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# UPOTREBA DELEROVE MASKE ZA LICE U LEČENJU MALOKLUZIJE III KLASSE

## USAGE OF DELAIRE FACEMASK FOR TREATMENT OF CLASS III MALOCCLUSION

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### Sažetak

**Uvod:** Različiti ortodontski aparati kao što su headgear i facijalne maske preporučuju se pacijentima u periodu rasta sa skeletnom malokluzijom III klase koju karakteriše maksilarni retrognatizam među umerenim do teškim slučajevima. Za većinu pacijenata sa malokluzijom III klase u ranoj mešovitoj denticiji ili u kasnoj mlečnoj denticiji Delerova (Delaire) facijalna maska predstavlja uobičajen izbor.

**Cilj:** S obzirom na navedene faktore i na sve veći značaj estetike u savremenom društvu, osnovni cilj ovog istraživanja bila je analiza relevantnih aspekata upotrebe facijalne maske u lečenju malokluzije III klase. Da bi glavni cilj istraživanja bio ostvaren, pregledana je odgovarajuća literatura. Delerova facijalna maska obično se koristi za protrakcije maksile.

**Zaključak:** Pojedini autori preporučuju ranu upotrebu facijalne maske budući da je efikasnija u ranom vremenu tretmana. Druge studije pak ne ukazuju na vezu između efekta protrakcije maksilarne facijalne maske i vremena tretmana. Princip maksilarne protrakcije podrazumeva primenu sile zatezanja na cirkum-maksilarne šavove i stimulaciju apozicije kostiju u oblastima šavova. Većina autora zabeležila je pozitivan efekat tretmana maskom za lice, uz značajno poboljšanje skeletnih parametara, kao i nepostojanje značajne razlike između ekspanzionog/neekspanzionog tretmana. Moglo bi se zaključiti da efekti lečenja malokluzije III klase maskom za lice u velikoj meri zavise od poznavanja bioloških, ortopedskih i kliničkih aspekata njihove upotrebe.

**Cljučne reči:** facijalna maska, Deler, malokluzija III klase, lečenje malokluzije III klase

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### Abstract

**Introduction:** Different orthodontic appliances like reverse headgear and face masks are recommended for patients in the growing period with skeletal Class III malocclusion characterized by maxillary retrognathism, among moderate to severe cases. For most patients with Class III malocclusion seen in the early mixed dentition or late deciduous dentition, a Delaire face mask is the customary choice.

**Aim:** Taking into account the aforementioned factors, as well as the growing importance of aesthetics in modern society, the main goal of this research was to analyse the relevant aspects of using face masks in the treatment of Class III malocclusion. Adequate literature research was performed to fulfil the main goal. Delaire face mask is commonly used for protraction of the maxilla.

**Conclusion:** Some authors recommend early usage of face masks because they are more efficient in early treatment time and other studies do not show the relationship between the effect of maxillary face mask protraction and treatment timing. The principle of maxillary protraction is to apply tensile force on the circummaxillary sutures and stimulate bone apposition in the suture areas. Most of the authors conclude a positive effect of face mask treatment with significant improvement of skeletal parameters, and no significant difference between expansion/nonexpansion treatments. In conclusion, we can note that the effects of the treatment of Class III malocclusion with face masks largely depend on the knowledge of biological, orthopaedic and clinical aspects of their usage.

**Key words:** face mask, Delaire, Class III malocclusion, Class III malocclusion treatment

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## Uvod

S obzirom na to da malokluzija III klase najviše utiče na dentofacijalni izgled i da su njene posledice u pogledu estetike izuzetno negativne, adolescenti sa ovakvim anomalijama percipiraju se kao „ružni” i odbačeni su od strane društva u svakodnevnom životu. Ovo ima uticaja i na njihovu psihu: razvijaju negativne emocije i imaju nizak nivo samopouzdanja, koji se uglavnom ne menja ni nakon urađene korektivno-estetske hirurške intervencije.

