International Journal of Medical Science and Health Research

Vol. 5, No. 03; 2021

ISSN: 2581-3366

Prevention of Obstructive Sleep Apnea by Functional Genioplasty Clinical Research

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doi: 10.51505/ijmshr.2021.5301 URL: http://dx.doi.org/10.51505/ijmshr.2021.5301

Abstract

Background: Obstructive sleep apnea (OSA) is a common sleep disorder under-diagnosed and widespread among adults and children. The aim of this study is to determine the impact of functional genioplasty on the upper airway and on the improvement of nasal breathing.

Material and method: A sample of 10 adults with OSA, skeletal open bite and normal body mass index were collected and divided into 2 groups; The first group received orthodontic treatment associated with a functional genioplasty, the second, the control group did not receive genioplasty. Clinical and cephalometric comparison was carried out between the two groups in order to assess the effect of genioplasty on aeropharyngeal space and consequently on respiration.

Results: Patients having undergone genioplasty have a higher SNB value, a lower PP-PM as well as an increased Min-EA, EA-PP, EA-PO values.

Conclusion: These preliminary results are in favor of the contribution of functional genioplasty, not only in the reduction of the vertical sense, but also in the increase of the aeropharyngeal space

Keywords: Obstructive sleep apnea; functional genioplasty; upper airway

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INTRODUCTION:

Obstructive sleep apnea (OSA) is a widespread and under-diagnosed condition, making it a major public health and safety issue **(1)**. This syndrome is defined as an episodic sleep state–dependent collapse of the upper airway, resulting in periodic reductions or cessations in ventilation, with consequent hypoxia, hypercapnia, or arousals from sleep **(2, 3)**. The prevalence of OSA is estimated between 2% and 4% among children **(4)** while among adults it's around 2% in women and 4% in men **(5)**. However, this prevalence may vary depending on some risk factors which can induce an increased collapsibility of the upper airways, such as obesity (body mass index [BMI] $30 kg/m2), genetic or congenital disease, and dentofacial deformations. **(6)**

Clinical and radiological examination helps screening obstructive sleep apnea by identifying symptomatology, and relevant coexisting conditions, but polysomnography still the gold standard to diagnose and assess the severity of OSAS by providing several breathing parameters, particularly Apnea-Hypopnea-index AHI used to categorize disease severity; persons with an AHI of 5 to 15, 16 to 30, or more than 30 events per hour are considered to have mild, moderate, or severe obstructive sleep apnea, respectively. **(7, 8, 9)**

Once a diagnosis is made, treatment is guided by the severity of disease, symptoms, coexisting conditions, and the presence of exacerbating factors. The role of the orthodontist in the multidisciplinary team in the management of OSA is essential by combining his knowledge of cranio-facial growth, anatomy and deformities, also by the large therapeutic arsenal available so as to improve the anatomical context and thus facilitate the integration of new correct respiratory function. One of these approaches, there is genioplasty that takes an increasingly important place in the management of OSA by promoting spontaneous lip closure without muscle contraction, and reorienting of the mandible towards anterior rotation. However the direct effectiveness of genioplasty on the correction of this syndrome still represent a huge controversy arousing authors' interest **(10, 11)**. Thus, the aim of this study is to determine the impact of functional genioplasty on respiration, and to identify the efficiency of the restoration of function in the multidisciplinary management of OSA

MATERIAL AND METHOD:

This is a preliminary comparative case-control study carried out on 10 adults with OSA in order to assess comparatively to a control group, the effect of genioplasty on aeropharyngeal space and consequently on respiration.

The sample is collected according to an exhaustive protocol respecting meticulous inclusion and exclusion criteria. (Figure1)

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INCLUSION CRITERIA

- **Adult patients**
- **Normal body mass index**
- **Patients with skeletal open bite**
- **Patients with breathing disorder**

EXCLUSION CRITERIA

- **Young growing patients**
- **Overweighted patients (BMI>30)**
- **Patients with normal nasal breathing**
- **Patients with correct vertical pattern**
- **=> (27<GoGN/SN<37 or 22<FMA<28)**

Figure 1: Inclusion and exclusion criteria

The positive diagnosis of OSA is established by clinical and polysomnographic examination. The sample is divided into 2 groups:

- The first group received orthodontic treatment associated with a functional genioplasty.
- The second, the control group did not receive genioplasty.

The comparison between the two groups was made through clinical and cephalometric examination:

- Clinical examination will demonstrate the existence of an improvement in the quality of sleep of patients, disappearance of dark circles, spontaneous mouth closing without muscle contraction, and the improvement of nasal breathing
- Cephalometric examination allows to highlight through cephalometric measurements the correction of anatomical craniofacial deformations and a possible widening of the aeropharyngeal tract after genioplasty. (Table 1)

Variable	Signification
SNB	Mandibular sagittal position according to skull base
PP-PM	Angle of intersection between palatal plan and mandibular plan
MIN-EA	The minimal aeropharyngeal space
EA-PP	Aeropharyngeal space along the palatal plan
EA-PO	Aeropharyngeal space along occlusal plan

