to their sustenance by chronic influence on head posture.^{1,2} Thus, these orthopedic disorders that mainly manifest in pathological curves of the spine become very important.^{3,4} According to the literature, the frequency of the different occlusion deformations malocclusions is 83-87% in the orthopedic patient group.⁵

The role of head posture tilted forwards and backwards has emerged once the consequences of the pathological curves of the sagittal plane (kyphosis and lordosis) were mainly examined in the development of the sagittal and vertical jaw anomalies.^{6,7} It has been proposed that the scoliotic curves that occur in the frontal plane – through the head posture tilted

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sideward – play a role in the development of the different dentofacial asymmetries.^{3,8} The alteration in the head posture may lead to development of TMJ dysfunction and TMJ structural deformity.⁹ Because of their similar epidemiologic characteristics – incidence, stability of the developed deformations, appearance time – the two spinal diseases considered as most appropriate in terms of the examinations are the Scheuermann's disease (or kyphosis dorsalis juvenilis) and the idiopathic scoliosis.¹⁰

The incidence of Scheuermann's disease varies between 0.4-11%, the pathological kyphotic curvature which is liable for the forward tilted head posture and hunchbacked appearance is primarily expressed and stabilized in the dorsal spinal region. (Fig. 1)



Figure 1. Lateral X-ray of a Scheuermann's kyphotic spine.

Its development begins during pre-puberty and is not characterized by generic deflection.¹¹⁻¹³ The frequency of the idiopathic scoliosis varies between 11.9-16.2%. The main curvature may be localized to any part of the vertebral column, the most common is the right convex dorsalis scoliosis, which in the non-compensated forms induces left tilted head posture. (Fig. 2)



Figure 2. Frontal X-ray of a scoliotic spine.

Its development starts during the pre-puberty, and is 7 to 10 times more frequent in girls than in boys.^{11,14,15}

The conservative treatment in the early stage of both spinal diseases consists of posture strengthening and improving the muscle tone by physical therapy. In late, severe stages of the disease, wearing a corset is necessary. The need for the corset depends on the malformation stage of the deformed vertebrae in Scheuermann's disease. In patients with scoliosis, the Cobb value with over 20 degrees warrants the corset.^{14,16}

We performed the orthodontic examination of

children suffering of the Scheuermann's kyphosis and with idiopathic scoliosis in order to collect data for further related studies. By using the outcomes, we would like to get a more accurate image on the craniofacial characteristics, functional habits and occlusal patterns of patient groups having spinal deformities in sagittal and frontal plane. The patients participating in the epidemiological survey received detailed information on the examinations in advance; their parents provided their written consent to the study procedures. The examinations were fully compliant with the requirements of the local Ethics Committee.

MATERIALS AND METHODS

For the epidemiologic study 65 patients recently diagnosed with Scheuermann's disease and idiopathic scoliosis were referred by the Orthopedic Department. Fourteen of these patients actually had a history of previous orthodontic treatment, hence they were excluded from the study. From the remaining 51 patients, 23 formed the group with Scheuermann's disease (MSCH) and 28 the group with scoliosis (SC). Due to the differences of the generic distribution characterizing the two orthopedic groups, the data for both genders were processed together. Eight children from the MSCH group and nine from the SC group were wearing a corset because of the severity of their orthopedic malformation.

For the examination of the selected children, a standardized orthodontic protocol was used, including, besides the clinical examination, the taking of impression and the usual dental and facial photos. The results for the exact evaluation were tabulated on the WHO broadsheet used for epidemiological studies.

The examination of the orthodontic particularities was structured around four groups of questions. The measurement of the occlusal characteristics in the sagittal plane was based on determination of the molar relation (Angle classification), and on the overjet of the incisors. The presence of the transversal abnormalities was measured by the registration of the crossbite in the molar region, of the upper and lower midline in relation to the facial midline and of the midline shift. The vertical abnormalities were assessed by recording the lateral open bite and measuring the overbite of the incisors. For the examination of the jaw space relations, the crowding and the presence of spacing in the incisor region was recorded. For thorough examination of the TMJ the abnormal symptoms (clicking of the joint, pain, limited mouth opening), mentum deviation during mouth opening, and the rate

of the lateral movement were marked and measured. Finally the visible facial asymmetries were visually assessed using well defined, predetermined criteria.

The evaluation of datasheets and the statistical analysis of values was prepared with the aid of the Microsoft Excel 2002 program (Microsoft Corporation, USA), and the significance level in all tests was determined to be $p < 0.05$.