Kod pacijenata sa skeletnom malokluzijom III klase sa maksilarnim retrognatizmom preporučuje se upotreba različitih funkcionalnih ortodontskih aparata, kao što su *headgear* i facijalne maske. Kada je reč o terapijskim modalitetima, treba napomenuti da se kod osoba sa blagim do umerenim promenama preporučuje ortodontski kamuflažni tretman, kao i da se u težim slučajevima obično preporučuje ortognatska hirurgija. Hirurgija ove vrste poremećaja, posebno kod osoba sa teškom malokluzijom, jedini je pristup u lečenju posledica abnormalnosti skeleta koje nastaju zbog maksilarnog retrognatizma. Međutim, ovakav tretman povezuje se sa brojnim dodatnim rizicima, dok izvođenje ovih intervencija iziskuje znatno veće troškove.

U poslednje tri decenije, facijalne maske postale su omiljene među ortodontima u lečenju slučajeva u kojima je potrebno stimulisati rast maksile. Delerova (Delaire) maska za lice je tako najčešći izbor u slučajevima malokluzije II klase u ranoj mešovitoj ili kasnoj mlečnoj denticiji<sup>1</sup>. Iako je moguće da tretman Delerovom maskom za lice izazove promene u maksilarnom skeletu kod mladih ljudi i adolescenata, neophodno je da ovaj tretman bude dopunjen ortodontskom kamuflažom ili ortognatskom hirurgijom.

Što se rezultata upotrebe facijalne maske u terapiji tiče, valja istaći da određene kliničke studije ukazuju na brojne učinke koji mogu biti postignuti u pogledu trajnog smanjenja količine rasta mandibule. Naprotiv, ustanovljeno je da će rast šavova biti podstaknut u toku njihove upotrebe. Iz ovih razloga, a prvenstveno kao rezultat relativnog mandibularne prognatizma, prevashodno zbog nedostatka vilice umesto protrakcije vilice, misli se da je Delerova maska za lice takođe tretman alternativa za sofisticirana malokluzija III klasa. Naime, iz navedenih razloga, a pre svega zbog relativnog mandibularnog prognatizma, prevashodno zbog maksilarnog deficita, a ne maksilarne protrakcije mandibule, većina autora smatra da ovakva maska za lice može biti tretman izbora za malokluziju III klase.

## Introduction

Class III malocclusion most importantly affects the dentofacial look and because of this extraordinarily negative aesthetic result, adolescents with such anomalies are perceived as "ugly" and socially rejected in their everyday life. Because of this, they psychologically develop negative emotions and possess low vanity, which generally remains even when the corrective-aesthetic surgical intervention is performed.

In patients with skeletal malocclusion class III with maxillary retrognathism, the use of various functional orthodontic appliances such as reverse headgear and face masks is recommended. Concerning the therapeutic modalities, it should be noted that in persons with mild to moderate changes, it is recommended to carry out orthodontic camouflage treatment, whereas in severe cases, orthognathic surgery is usually recommended. Surgery of this kind of disorder, particularly in persons with a severe malocclusion, is the sole approach of treatment for the sequelae of skeletal abnormalities that occur because of maxillary retrognathism. However, this kind of treatment is related to considerable additional risks and performing these interventions is related to considerably higher costs.

In the last 3 decades, facial masks became well-liked among orthodontists for treatment in cases where it is necessary to stimulate the growth of the maxilla. Delaire facial mask is so the most common choice in cases of Class II malocclusion within the early mixed or late deciduous dentition<sup>1</sup>. Treatment with Delaire facial mask is also possible to cause changes in the maxillary skeleton in young people and teenagers, however, these people need to supplement this treatment with orthodontic camouflage or orthognathic surgery.

Regarding the therapeutic effects of facial masks, some clinical studies suggest that they can lead to a permanent reduction in mandibular growth. However, they may also stimulate sutural growth. For these reasons and primarily as a result of relative mandibular prognathism, predominantly caused by jaw deficiency rather than jaw protraction, many authors believe that Delaire facial mask may be the treatment of choice for class III malocclusion.

Taking into consideration these facts, furthermore, because of the growing importance of aesthetics in our society, the main goal of this study was set—to make an analysis of the relevant aspects of using face masks in the treatment of Class III malocclusion.

S obzirom na sve navedene činjenice i na činjenicu da je značaj estetike u našem društvu sve veći, osnovni cilj ove studije bio je da se izvrši analiza relevantnih aspekata upotrebe facijalne maske u lečenju malokluzije III klase.