Table 1: cephalometric measurements

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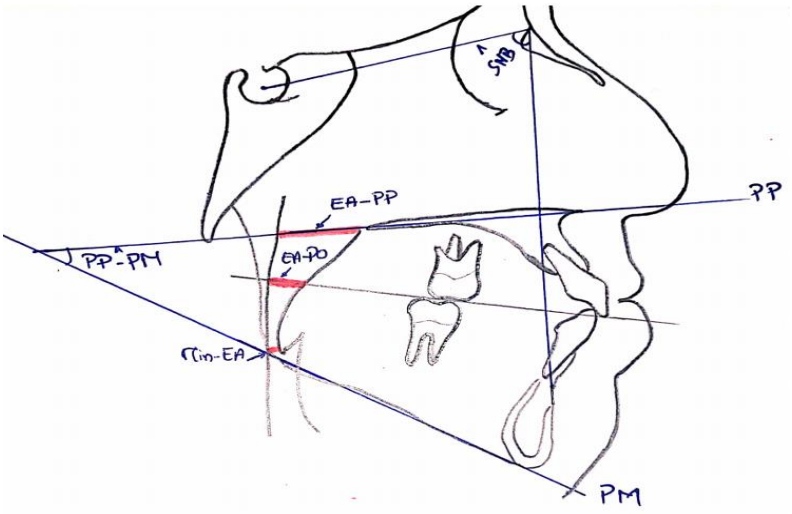

Figure 2: Lateral cephalometric with the measurements used in the study

The measurements explained above were subsequently done for all the patients included in the sample of our investigation.

RESULTS:

After doing all the cephalometric measurements for all the population, the cephalometric values found in the group treated by genioplasty were then compared to the cephalometric values of the control group.

Table 3 expose the cephalometric values found in each patient belonging to the control group

Table 4 expose the cephalometric values found in each patient belonging to the treated group

Patients having undergone genioplasty have a higher SNB value, a lower PP-PM as well as an increased Min-EA, EA-PP, EA-PO values. (Table 3 and 4)

Control group	Cas 1	Cas 2	Cas 3	Cas 4	Cas 5
SNB	72	80	73	79	75
PP-PM	38	32	32	34	38
Min-EA	7	8	3	2	8
EA-PP	14	11	6	20	20
EA-PO	7	11	8	12	10

Table 2: cephalometric measurements for control group population

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Treated group	Cas 1	Cas 2	Cas 3	Cas 4	Cas 5
SNB	76	89	90	70	79
PP-PM	29	27	25	37	22
Min-EA	9	9	4	7	11
EA-PP	21	17	18	20	27
EA-PO	12	12	10	8	15

Table 3: cephalometric measurements of treated group population

These preliminary results are in favor of the contribution of functional genioplasty, not only in the reduction of the vertical sense, but also in the increase of the aeropharyngeal space which can be explained by anterior mandibular projection freeing the airways following the modifications of the muscular insertions.

DISCUSSION:

Heredity is a characteristic factor in determining the shape and dimensions of craniofacial structures. However, other environmental elements, particularly ventilation can influence the development of the craniofacial complex **(12)**. In fact, obstructive sleep apnea is often associated on the first hand with various dentofacial deformities especially mandibular retrusion and skeletal open bite, and have on the other hand a close relationship with the morphology of the aeropharyngeal space. **(13)**

In moderate forms of OSA early ENT, physiologic and orthopedic management can offer a favorable prognosis and effective results. However, when, despite all this therapeutic approaches, obstructive sleep apnea persists with an isolated mandibular retrusion and vertical excess, genioplasty performed during growth can improve esthetic and functional results and provide stability, insofar as it induce mandibular reorienting towards anterior rotation and encourages spontaneous lip closure without excessive demands on the perio-oral muscles, particularly the mentalis **(14)**. The aim of our study is to assess the influence of genioplasty on the correction of anatomical obstacles leading to OSA. To achieve this purpose, we collected a sample including 10 adult patients with, normal weigh, facial vertical excess, breathing disorders, and who have undergone ENT treatment. The sample was divided into two groups, the first included patients treated by genioplasty, and the second group included control population who hadn’t had any treatment. The comparison between the two groups was made through clinical and cephalometric examination. The preliminary results found reported that patients having undergone genioplasty have a higher SNB value, a lower PP-PM as well as an increased Min-EA, EA-PP, EA-PO values, and this is in favor of the contribution of functional genioplasty in the increasement of the aeropharyngeal space and the improvement of the ventilation. This outcome agreed with Bedoucha and Al in 2015 **(15)** who states that early genioplasty can help

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correct nasal breathing by the recalibration of the upper airway at oropharyngeal level. Furthermore, Frappier and Al **(16)** in 2011, Chamberland and al. **(17)** in 2015 reported that Genioplasty performed during the growth promotes change in the direction of mandibular growth towards anterior rotation with a sagittal gain, which is beneficial for increasing pharyngeal dimension and improvement of ventilation. However, role of genioplasty in improving breathing is limited and derives only from few assessments. Thus, more investigations may be helpful to clearly demonstrate the beneficial effect of this surgical approach on the respiratory pattern.

CONCLUSION:

Apnea syndrome is a very common public health problem among adults and children. Several craniofacial deformations are associated with this syndrome, such as the adenoidal face and mandibular retrusion. According to this preliminary study and to the few other investigations already done, genioplasty would have beneficial effect on the upper airway and on the improvement of nasal breathing. Nevertheless, more studies are needed with this perspective so as to assess clearly the involvement of genioplasty in OSA management.

Acknowledgments: None.

Authors' contributions: All the cited authors have made a strong contribution to this work.

Funding: No funding sources

Availability of data and materials: Yes.

Competing interests: The authors declare that they have no competing interests.

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