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PROCENA TRAJANJA FAZE UHODAVANJA TELESKOP PROTEZA

ASSESSMENT OF TELESCOPIC DENTURE'S SETTLING IN PHASE DURATION

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Sažetak

Uvod. Dvostruke teleskop krune predstavljaju vezne elemente parcijalne proteze i smatraju se zubnim nadoknadama visokih estetskih i bioloških vrednosti. Njihov osnovni nedostatak predstavlja procena veličine retencione sile, koja mora biti dovoljno velika da uravnotežava suprotne sile a da sa druge strane, prilikom skidanja, ne dovodi do oštećenja parodontalnog tkiva zuba nosača. Retenciona sila je najveća odmah po izradi proteze i ona progresivno opada sve dok se ne završi tzv. „faza uhodavanja“, odnosno dok vrednost retencione sile ne postane ustaljena vrednost.

Cilj istraživanja bio je merenje ukupne retencione sile gotovih teleskop proteza i ispitivanje vremenskog trajanja „faze uhodavanja“.

Materijal i metod. Merenja su vršena na 20 teleskop proteza, koje su u svom sastavu imale 2, 3 ili 4 teleskop krune izrađene od legure zlata tip IV. Merenja su vršena pomoću dinamometra.

Rezultati. Kod samo 37% teleskop proteza registrovana je optimalna retenciona sila. Kod 16% registrovana je nedovoljna retenciona sila, dok je kod ostalih 47% registrovana prekomerna retenciona sila. Kod najvećeg broja proteza (35%), faza uhodavanja nastupila je nakon 33 ciklusa, što znači da je potrebno u proseku 10,6 dana za „fazu uhodavanja“.

Zaključak. „Faza uhodavanja“ tokom koje dolazi do ustaljenja retencione sile u proseku se završava u okviru prvih deset dana nakon predaje završene teleskop proteze.

Cljučne reči: teleskop krune, retenciona sila, faza uhodavanja

Uvod

Dvostruke teleskop krune predstavljaju sistem veznih elemenata parcijalnih proteza koji pacijentu obezbeđuje osećaj stabilnosti i sub-

Abstract

Introduction. Double telescopic crowns are connecting elements of partial dentures and are considered to be prosthetic devices of high aesthetic and biological value. Their basic drawback is the assessment of retention force value which has to be strong enough to balance the opposite forces but, nevertheless, must not result in harming the periodontal tissue of retention teeth while taking the denture off. The retention force is the highest immediately after the denture's construction and is progressively declining until the end of the "settling in phase", i.e. until the retention force value becomes well-established.

Aim of the study was the measurement of the overall retention force of completed telescopic dentures and a survey of „settling in phase“ duration.

Methods. The measuring was conducted on 20 telescopic dentures consisting of 2, 3 or 4 telescopic crowns made of gold alloy type IV and executed by dynamometer.

Results. An optimal retention force was detected in only 37% of telescopic dentures. An insufficient retention force was observed in 16%, while in the remaining 47% an excessive force was detected. In the largest number of dentures (35%) the settling in phase began after 33 cycles, which shows that this phase takes on average 10,6 days.

Conclusion. The „settling in phase“, during which retention force becomes stabilized, is completed in the first ten days after the delivery of the completed telescopic denture.

Key words: telescopic crowns, retention force, settling in phase

Introduction

Double telescopic crowns represent a system of connecting elements of partial denture insuring the sense of stability in patients with a

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jektivni utisak da fiksni i mobilni deo čine jednu celinu. Pored toga, ova vrsta kompleksnih proteza obezbeđuje i dobru retenciju, vođenje proteze ka nosećim tkivima i aksijalni prenos pritiska žvakanja¹⁻³, zbog čega se smatraju zubnim nadoknadama visokih estetskih i bioloških vrednosti⁴⁻⁶.