RESULTS

The sagittal abnormalities in the posterior region were examined by the analysis of the molar relations (Angle classification). The unilateral and bilateral neutral occlusions, distal occlusions and the mesial occlusions were recorded separately. In both patient groups the incidence rate was about equal, no significant differences were detected. The only noticeable phenomenon was that the frequency of the unilateral distal occlusions (30.43% for MSCH group, 22.4% for SC group) was substantially higher in both patient groups than the frequency of bilateral distal occlusion (21.73%, respectively 10.7%). The presence of the sagittal deviations in the frontal region was recorded by the measurement of the overjet of the incisors. Besides the normal overjet, the cases presenting extreme overjet ≥ 6 mm, and frontal crossbite were recorded separately. Although, in the examined patient groups the frontal crossbite was not registered, there was a significant difference in the incidences and in the mean values of the two other indexes. The incidence of normal overjet in the scoliosis group was substantially higher and there was a large difference between the means. (Fig. 3)

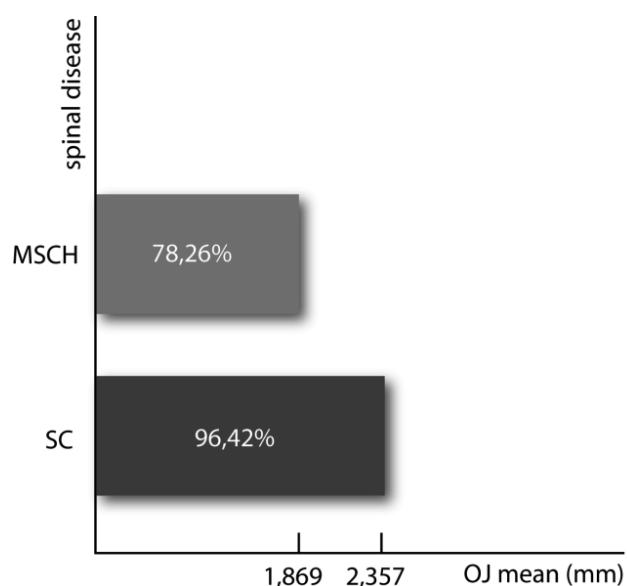


Figure 3. Means of the overjet values in the studied groups.

Examining the values of the extreme overjet, the significantly higher incidence rate and average occurrence is characteristic to the MSCH group.

Examining the data from the vertical abnormalities, there were no detectable posterior open bite cases. To determine the vertical anomalies of the frontal region we used the registration of the normal overbite, the deep bite ≥ 5 mm, and the open bite ≥ 0 mm. In MSCH group the normal overbite values were substantially more infrequent and the mean values are also different from those of SC group. (Fig. 4)

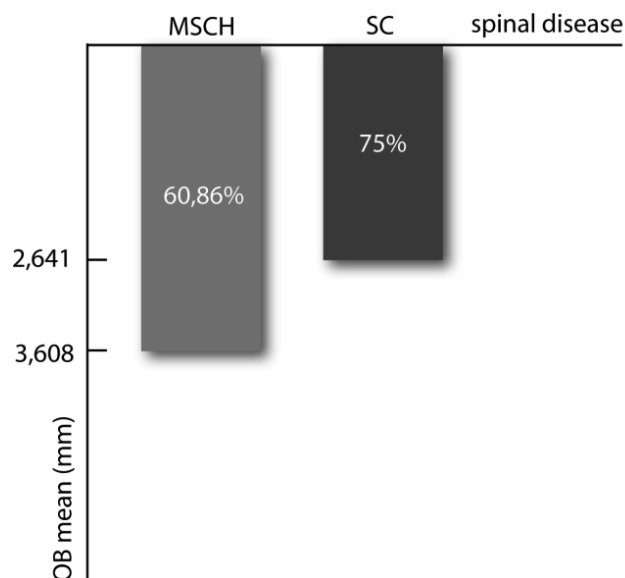


Figure 4. Means of the overbite values in the studied groups.

In MSCH group the frequency of the deep bite cases was higher, while the majority of the frontal open bite cases were registered among SC group.

The study of the occlusal anomalies was finalized with the analysis of the transversal relations (Table 1).

Table 1. Occlusion parameters of the studied groups.

