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MANDIBULAR POSITION AS A PREDICTOR OF THE UPPER AIRWAY RESISTANCE SYNDROME

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Abstract:

The studied problem is urgent as one of the most common complications of the upper airway resistance syndrome (UARS) is chronic insomnia. It constitutes a serious medical and social problem considering a group of risk (children and adolescents). This article is aimed at the determination of the effect produced by the distal position of the lower jaw (distocclusion) on the UARS. The leading method is processing of data obtained during cephalometric studies that enables to determine the anteroposterior position of the lower jaw, craniocervical compensation, and diameter of the upper airways at the tongue base level. During the study it was found out that distocclusion is a direct factor that promotes UARS. This is proved by the luminal narrowing of the upper airways (8.1-9.4 mm) in these patients. The craniocervical angle was greater than 105^0 indicating at the compensatory changes in the atlanto-occipital joint. The article can be useful for orthodontists, somnologists, ENT specialists, pediatricians, podiatrists and osteopathologists during an examination and provision of complex aid to children and adolescents.

Key words: *dentistry, orthodontics, distal occlusion, sleep disturbances, craniocervical compensation.*

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INTRODUCTION:

Nowadays, many scientists of the world pay much attention to the study of sleep physiology and its importance. It is believed that continuous sleeplessness, insomnia and other sleep disturbances diminish both the general health and stress-resistance, worsening the psycho-emotional state [1,2].

Sleep is not rest but a certain activity phase accompanied with a powerful brain activity and characterized by activation of the vegetative nervous system. The sensory data obtained during a day is processed during sleep and a subject's individual experience is renewed. Thyroid stimulating and somatotrophic hormones that aid the metabolism are synthetized while sleeping. Active work of the hippocampus promotes modification and subsequent consolidation of data. It is established that the hippocampus is responsible for the formation of long-term memories during sleep; slow-wave sleep is critical for declarative memory whereas the procedural memory is enhanced during the rapid eye movement sleep (REM sleep). This occurs when uniform groups of neurons are excited in the sequence similar to the process of education [3]

It must be taken into account that adolescents are most sensitive to sleep deprivation. Huge mental burden, endocrine changes, active growth and mental formation require complete restoration of the body. Thus, any change in the physiology that causes sleep disturbances influences the body's life activity; UARS is one of the factors.

This syndrome is characterized by such sleep related breathing disorders that are accompanied by obstructive breathing disturbances but without apnea/hypopnea and oxygen saturation of hemoglobin [4,5]. As a rule, the symptoms of the disturbances include sleep fragmentation, snoring, daytime sleeplessness, high fatigue and depression [6,7].

For the first time, the problem was described by Christian Guilleminault in 1993. In a polysomnographic study 15 men suffering from snoring and excessive daytime somnolence had frequent short reactions of ECG-activation when apnea/hypopnea index (AHI) is less than 5/hour [8,9]. Patients with UARS had recurrent episodes of upper airway (hereinafter referred to as the UAW) resistance syndrome due to the increased negative intestinal pressure on aspiration. This was caused by the decreased arrival of air to the oral and nasal cavities. The episodes were not accompanied by apnea/hypopnea, they were short with easy awakenings fixed using ECG. [10]

The UARS risk group included mainly young people of both genders with normal weight. The leading sign of UARS is daytime fatigue associated with sleep fragmentation which can result in insomnia if the disease if long-term. [11]

Many adult patients with UARS report night awakenings followed by the impossibility to fall asleep again (sleep maintenance insomnia) and difficult dropping-off to sleep (sleep-onset insomnia). Chronic insomnia in UARS is a cognitive and behavioral reflex resulted from frequent awakenings. [12]

Based on the data obtained during the studies held at the Institute of Clinical Medicine in Kuopio, the distocclusion leads to UAW narrowing. [13] As mentioned earlier, UARS was associated with the increased resistance of UAW to the air flow. The UAW diameter is determined by the lower jaw position.