Da bi glavni cilj bio ostvaren, analizirana je odgovarajuća literatura. Izvori podataka korišćeni u ovoj studiji dobijeni su iz baze *PubMed*, koja se upotrebljava češće od svih drugih naučnih baza podataka. Svi korišćeni podaci iz literature prethodno su bili objavljeni u recenziranim publikacijama i časopisima. Većina članaka korišćenih za ovaj pregled literature objavljena je na engleskom jeziku i nastala je u poslednje dve decenije, tj. u periodu od 2004. do 2022. godine.

Smatramo da se ovim pregledom literature može pružiti važna teorijska podrška mogućnostima i kliničkim primenama upotrebe ovakvog aparata za maksilnu protrakciju i efektima koji rezultiraju povoljnom promenom skeletnog odnosa u korekciji malokluzije III klase.

### *Efekti Delerove maske za lice*

Prema mišljenju većine ortodonata, adekvatno lečenje skeletne malokluzije III klase je najteže, prvenstveno zbog nepredvidivog potencijala rasta maksile u kombinaciji sa nepovoljnim rastom mandibule, ali i zbog konkavnog srednjeg profila. U vezi sa načinom na koji se ova malokluzija javlja primećeno je da su u oko 75% slučajeva skeletne malokluzije III klase uzrokovane maksilarnim retrognatizmom ili kombinacijom maksilarnog retrognatizma i mandibularnog prognatizma. Na osnovu činjenice da malokluziju III klase uglavnom karakteriše hipoplazija maksilarnog tkiva, neminovno se nametnula potreba za korišćenjem uređaja koji bi stimulisali rast maksilarnog tkiva. Danas postoje brojne tehnike za efikasnu protruziju maksile, zajedno sa upotrebom facijalne maske ili direktnom silom koja se primenjuje na ankilozirane primarne očnjake.

Malokluzija III klase je bolest koja ima multifaktorsku etiologiju, uključujući brojne genetske i ekološke uzroke<sup>2</sup>. Budući da ova anomalija ima različite uticaje na skeletna i zubna tkiva, neophodno je poznavanje njenih etioloških faktora. Konačna dijagnoza skeletne malokluzije III klase postavlja se na osnovu nekoliko kriterijuma opisanih u savremenoj literaturi. Tu spadaju: 1. pozitivna porodična anamneza; 2. odgovarajući cefalometrijski parametri, kao što su opadajući SNA ugao, negativan ANB ugao, mandibularna protruzija, tup gonijalni ugao i velika niža prednja visina

Adequate literature analysis was performed to fulfil the goal. Sources of data used in this study were obtained from the foremost used of all scientific databases—*PubMed*. Most of the articles used for this literature review have been previously published in English, in peer-reviewed publications and journals and cover the period from the last two decades, 2004 to 2022.

We believe that this review of the literature can offer vital theoretical support for the possibilities and clinical applications of the usage of this kind of maxillary protraction appliance and effects that result in a favourable change in the skeletal relationship for the correction of class III malocclusion.

### *Effects of Delaire face mask*

According to most orthodontists, adequate treatment of skeletal Class III malocclusion is the most difficult primarily because of the unpredictable growth potential of the maxilla combined with unfavourable mandibular growth, as well as because of the concave midfacial profile. Regarding the way this malocclusion occurs, it can be noted that in about seventy-five percent of skeletal class III malocclusions, they are caused by maxillary retrognathism or a combination of maxillary retrognathism and mandibular prognathism. Based on the fact that Class III malocclusion is predominantly characterized by maxillary hypoplasia, the need to start using devices that would stimulate maxillary growth was inevitably imposed. To date, many techniques are delineated for the effective extension of the maxilla, together with the usage of a face mask or chin cup or through direct force applied to ankylosed primary canines.