Direction and site of the malocclusion	Parameters	Scheuermann's disease group	Scoliosis group	p
Sagittal incisal relation	Normal overjet frequency (%)	78.26	96.42	.00068*
	Normal overjet mean (mm)	1.869	2.357	.00708E-03**
Vertical incisal relation	Normal overbite frequency (%)	60.86	75.00	.288
	Normal overbite mean (mm)	3.608	2.642	.00293E-03**
	Upper midline deviancy from the facial midline frequency (%)	60.86	42.85	.208
Transversal incisal relation	Lower midline deviancy from the facial midline frequency (%)	60.86	32.14	.041*
	Midline shift mean (mm)	1.087	1.214	.0003**

* Significant

** Highly significant

One child in MSCH group and three children in SC group were found to have unilateral crossbite and there were 1-1 bilateral crossbites in both groups. The evaluation of the records of the frontal region gave a better estimate of the picture. Just like in the upper, the lower midline's deviation from the facial midline was more frequent in the MSCH group than in the SC group. The higher number of midline shifts was characteristic for MSCH group, however the SC group had higher deviation means.

The evaluation of the space anomalies in the jaws consisted in the recording of the crowding and spacing, present in the upper and lower frontal regions. With almost equivalent crowding and upper spacing values, the incidence of the spacing in the lower region showed significant difference, being higher in the SC group.

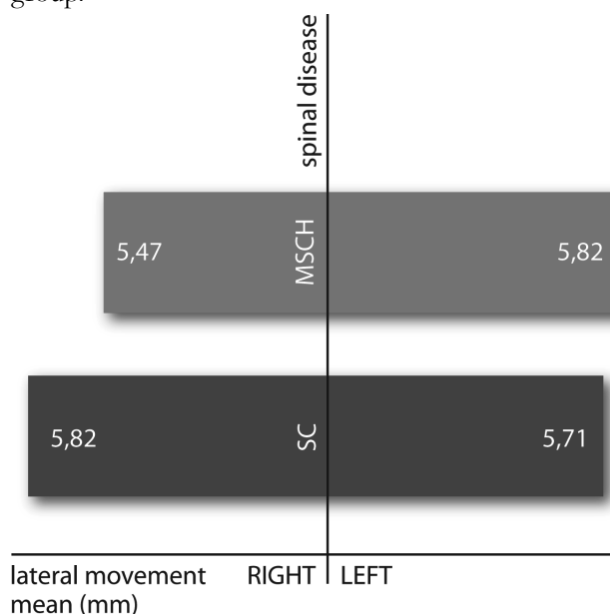


Figure 5. Lateral movement ranges measured in the studied groups.

During the clinical examination of TMJ, almost one quarter of SC group presented a pathological symptom, as opposed to group MSCH where only 4.34% had an abnormality. The study of the mandibular lateral movement recorded two significantly different movement ranges in the studied groups. (Fig. 5)

Only half of the patients in SC group were able to make the same range of bilateral movement, while in the MSCH group the frequency of these patients is 60.86%.

The visual record of the facial asymmetries detected asymmetry significantly more frequently in MSCH than in SC group (78.26% vs. 57.14%). (Table 2)

Table 2. Dentofacial parameters of the studied groups.

Examined region	Parameters	Scheuermann's disease group	Scoliosis group	p
Temporomandibular joint	Presence of the symptoms and signs frequency (%)	4.34	21.42	.0122*
	Lateral movement to the right mean (mm)	5.478	5.821	.00341E-21**
	Lateral movement to the left mean (mm)	5.826	5.714	.00538E-20**
Facial asymmetry	Presence of facial asymmetry frequency (%)	78.26	57.14	.00068**

* Significant

** Highly significant

When comparing the parameters of the two groups based on the severity of the spinal deformities, significant differences were seen only in the midline shifts, and in facial asymmetries. Both parameters were directly proportional to the severity of the orthopedic deformation. (Figs. 6,7)

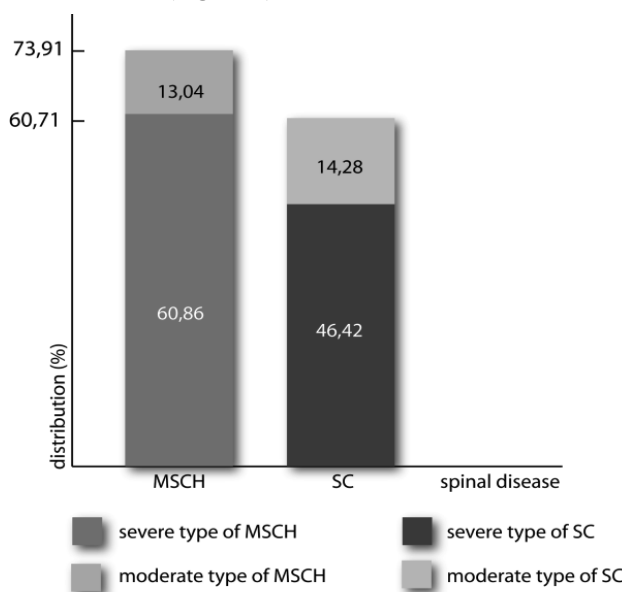


Figure 6. Presence of the midline shift depending on the severity of spinal deformities.