Međutim, izrada ovih proteza nailazi na značajne probleme, koji su uglavnom vezani za laboratorijsku izradu. Jedan od najznačajnijih problema jeste procena veličine retencione sile, koja mora biti dovoljno velika da uravnotežava suprotne sile (akcija mišića jezika, mimičnih mišića, lepljivosti hrane i zemljine teže), a da sa druge strane, prilikom skidanja, ne dovodi do oštećenja parodontalnog tkiva zuba nosača⁷.

Optimalna vrednost retencione sile varira u zavisnosti od broja teleskop kruna i njihovog rasporeda. Optimalna vrednost retencione sile po jednoj teleskop kruni iznosi 5-9N^{6,8}. Kada proteza sadrži dve teleskop krune, optimalna vrednost pojedinačne retencione sile teleskop kruna trebalo bi da iznosi oko 5N, u zbiru - 10N. Kod proteza sa tri teleskop krune, vrednost pojedinačne retencione sile teleskop krune trebalo bi da iznosi 3-4N, a ukupa retenciona sila 9-12N⁹.

Retenciona sila je najveća odmah po izradi proteze i ona progresivno opada sve dok se ne završi tzv. „inicijalna faza uhodavanja“, odnosno dok vrednost retencione sile ne postane ustaljena vrednost.

Cilj ovog rada bio je merenje ukupne retencione sile gotovih teleskop proteza i procena vremenskog trajanja „faze uhodavanja“.

Materijal i metod

Ispitivanje ukupne retencione sile

Za potrebe eksperimenta korišćeno je 20 kompleksnih parcijalnih proteza retiniranih teleskop krunama, izrađenih na Klinici za stomatološku protetiku Stomatološkog fakulteta Univerziteta u Beogradu, u periodu od januara do decembra 2009. godine. Teleskop proteze su u svom sastavu imale 2, 3 ili 4 sklopa izrađena od legure zlata tip IV (*Dentor S*, Germany).

Merenja su vršena pomoću dinamometra, firme *Bredent (Frikationsmesgerat fmg 20; Bredent, Senden, Germany)*. Ovaj dinamometar vrši merenja sila u opsegu 0-20N sa tačnošću od 0.4N. Preduslov: spajanje spoljašnje krune sa metalnim skeletom.

subjective impression that the fixed and mobile parts are a whole. Aside from this, this type of complex enables good retention, denture's conduction towards supporting tissues and axial transmission of mastication pressure¹⁻³ making them considered to be prosthetic device of high aesthetic and biological value⁴⁻⁶.

However, production of these dentures involves considerable problems mainly connected to the laboratory part of their manufacture. One of the most compelling problems is the assessment of the retention force value which has to be strong enough to balance the opposite forces (the action of tongue muscles, mimic muscles, food adhesiveness and gravitation), but nevertheless must not result in harming the periodontal tissue while taking the denture off⁷.

The optimal retention force value varies depending on the number of telescopic crowns and their disposition. An optimal retention force value per one telescopic crown amounts to 5-9N^{6,8}. When the denture is made of two telescopic crowns the optimal value of retention force should be approximately 5N, in total around 10N. In denture with three telescopic crowns, the value of a retention force of each individual telescopic crown should be 3-4N with the total retention force of 9-12N⁹.

The retention force is the highest immediately after the denture's construction and is progressively declining until the end of the "settling in phase", i.e., until the retention force value becomes well-established.

The aim of the study was the measurement of the overall retention force of completed telescopic dentures and a survey of „settling in“ phase duration.

Material and method

The survey of the overall retention force

For the purposes of the experiment, 20 complex partial dentures retained with telescopic crowns made in the Clinic for Prosthetic Dentistry, Faculty of Dentistry, Belgrade University, were used in the period between January and December 2009. Telescopic dentures consisted of 2, 3 or 4 complexes made of gold alloy type IV (*Dentor S*, Germany).

The measurements were conducted with *Bredent* dynamometer (*Frikationsmesgerat fmg 20; Bredent, Senden, Germany*). This dynamometer performs measuring of force in scope of 0-20N with the accuracy of 0.4N under a condition of external crown's junction with a metallic frame.