Class III malocclusion is a disease that has a multifactorial aetiology including numerous genetic and environmental causes<sup>2</sup>. Because of the many effects caused by this anomaly on the skeletal and dental tissues, it is necessary to know the etiological factors of this disorder. The definitive diagnosis of skeletal class III is made based on several criteria described in the contemporary literature such as 1. positive family history; 2. appropriate cephalometric parameters such as decreasing SNA angle, negative ANB angle, mandibular protrusion, obtuse gonial angle, and large LAFH (lower anterior facial height); 3. determining the correlation between normal centric position with the habitual position<sup>3</sup>; and 4. determining the incisal relationship<sup>3</sup>.

Because the facial look and profile of class III malocclusion are the main complaints of patients, early treatment of this disorder is of enormous importance.

lica (engl. *lower anterior facial height* – LAFH); 3. utvrđivanje korelacije između normalnog centričnog položaja i uobičajenog položaja; 4. utvrđivanje incizalnog odnosa<sup>3</sup>.

Pošto se pacijenti sa malokluzijom III klase često žale na izgled i profil lica, rano lečenje ovog poremećaja ima ogroman značaj. Osnovni cilj ranog lečenja jeste da se omogući pravovremena korekcija profila lica, koja sukcesivno utiče na razvoj psihosocijalnog blagostanja i izgleda pacijenta, posebno u adolescentskim godinama. Kao što je prethodno pomenuto, pacijenti sa skeletnom III klase koji su propustili priliku za blagovremenu ranu modifikaciju rasta u tinejdžerskom periodu imaju brojne socijalne i funkcionalne anomalije<sup>4-6</sup>. Stoga, rano lečenje je veoma važno i takvim pacijentima može ponuditi znatno veći kvalitet života u godinama kada su najranjiviji, posebno u vezi sa izgledom<sup>7</sup>.

Delerova maska za lice najčešće je korišćeni uređaj za maksilarnu protrakciju. Čaše za bradu i čelo služe za ekstraoralno sidrenje ovog uređaja. Jedan od značajnijih negativnih efekata ovog uređaja ogleda se u tome da može onemogućiti nošenje naočara ili ometati spavanje tokom terapije. Peti (Petit) je modifikovao Delerovo lice 1983. godine povezujući čelo i bradu teškom čeličnom šipkom<sup>8</sup>.

U literaturi postoje kontroverze u vezi sa tim koji je trenutak idealan za primenu i korišćenje ovog uređaja u terapiji. Jedna grupa autora ističe da rano lečenje najprikladnije utiče na adekvatan rast prednjeg dela maksilarnog dela. Stoga, ovi autori ukazuju na to da je rana upotreba maski za lice i ekspanzione terapije značajno efikasnija ako se primenjuju ranije u detinjstvu<sup>9,10</sup>. S druge strane, postoji grupa autora koja tvrdi suprotno – da ne postoji korelacija između protrakcije maksilarne maske za lice i vremena tretmana<sup>11-14</sup>.

Na osnovu brojnih višegodišnjih naučnih istraživanja, u savremenoj ortodontici smatra se da je najprikladnija terapija za skeletnu III klasu ona koja se izvodi u dve etape. U prvoj fazi, aparat se koristi za proširenje maksilarnog dela, sve dok se ne postigne željena poprečna širina. Prema većini studija, prvi korak ne podrazumeva samo povećanje poprečne dimenzije nepca već i otvaranje šavova srednjeg kompleksa lica i pojačavanje protrakcionog efekta maske za lice u sledećoj fazi<sup>12,15-17</sup>. U sledećoj fazi, maska za lice koristi se kako bi se maksilarni kompleks unapredio.

The main goal of early treatment is to permit timely correction of the facial profile, which successively affects the development of the patient's psychosocial well-being and look, particularly throughout their adolescent years. As antecedently mentioned, patients with skeletal Class III who missed the opportunity for timely early growth modification in the teenage period have numerous social and functional anomalies<sup>4-6</sup>. Therefore, early treatment is of the greatest importance and it may offer such patients a considerably higher quality of life throughout the years when they are most vulnerable especially regarding their appearance<sup>7</sup>.

Delaire face mask is the most commonly used device for maxillary protraction. The chin and forehead cups are used for extraoral anchoring of this device. One of the more significant negative effects that this device provides is that it can be impossible to wear glasses or disturb sleep during the therapy. Petit modified Delaire face mask in 1983 by connecting the forehead and a chin pad with a heavy steel rod<sup>8</sup>.