Distal occlusion is one of the most common dentition abnormalities in European population. According to some authors, the rate of malocclusions is 42.7 to 71%. Meanwhile, distal occlusion occupies the first position and amounts from 27 to 32.5% [13,14].

The data above show that sleep disturbances produce a great effect on the somatic and psychosomatic condition of adolescents. This significantly decreases life quality and is a serious social and economic problem.

MATERIALS AND METHODS:

The study included 37 children (23 boys, 14 girls) aged 11 to 15 without comorbidity who underwent a dental treatment at the University Children's Clinical Hospital of Sechenov University. Lateral cephalograms taken from all the examined patients were analyzed using the Sassouni plus analysis in AudaxCeph. The anteroposterior position of the lower jaw, craniocervical compensation and the diameter of the UAW at the tongue base level were estimated [15,16,17]. The films were taken in the standing positions, head fixed in the natural position with cephalostat, ear rods, support on the forehead, occluded teeth and relaxed lips.

Cranial base plane cephalograms: NSL – skull base plane, the line between Na-s, PL- upper jaw plane, palatal line between ANS-PNS, OPT- the tangent line to the axis odontoid process, CVT- the tangent line to

the cervical section of the spine, ML- the lower jaw body base plane through Me and Go, Na-B- the line from the frontonasal suture to the deepest point of the mandibular alveolar process, anterior part, A-Na- the line from frontonasal suture to the deepest point of the maxillary alveolar process, anterior part.

In the following, the angles are calculated; parameters are estimated based on the measurements: CVT-NSL-craniocervical angle, OPT-CVT-cervical spine curvature, ANB(A-Na;Na-B)- the angle that estimates the anteroposterior position of the lower jaw as related to the upper jaw, NSL-ML-the lower jaw angulation as related to the anterior skull base, PL-ML-the jaws angulation.

In 1996 doctor Jefferson suggested that the skeletal type shall be analyzed using lateral teleroentgenograms. For this, the anterior face bow was generated; later it was estimated determining the position of Gn and ANS points as related to the obtained arch [17].

The data were analyzed using Spearman rank correlation method. They suggest that the mandibular retroposition will lead to the upper airway compression and subsequent compensatory changes in the atlanto-axial and atlanto-occipital joint for the anterior head position.

RESULTS:

The study displayed a significant interrelation between the distocclusion and decreased diameter of the upper airways; between the distocclusion and increased CVT-NSL angle. The following results were obtained:

1. 13.5% of patients had mandibular lower jaw protrusion with skeletal pattern of Class III by Jefferson;
2. 3% of children had a normal position of the mandible i.e. Class I skeletal profile.
3. 83.5% of children have mandibular retrusion with Class IIB, IIC, BR skeletal profiles by Jefferson.

Thus, all the children with the disturbances typical of Class II skeletal profiles by Jefferson had a narrowing of the upper airways from 8.1 to 9.4 mm with normal values of 10.1 mm. And on the contrary, in children with Class I and III skeletal patterns, the upper airways diameter exceeded the one that was set and amounted to 12.5-13.7 mm.

According to statistics, the angle of cervical spine curvature did not only exceed the normal value of 105°, but also were beyond the scope of the accepted values in 73% of the examined patients. 27% of the subjects had a normal angle of curvature.

DISCUSSION:

According to the obtained data, the mandibular retroposition results in the upper airways compression and compensatory changes in the atlanto-axial and atlanto-occipital joint for the anterior head position [19,20].

As consequence, UARS causes no complete breathing arrest. It is not always characterized by the decreased blood oxygen level which is probably due to respiratory difficulty as the inspiratory volume is restricted. It occurs because the upper airways are decreased in diameter.

During the conducted study we retrieved data stating that distocclusion is a predictor of upper airway resistance syndrome [21].

CONCLUSION:

During the conducted study we obtained data stating that distocclusion was a predisposing factor to the upper airway resistance syndrome. This requires further study of the problem and development of a complex of therapeutic and preventive activities.

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