Merenje ukupne retencione sile vršeno je na sledeći način: teleskop kruna i metalni skelet postavljani su neposredno ispod ploče sa zavrtnjima, prema kojoj je bila orijentisana unutrašnjost unutrašnje kruna. Kroz ploču su se postavljali podesivi zavrtnji, tako da urone u unutrašnjost unutrašnje kruna u koju je prethodno unet autopolimerizujući akrilat (slika 1). Vertikalni stubić je zatim bio zakočen pomoću specijalnog točka. Nakon vezivanja autopolimerizujućeg akrilata, vršeno je ponavljano razdvajanje skeleta spojenog sa spoljašnjim krunama, od unutrašnjih. Na satu je vršeno očitavanje vrednosti ukupne retencione sile (slika 2). Nakon izvršenih merenja, izračunavane su srednje vrednosti retencionih sila svih ispitivanih teleskop proteza.

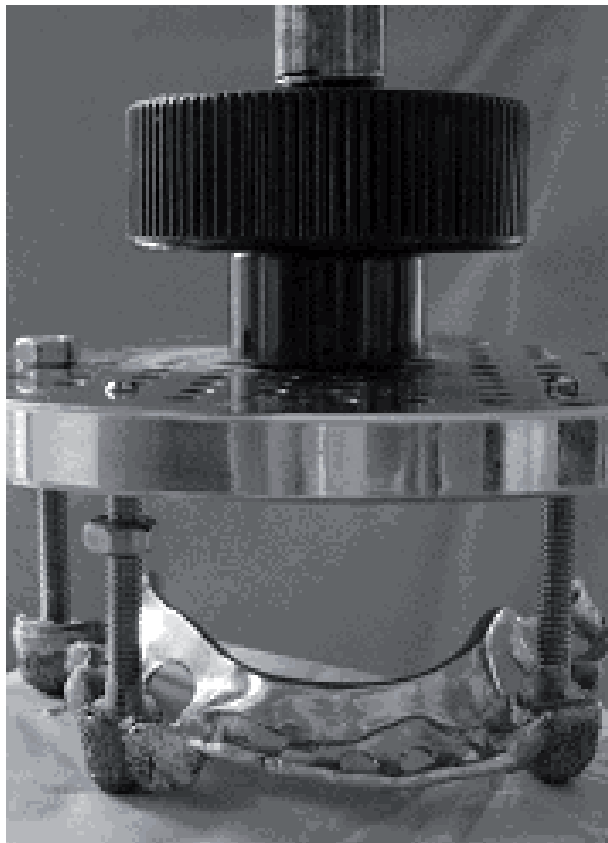
Ispitivanje vremenskog trajanja „faze uhadavanja“ kod završenih teleskop proteza

Razdvajanje unutrašnje od spoljašnje kruna i merenja retencionih sila ponavljana su sve dok

Measurement of the overall retention force was executed in the following way: the telescopic crowns and the metallic frame were positioned right in front of the panel with screws, towards which the interior of interior crowns were orientated. The adjustable screws were positioned through the panel in the manner that enabled them to be plunged in the interior of the interior crown into which the autopolymerized acrylate was previously introduced (Figure 1). The vertical pillar was afterwards blocked with a special cog. After the linking of autopolymerized acrylate a repeated separation of frame connected to the external crowns from the internal ones was conducted. The timer displayed the values of the overall retention force (Figure 2). After the completion of the measurements, the retention force average values of all tested telescopic prosthetic devices were calculated.

The survey of „settling in phase“ duration in completed telescopic dentures

Separation of internal from the external crown and measurement of retention force was



*Slika 1. Unutrašnje kruna povezane autopolimerizujućim akrilatom za meri instrument
Ispitivanje retencione sile kod završenih teleskop proteza
Figure 1. The inner crown with autopolymerized acrylate associated with measuring instrument.
Examination of retention force in completed telescope denture.*



*Slika 2. Razdvajanje spoljašnje od unutrašnje kruna
Figure 2. The separation the outor from the inner crown.*

na skali nije očitana konstantna vrednost retencione sile, odnosno do ustaljenja.