There are controversial aspects in the literature regarding what is the ideal timing for applying and using this device in therapy. One group of authors points out that early treatment has the most appropriate effect on the adequate growth of the maxillary anterior part. Therefore, these authors indicate that the early use of face masks and expansion therapy is significantly more effective if applied earlier in childhood<sup>9,10</sup>. In contrast, there is a group of authors who claim the exact opposite, that there is no correlation between the maxillary face mask protraction and the treatment time<sup>11-14</sup>.

In contemporary orthodontics, based on numerous long-term scientific types of research, it is considered that the most appropriate therapy for skeletal Class III is if it is performed in two stages. In the first stage, the appliance is used for maxillary expansion until the desired transverse width is achieved. According to the majority of studies, the first step is not only to increase the transverse dimension of the palate but also to open the sutures of the midface complex and to amplify the protraction effect of the face mask in the next stage<sup>12,15-17</sup>. In the next phase, the face mask is used to get the maxillary complex advanced. It must be noted, however, that this type of treatment remains limited to deciduous or early mixed dentition. It has been noted that postero-anterior displacement causes more dental effects after this period than on different skeletal elements<sup>18,19</sup>.

Međutim, mora se pomenuti da je ova vrsta lečenja ograničena na mlečnu ili ranu mešovitu denticiju. Primećeno je da posle ovog perioda postero-anteriorno pomeranje izaziva više dentalnih efekata<sup>18,19</sup> nego na različitim elementima skeleta.

Većina autora smatra da je standardna terapija za malokluziju III klase koja je blaga do umerena kod pacijenata u periodu rasta maksimalna protrakcija radi korekcije deficita maksile. Iako su aspekti maksimalne komponente skeletnih modela III klase dobro poznati, mora se istaći da je razumevanje terapijskog uticaja na donju vilicu u toku rasta prilično ograničeno i da ima brojne nuspojave na temporomandibularnom zglobo.

Veoma je teško izvesti poređenje različitih cefalometrijskih varijabli, pre svega zbog velike promenljivosti parametara koji se koriste u različitim studijama. Ipak, kao i većina studija, ovaj pregled literature fokusira se na najčešća merenja i parametre: SNA ugao, SNB ugao, ANB ugao, Vitsova (Wits) analiza, mandibularna ravan, palatinalna ravan, ugao gornjeg sekutića i ugao donjeg sekutića. U studiji Foerscha i sar.<sup>20</sup> primećene su ukupne promene ugla SNA od  $2,47^\circ$ , promene ugla SNB od  $-1,42^\circ$ , promene ugla ANB od  $3,72^\circ$ , promene ugla mandibularne ravni od  $1,85^\circ$ , promene ugla palatinalne ravni od  $-0,91^\circ$  i promene ugla gornjeg sekutića od  $5,17^\circ$ . Prema njihovim rezultatima, u pogledu skeletnih parametara, pozitivni efekti tretmana predstavljeni antero-posteriornom repozicijom mandibule i sagitalnim maksimalnim pomeranjem napred mogu se uočiti kod pacijenata koji koriste masku za lice. Rezultati ovih autora takođe su pokazali da postoji blaga rotacija mandibule u smeru kazaljke na satu, kao i rotacija maksimalnog planuma u smeru kazaljke na satu. U istom preglednom radu navodi se da su efekti tretmana maske za lice sa aktivacijom aparata za brzo proširenje maksimalnog tela, procenjeni na osnovu sedam studija, prikazali ukupne promene ugla SNA od  $1,71^\circ$ , promene ugla SNB od  $-1,17^\circ$ , promene ugla ANB od  $2,28^\circ$ , promene ugla mandibularne ravni od  $1,61^\circ$ , promene ugla palatinalne ravni od  $-0,71^\circ$  i promene ugla gornjeg sekutića za  $2,51^\circ$ . Takođe, u okviru ove studije utvrđene su manje promene u ugaonosti sekutića od  $-1,99^\circ$  i promene u Vits analizi od  $0,52$  mm kada je ekspanzija bila izvršena u periodu pre tretmana maskom za lice.