DISCUSSIONS

The relation between the several postural disorders and spinal illnesses causing them and the dental complex was described in numerous studies. Among the examined spinal disorders, the incidence of idiopathic scoliosis characterized by the pathologic curvature of the spine in the frontal plane is relatively high. On the other hand, Scheuermann's disease with pathological curvature in the sagittal plane is uncommon.⁶ According to the studies reviewed, the pathological postures correlated with dominant

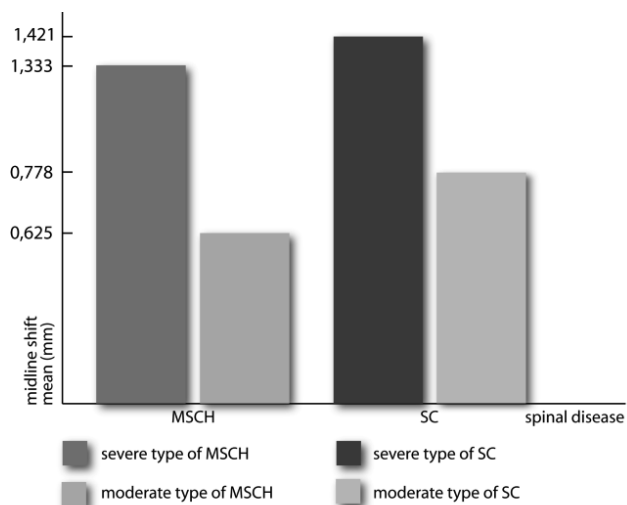


Figure 7. Means of the midline shift values characteristic depending on the severity of spinal deformities.

kyphotic curvature were frequently encountered, however, the Scheuermann's kyphosis is not only characterized by the increased curvature values, but also by degenerative vertebral changes of the affected spinal section, resulting in irreversible posture abnormality.^{17,18} The statistically high incidence values, the progression of the disease over time, and the presence of the pathological curvature justified the participation of the children with Scheuermann's disease in this epidemiological study. In the majority

of studies found in the literature, data for dentofacial anomalies were obtained by the evaluation of the X-ray records.^{1,5,6} There are only a few articles that describe the orthodontic examination as a possible opportunity for early detection of the spinal disorders, emphasize the necessity of early orthodontic check-ups for children with diagnosed spinal disorders, and highlight the application of non-invasive methods for screening in the affected population.^{3,8} That is why we chose to use in our study these methods.

In the previous studies, dentofacial asymmetry predominates in SC group, while in MSCH group the sagittal and vertical alterations caused by the forward tilted head posture and an increase in the numbers of the TMJ abnormalities were expected.^{1,4,6} After the evaluation, in most cases our values were similar to those of other studies, however some exemptions were found.

The asymmetric deviations of posterior region in sagittal dimension were more frequent in MSCH group, while the frontal crossbites characterizing mostly the patients with scoliosis were not found in the examined patient group.⁸ Examination of the incisor relation proved the previously described correlation between the alterations in the sagittal plane and the pathological kyphotic curvature. Just like the extreme overjet, the deep bite was significantly more frequent in patients affected by Scheuermann's disease.

The numbers of lateral crossbites were minimal in both groups, however the transversal deviations of the frontal region could have been evaluated. The incidence of the dentofacial asymmetry, characterizing the patients with scoliosis, was higher in MSCH group, for the deviation of the upper and lower midline as well as for the midline shift. The mean dimension of the midline shift was significantly higher in the scoliotic group.

In the literature the opinions are divided concerning the correlation between the poor head posture and alterations of the TMJ.⁵ Some favor the theory that in case of the forward tilted head position, the displaced center of gravity can be a risk factor in the development of the TMJ dysfunction. Other authors contend that laterally tilted head posture favors the mandible deviation loading the articulation asymmetrically.^{2,9} The latter hypothesis seems to be supported by the numerous pathological symptoms of the TMJ encountered in scoliotic patients, together with the several number of asymmetrical indexes found for the lateral movements.

The difficulty of this question group is shown by the concordant or the contrary results of this study compared to the ones previously reported in the

literature studying the etiological roles of the spinal deformities with unclear origins in the development of the craniofacial deformities.¹⁹

CONCLUSIONS

The results of this epidemiological study prove and partially complete the numerous previous reports on the high number of dentofacial anomalies in children with various spinal diseases. Patients with Scheuermann's disease were less often screened for orthodontic problems in the past. The higher number of anomalies found among the patients affected by this type of spinal deformity show the necessity of the close monitoring for orthodontic problems due to the correlations of the two conditions.

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