Nakon izvršenih merenja, izračunavane su srednje vrednosti dobijenih retencionih sila svih proteza nakon prvog i poslednjeg merenja. Pod poslednjim merenjem podrazumeva se ona vrednost retencione sile koja se ponavljala u pet uzastopnih merenja.

Prilikom obrade podataka, pošlo se od pretpostavke da pacijenti u toku dana izvrše tri razdvajanja spoljašnje od unutrašnje krunice, odnosno da tri puta u toku dana skidaju i stavljaju protezu. Na taj način, izvršeno je izračunavanje broja dana, nakon koga dolazi do ustaljenja retencione sile i trenutka kada se završava „inicijalna faza uhadavanja“.

Rezultati

Rezultati ispitivanja retencione sile kod završenih teleskop proteza

Prosečan broj sklopova u sastavu završenih teleskop proteza iznosio je dva sklopa i najčešće su bili locirani na očnjacima (65%). Prosečna vrednost ukupne retencione sile završenih teleskop proteza, dobijene nakon prvog merenja, iznosila je 15,5N.

Kod samo 37% teleskop proteza registrovana je optimalna retenciona sila. Kod 16% je registrovana nedovoljna retenciona sila, dok je kod ostalih 47% registrovana prekomerna retenciona sila (grafikon 3). Najveća vrednost

repeated until the scale showed constant value of retention force, in other words, until its establishment. Following the measurements, the average values of all the retention force values of all the dentures after the first and the last measuring were calculated. By the last measuring was considered. A retention force value repeated in five consecutive measurements was considered to be the last measurement.

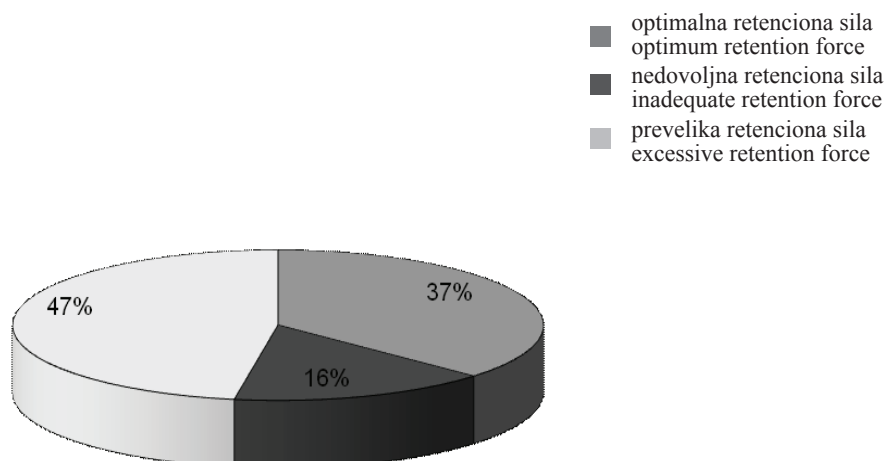
In the data processing, an assumption was made that the patients conduct three separations of external from the internal crown per day i.e. that they put the denture on and off three times a day. In that way the number of days after which retention force became established was calculated and a settling in phase was completed.