Prema Westwood i sar.<sup>21</sup>, adekvatna procena promena koje nastaju posle tretmana facijalnom maskom treba da uključi dugoročnu procenu lečenih pacijenata, naročito nakon napredovanja rasta u pubertetu, kako bi se dugoročni efekti mogli pretpostaviti i utvrditi.

Most authors consider that the standard therapy for mild to moderate Class III malocclusion in growing patients is maxillary protraction to correct the deficient maxilla. Although aspects of the maxillary component of Class III skeletal models are well known, it must be noted that the understanding of the therapeutic impact on the mandible during growth is quite limited with numerous undesirable side effects occurring at the temporomandibular joint.

Regarding the possibility of comparing different cephalometric variables, it must be noted that it is very difficult, primarily due to the high variability of the parameters used in the different studies. However, as most studies, this literature review focused on the most common measurements and parameters: SNA angle, SNB angle, ANB angle, Wits' analysis, mandibular plane, palatal plane, upper incisor angulation and lower incisor angulation. In a study by Foersch et al.<sup>20</sup>, it was observed that there were changes in the following angles: total SNA angle changed by  $2.47^\circ$ , SNB angle changed by  $-1.42^\circ$ , ANB angle changed by  $3.72^\circ$ , mandibular plane angle changed by  $1.85^\circ$ , palatal plane angle changed by  $-0.91^\circ$  and upper incisor angulation changed by  $5.17^\circ$ . According to their results, in the context of skeletal parameters, positive effects of treatment represented by anteroposterior reposition of the mandible and sagittal maxillary forward movement can be observed in patients using a face mask appliance. The results of these authors also showed that there was a slight clockwise rotation of the mandible and a counterclockwise rotation of the maxillary planum. In the same review paper, it was noted that when a face mask treatment was combined with the activation of a rapid maxillary expansion appliance, based on seven studies, the following total changes were observed: SNA angle changed by  $1.71^\circ$ , SNB angle changed by  $-1.17^\circ$ , ANB angle changed by  $2.28^\circ$ , mandibular plane angle changed by  $1.61^\circ$ , palatal plane angle changed by  $-0.71^\circ$ , upper incisor angulation changed by  $2.51^\circ$ . Additionally, within this study, smaller changes in incisor angulation of  $-1.99^\circ$  and changes in Wits analysis of  $0.52$  mm were found when the expansion was performed during the period before the face mask treatment.

According to Westwood et al.,<sup>21</sup> an adequate evaluation of the changes that occur after treatment with a face mask should include a long-term evaluation of the treated patients, especially after the pubertal growth spurt, so that long-term effects can be

Pomenuti autori istakli su i da su uočene značajne povoljne promene i na maksilarnoj i na mandibularnoj skeletnoj komponenti. Međutim, prilikom poređenja sa nelečenom kontrolnom grupom sa malokluzijom III klase može se primetiti da se u periodu posle tretmana karakteristike rasta III klase uglavnom vraćaju nakon terapije maskom za lice. Upravo zbog toga, nakon procene celokupnog tretmana i promena nakon tretmana, može se jasno zaključiti da se korisne promene u skeletnom odnosu mogu postići samo u toku aktivne terapije maskom za lice i da se kasnije zubne komponente mogu održati u pomenutom odnosu pomoću fiksnih aparata.

Osnovni princip delovanja ovog uređaja zasniiva se na izvođenju maksilarne protrakcije; pritom se primenjuje sila koja dovodi do istežanja cirkum-maksilarnih šavova i na taj način stimuliše stvaranje i rast kosti u predelima šavova. Potom, efekat facijalne maske predstavlja stvaranje sile koja je stalno usmerena na prednju stranu maksile, uzrokujući njeno produženje. Zapaženo je da primenom ove vrste konstantnih protrakcionih sila dolazi do značajnog prednjeg pomeranja maksilarnih šavova, koje je praćeno i osnovnim histološkim promenama u cirkum-maksilarnim šavovima. Ovo maksilarno kretanje može biti olakšano brzim poprečnim proširenjem maksilarnog tkiva. Može se zapaziti da delovanjem ovog uređaja dolazi do izraženog poremećaja suturalne artikulacije maksile do preostalih devet kostiju kraniofacijalnog kompleksa, što omogućava reakciju na sile protrakcije<sup>22</sup>.