Results

Results of retention force measurement in completed telescopic dentures

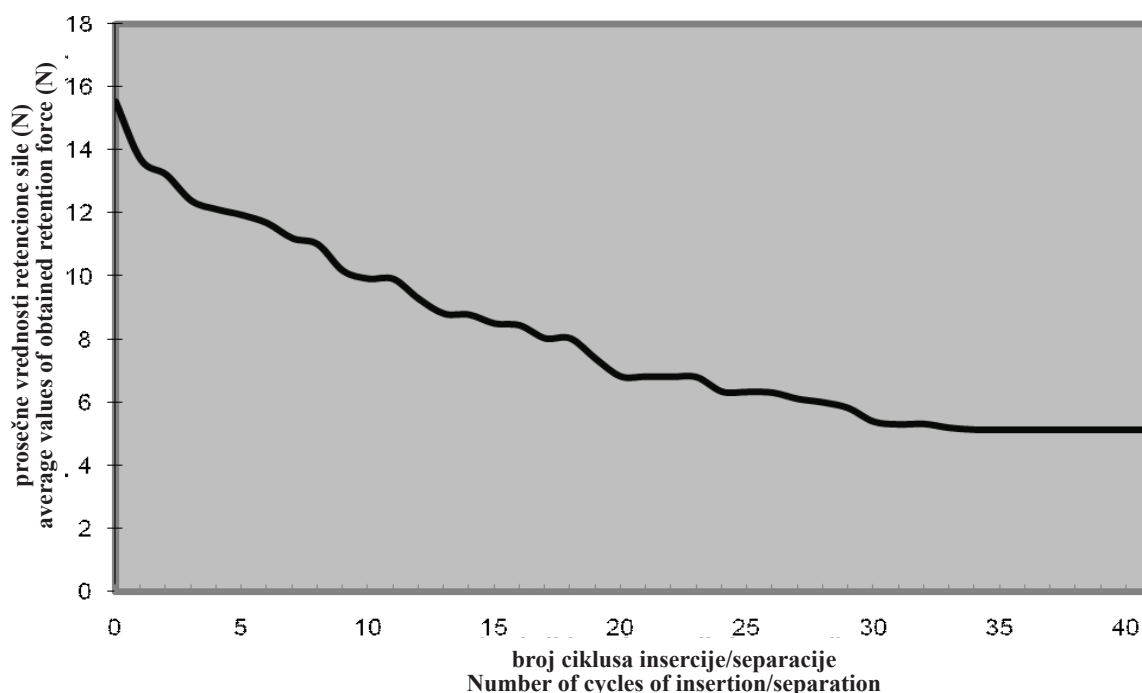
The average number of telescopic structures was two and they were most frequently located on canine teeth (65%). The average value of total retention force of completed telescopic dentures, gained after the first measurement was 15,5N.

In only 37% of telescopic dentures, optimal retention force was registered. In 16%, insufficient force was found and in the rest of dentures

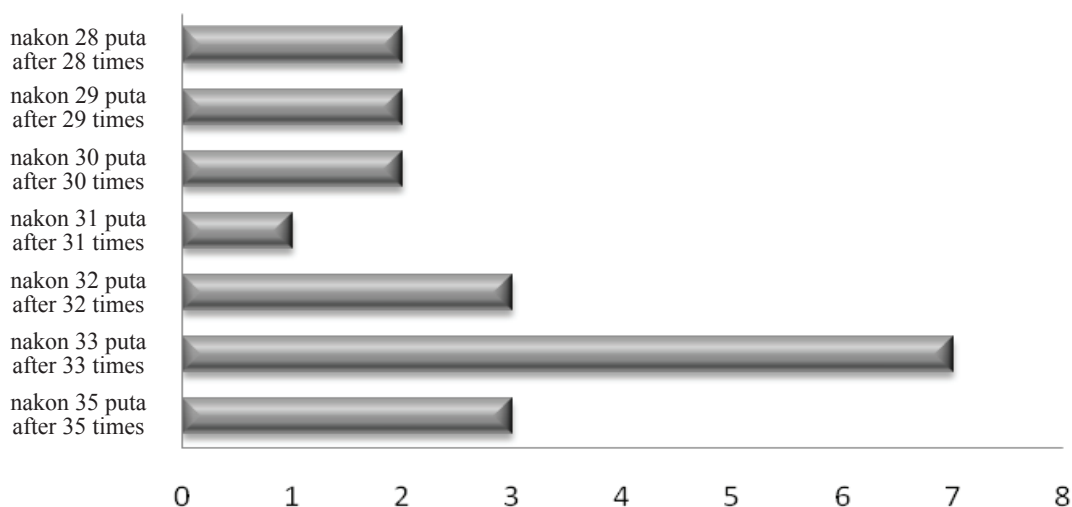


Grafikon 3. - Distribucija dobijenih retencionih sila kod ispitivanih teleskop proteza.

Figure 3. Distribution of the obtained retention force in the examined denture



Grafikon 4. Dobijene prosečne vrednosti retencione sile u zavisnosti od broja ciklusa insercije/separacije
 Figure 4. Average values of obtained retention force depending on the number of cyclucs of insertion/separation



Grafikon 5. - Distribucija broja proteza prema broju ciklusa nakon koga dolazi do ustaljenja retencione sile
 Figure 5. The distribution of dentures according to the number of cycles after which there is plateau of retention force

izmerene retencione sile bila je 18,4N, a najmanja 4,8N.

Rezultati ispitivanja vremenskog trajanja „faze uhodavanja“ kod završenih teleskop proteza

Nakon inicijalne faze uhodavanja, srednja vrednost ukupne retencione sile iznosila je 5,1N (grafikon 4). Prosečna vrednost broja

(47%) excessive force was reported (Figure 3). The highest value of retention force was 18.4N and lowest was 4.8N.

Results of the survey of „settling in phase“ duration in completed telescopic dentures

After the initial settling in phase, medium value of total retention force was 5.1N

ciklusa spajanja i razdvajanja cilindričnih sklopova kod teleskop proteza u toku faze uhodavanja iznosila je 31,85 puta. Kod najvećeg broja proteza (35%), faza uhodavanja nastupila je nakon 33 ciklusa (grafikon 5). Pod pretpostavkom da pacijent u toku dana tri puta skine i stavi protezu, prema rezultatima ovog istraživanja dobija se podatak da je u proseku potrebno 10,6 dana da se ustalji retenciona sila, odnosno da „faza uhodavanja“ u proseku toliko i traje.

Diskusija

Kod proteza sa jednom teleskop krunom, optimalna vrednost retencione sile teleskop krune je 5-9N^{6,8}. *Korber* predlaže retencionu silu od 500g (4,9N) po teleskop sidru⁹. Prekomerna retenciona sila bila je zastupljena kod 47% proteza. To je prilično veliki procenat, s obzirom da treba imati u vidu da je kod prekomerne sile moguće oštećenje parodontijuma zuba nosača. Sva odstupanja od optimalnog opsega nastaju kao posledica propusta u laboratorijskim fazama izrade teleskop kruna.

Pored veličine ukupne retencione sile, od ključne važnosti za očuvanje parodontijuma jeste i ravnomerna distribucija retencione sile, koja zavisi od broja teleskop kruna, njihovog rasporeda, biološke vrednosti i klase zuba^{10,11}. Optimalan broj teleskop kruna za parcijalnu protezu je 2-4, ukoliko je njihov broj veći, veća je i opasnost da će ukupna retenciona sila biti prekomerna. Kod izbora retencionih zuba, treba voditi računa o njihovom položaju u zubnom luku. Najpovoljnije je kada se odaberu zubi sa obe strane linije medijane⁴. Optimalna veličina ukupne retencione sile, kao i njena ravnomerna distribucija kod većeg broja sidara, lakše se može postići koničnim sklopovima. Retencija koničnih sklopova zasniva se na trenju mirovanja i principu samokočivog klina. Međutim, kod najvećeg broja slučajeva, gde je uključen manji broj sidara, adekvatna nadoknada, u smislu retencije i stabilnosti, može se izraditi isključivo primenom cilindričnog sklopa.