Promena skeleta koja se kod osoba sa malokluzijom III klase javlja u toku ortodontskog lečenja maskama za lice prvenstveno dovodi do promene veličine disajnih puteva. Lee i sar.<sup>23</sup> istakli su da skeletne promene koje se javljaju tokom tretmana malokluzije III klase maskom za lice značajno utiču na veličinu disajnih puteva. Podaci koji svedoče o promenama u orofaringealnim i nazofaringealnim dimenzijama nakon terapije maskom za lice takođe se mogu pronaći u literaturi<sup>24,25</sup>. S druge strane, određeni autori, Hiyama i sar.<sup>26</sup> na primer, nisu primetili promene u dimenzijama disajnih puteva. Saijinsu i sar.<sup>27</sup> su u jednoj od svojih studija uočili značajne promene vezane samo za veličinu nazofarinksa. Međutim, kako skoro svi autori ističu, maksilarna protrakcija sa brзом ekspanzijom maksile<sup>26</sup> ili bez nje<sup>24</sup> dovodi do statistički značajnog povećanja dimenzija disajnih puteva. Većina autora saglasna je sa tim da postoji značajan pozitivan efekat tretmana facijalnom maskom, i to sa

assumed and determined. According to the same authors, significant favourable changes were observed in both maxillary and mandibular skeletal components. However, compared to the untreated control group with Class III malocclusion, it can be noted that in the post-treatment period, Class III growth characteristics generally return following face mask therapy. Precisely because of this, after the evaluation of the overall treatment and the changes after the treatment, it can be concluded that the amount of beneficial changes in the skeletal relationship can be obtained only during the active therapy with a face mask and in the later phase using the fixed appliances can maintain the dental components in the given ratio.

The basic principle of activity of this device is based on the performance of maxillary protraction, during which a force is applied that leads to the stretching of the circummaxillary sutures and thus stimulates the creation and growth of bone in the areas of the sutures. From here, the effect of the face mask is to create a force that is constantly directed at the frontal side of the maxilla, causing it to protract. With the application of this type of constant protraction force, a significant anterior displacement of the maxillary sutures has been observed, which is also accompanied by basic histological changes in the circummaxillary sutures. This maxillary movement can be facilitated by rapid maxillary transverse expansion. Through the action of this device, it can be observed that there is a pronounced disruption of the sutural articulation of the maxilla to the remaining nine bones of the craniofacial complex, enabling a reaction to the forces of protraction<sup>22</sup>.

The skeletal change that occurs in individuals with Class III malocclusion during orthodontic treatment with facial masks primarily leads to a change in the size of the airway. According to Lee et al.<sup>23</sup>, the skeletal changes that occur during face mask treatment of class III malocclusion significantly affect airway size. Data on changes in both oropharyngeal and nasopharyngeal dimensions after face mask therapy can also be noted in the literature<sup>24,25</sup>. In contrast, certain authors such as Hiyama et al.<sup>26</sup> observed no changes in airway dimensions. Saijinsu et al.<sup>27</sup> in one of their studies observed significant changes only in the size of the nasopharynx. However, maxillary protraction with<sup>26</sup> or without<sup>24</sup> rapid maxillary expansion leads to statistically significant increases in airway dimensions according to almost all authors.

znatnim poboljšanjem skeletnih parametara; pritom, nije primećena značajna razlika između slučajeva sa urađenim ekspanzionim tretmanom i onima bez njih, osim pojave smanjenih dentalnih neželjenih efekata ugaonost gornjeg sekutića kada se vrši dalja ekspanzija. Međutim, prema studiji Tofola i sar.<sup>2</sup>, upotreba ekspanzivne terapije poboljšava efekat ekspanzije u odnosu na vreme lečenja. Isti autori su na osnovu analize devetnaest članaka u kojima je bio obuhvaćen period od pet godina naveli da stopa uspešnosti lečenja ortopedskim maskama za lice iznosi 76%.

Potreba za transverzalnom ekspanzijom kod pacijenata klase III pretežno je povezana sa prisustvom dentoalveolarnih abnormalnosti u poprečnoj dimenziji, kao što je prisustvo ukrasnih ugriza ili malokluzije koji se karakterizuju sa okluzalnim odnos ivice na ivice. Međutim, primećeno je da nije bilo značajnog poboljšanja maksilarne protrakcije kada je izvršena dodatna ekspanzija. Spontano poboljšanje bočnih ukrštenih ugriza kod pacijenata primećeno je nakon učinjene maksilarne protrakcije, prvenstveno zato što se ovako formiran maksilarni luk vrlo dobro uklapa sa manjim mandibularnim pandanom<sup>20</sup>.

U većini studija nije se ispitivala efikasnost tretmana maskama za lice kod veoma mladih pacijenata sa mlečnim zubima. Lee i sar.<sup>28</sup> istakli su da je u periodu nakon korekcije malokluzije III klase terapijom koja je podrazumevala masku za lice primećena tendencija recidiva u periodu posmatranja. Maksilarna protrakcija izazvana maskama za lice bez brze maksilarne ekspanzije može biti manje stabilna kod veoma mladih pacijenata. Isti ovi autori istakli su da nije zabeležena značajna razlika u promenama skeleta prilikom poređenja dveju grupa pacijenata (pacijenti lečeni maskom za lice sa brzom maksilarnom ekspanzijom i bez nje) u celokupnom periodu.

Ipak, na kraju se mora napomenuti da sve pregledane studije pokazuju samo određene homogenosti u pogledu kvaliteta, prvenstveno zbog različitih statističkih metoda i korišćenih cefalometrijskih varijabli, ali i zbog različitih starosnih grupa koje su bile uključene u ispitivanje. Sve to je u priličnoj meri otežalo analizu i poređenje rezultata dobijenih u studijama. S druge strane, na uporedivost mogu uticati i nivo sile i trajanje lečenja i neki dodatni nekontrolisani faktori, kao što su individualne razlike u rastu.

Most of the authors agree that there is a significant positive effect of treatment with a face mask with a significant improvement in skeletal parameters, with no significant difference observed between whether or not expansion treatment was performed, except for the appearance of reduced dental side effects of the angulation of the upper incisor when further expansion is performed. However, according to a study by Tofol et al.<sup>2</sup> the use of expansive therapy improves the protracting effect with respect to treatment time. The same authors describe a 76% success rate for treatment with orthopaedic face masks, based on an analysis of 19 articles over a 5-year follow-up period.

The need for transverse expansion in Class III patients is predominantly correlated with the presence of dentoalveolar abnormalities in the transverse dimension such as the presence of crossbites or edge-to-edge occlusion. However, it was noted that there was no significant improvement in maxillary protraction when additional expansion was performed. After performing maxillary protraction, spontaneous improvement of lateral crossbites was observed in patients. This occurs because the maxillary arch formed in this way fits well with its smaller mandibular counterpart<sup>20</sup>.

Most studies have not investigated the efficacy of face mask treatment in very young primary dentition patients. According to Lee et al.<sup>28</sup> in the period after the correction of Class III malocclusion with a face mask therapy, a tendency to relapse was observed during the observation period. Maxillary protraction induced by face masks without rapid maxillary expansion may be less stable in very young patients. These same authors noted that no significant difference in skeletal changes was observed between the two groups (patients treated with a face mask with and without rapid maxillary expansion) over the overall time period.

But in the end, it must be noted that all the retrieved studies show only certain homogeneities in terms of study quality, primarily due to different statistical methods and cephalometric variables used, as well as the different age groups involved, which makes it rather difficult to analyse properly and compare their findings. On the other hand, the level of force and the duration of treatment and some additional uncontrolled factors, such as individual differences in growth, may affect comparability.



## Zaključak

Na kraju, možemo primetiti da efekti lečenja malokluzije III klase facijalnom maskom u velikoj meri zavise od poznavanja bioloških, ortopedskih i kliničkih aspekata njihove upotrebe.

## Conclusion

In conclusion we can note that the effects of the treatment of Class III malocclusion with face masks largely depend on the knowledge of biological, orthopaedic and clinical aspects of their usage.

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