Zahvaljujući procesu habanja, dolazi do progresivnog smanjenja retencione sile, ali samo do određenog nivoa, odnosno do završetka „faze uhodavanja“. Zahvaljujući ovom mehanizmu, vrednosti optimalne sile mogu se, prema rezultatima ovog istraživanja, dovesti u optimalni opseg za 10,6 dana, ukoliko početna retenciona sila ne prelazi 20N. Ukoliko faza uhodavanja ne traje predugo, a vrednost početne sile nije

(Figure 4). Medium value of conjunction and separation cycles' number during the settling in phase was 31.85. Most frequently (35%), settling in phase began after 33 cycles (Figure 5). Having in mind that patient approximately three times a day performs cycle of conjunction and separation, it can be concluded that it takes 10.6 days to stabilize the retention force, in other words, that is the duration of the settling in phase.

Discussion

In dentures with only one telescopic structure, optimal value of retention force is 5-9N^{6,8}. *Korber* suggests retention force of 500g (4,9N) in one telescopic structure.⁹ Excessive retention force was present in 47% of dentures. That is rather high frequency, having in mind that in excessive force damage of periodontal tissue of retention teeth is possible. Every deviation of optimal range is the consequence of laboratory work neglect in telescopic crowns production phases.

Beside the retention force value, even distribution of retention force is of crucial importance, which depends on the number of telescopic crowns, their arrangement, biological value and teeth class^{10,11}. Optimal number of telescopic crowns for partial denture is from 2 to 4, and if their number is higher, the higher is the possibility that the retention force will be excessive. When choosing retention teeth, clinician should consider their position in dental arch. It is most convenient when retention teeth are on both sides of medial line⁴. Optimal value of total retention force and its even distribution in higher number of structures is easier to achieve with conical structures. Retention of conical structures is based on friction mode and principle of self-restrained wedge. However, in most cases when a small number of structures exists, adequate denture can be made only with cylindrical structure.

Thanks to wear process, progressive reduction of retention force occurs, but only to a certain level, in other words, until the finish of settling in phase. Because of this mechanism, retention force value can be brought to optimal range in 10,6 days unless the initial force ex-

previsoka, ne bi trebalo da dođe do oštećenja parodontalnih tkiva, već samo do njegove stimulacije, u suprotnom, može doći do trajnog oštećenja potpornog aparata zuba nosača. S obzirom da je prosečna retenciona sila na početku merenja bila 15,52N, a nakon faze uhdavanja 5,12N, ne može se oteti utisku da faza uhdavanja u nekim slučajevima ima poželjno delovanje, kada svojim delovanjem neutrališe greške nastale tokom izrade. Takođe, habanje koje nastaje tokom ove faze može dovesti do značajnog umanjavanja retencione sile kao i do neminovnih korekcija primenom kompozitnih materijala^{9,12,13}. Ovaj postupak se odvija u cilju nadoknade materijala izgubljenog u toku procesa habanja i ponovnog formiranja kontakata između spoljašnje i unutrašnje krune, kako bi se opet postigla optimalna retencija.

Stančić i Jelenković su prilikom merenja retencione sile završenih teleskop proteza dobili da je 36% proteza imalo retenciju u okviru optimalnih vrednosti, dok su sve ostale proteze imale prekomernu retencionu silu¹⁴. U poređenju sa rezultatima ovog istraživanja, uočava se sličan procenat proteza koje su imale optimalnu retenciju (37%), dok su u ovom istraživanju, za razliku od prethodnog, sa zastupljenošću od 16% bile prisutne i proteze sa manjom retencionom silom od optimalne.

Trenje, a samim tim i veličina ukupne retencione sile, zavisi od prisustva pljuvačke kao lubrikantnog sredstva^{4,5}. Prisustvo lubrikantnog sredstva umanjuje vrednosti trenja. Različite materije u ustima imaju podmazujuće (dentalni plak) i protivpodmazujuće dejstvo (voda). Uticaj pljuvačke koja je prisutna u oralnoj sredini, nije bio uključen prilikom merenja u „in vitro“ uslovima, u kojima je eksperiment vršen. Ovu činjenicu treba uzeti u obzir prilikom analize dobijenih rezultata.

Takođe, radi merenja ukupne retencione sile, vršilo se vertikalno razdvajanje spoljašnjih od unutrašnjih kruna, što sa sobom nosi mogućnost pojave dodatnih grešaka izazvanih ljudskim faktorom¹⁴. U „in vivo“ uslovima, put unošenja proteze u najvećem broju slučajeva ne odgovara putanji koja je primenjena prilikom merenja. Naravno, treba uzeti u obzir gore navedene probleme vezane za vršenje merenja u „in vitro“ uslovima, zbog čega rezultate treba prihvatiti sa rezervom.

Ovim istraživanjem ukazano je na potrebu provere vrednosti retencione sile u dinamometru pre predaje proteze^{10,13-15}. Na taj način se sprečava štetno dejstvo prejake retencione sile na parodontijum, kao i nastajanje

ceeds 20N. If the settling in phase does not last too much, and the initial force value is not too excessive, damage of periodontal tissue of retention teeth should not occur, but the opposite, its stimulation. Having in mind that the initial retention force was 15,52N, and retention force after settling in phase is 5,12N, it can be concluded that this phase can have positive effect in sense of neutralization of laboratory work mistakes. Also, wear which appears during this phase can lead to significant reduction of retention force and therefore unavoidable application of composite materials^{9,12,13}. This procedure is performed with the aim to compensate the material lost during the process of wear and to reform contacts between internal and external crown.

Stančić and Jelenković measured retention force of completed telescopic dentures and the results showed that only 36% dentures had optimal value of retention force. All other dentures had excessive force¹⁴. Compared to results of this research, it can be observed that similar percentage of dentures had optimal retention force (37%), but the difference is in the fact that in this study there is also small percent of dentures with insufficient retention force.

Friction, and therefore overall retention force depends on the presence of saliva as lubricant^{4,5}. Presence of lubricant reduce values of friction. Different materials in oral cavity have lubricant (dental plaque) and antilubricant (water) effect. The influence of saliva which is present in the oral cavity was not included during the measurements „in vitro“ in which experiment was conducted. This fact should be considered when analysing the results.

In order to measure the total retention force, vertical separation of external from internal crowns was performed, which carries the possibility of additional mistakes provoked by human factor¹⁴. Under „in vivo“ conditions the insertion path of denture in most cases is not the same as the path used during the measurements. All these facts need to be considered in order to accept these results with some reserve.

This research showed the necessity of retention force testing before the denture delivery^{10,13-15}. In this way, harmful influence of excessive retention force on periodontium of retention teeth can be prevented, as well as effects of

nepovoljnih horizontalnih sila kod nedovoljno retiniranih proteza¹⁶⁻²⁰. Dobijene vrednosti retencionih sila u ovom istraživanju ukazuju na veliki procenat propusta u laboratorijskoj izradi i nameću potrebu bolje kontrole samog procesa izrade proteza sa teleskop krunama.

Zaključak

Veliki broj teleskop proteza ima početnu retencionu silu veću od optimalne. Sa povećanjem broja teleskop kruna u okviru proteze, neophodno je smanjenje retencione sile svake pojedinačne teleskop krune kako bi se izbegli negativni efekti delovanja prekomerne sile na parodontijum zuba nosača.

„Faza uhadavanja“ tokom koje dolazi do ustaljenja retencione sile u proseku se završava u okviru prvih deset dana nakon predaje završene teleskop proteze.

negative horizontal forces which can be developed in dentures with insufficient forces¹⁶⁻²⁰. Retention force values measured in this study show high frequency of laboratory work neglect and therefore impose the need of control in the process of telescopic denture production.

Conclusion

A lot of telescopic dentures have the initial retention force higher than the optimal. With an increase of the number of telescopic crowns in denture, it is necessary to decrease the retention force of each telescopic crown to avoid the negative effects of an excessive force on the periodontium of retention teeth.

The „settling in phase“, during which retention force becomes stabilized, is completed in the first ten days after the delivery of the completed telescopic denture.

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