



KRAHASIMI I FORCËS PËRKULËSE NDËRMJET DY MATERIALEVE TË NDRYSHME ME BAZË PMMA

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ABSTRAKT

Hyrja. Forca perkulese eshte e rendesishme per te percaktuar forcen e punimit protetik, sidomos ne rastet kur ai eshte afat-gjate.

Qellimi. Krahasimi i forces perkulese ndermjet materialit te perkohshem me rezine vete-polimerizuese Polimetil-Metakrilatit dhe materialit restorativ te perkohshem me rezine foto-polimerizuese, Uretan-di-Metakrilatit.

Metodat. Ne studim u perfshin gjithsej 20 mostra, 10 per nga secili material. Keto mostra u ruajten ne peshtyme artificiale per 7 dite, me pas u shpelane dhe u thane. Forca perkulese u llogarit duke perdorur testin 3 pikesh ne makinene universale. Te dhenat u analizuan me t-test.

Rezultatet. Vlera mesatare e forces perkulese e mostrave te perbera nga Poli-Metilmetakrilati (134,4 MPa) ishte me e larte se sa atyre duke perdorur Uretan-diMetakrilatin (107,5 MPa).

Konkluzioni. Brenda limiteve te ketij studimi u nxor si konkluzion qe forca perkulese e Poli-Metilmetakrilatit eshte me e larte sesa e Uretil-diMetakrilatit. Polimetil-Metakrilati mund te sherbeje si nje punim restorativ i perkohshem me i mire sidomos per nje periudhe te gjate kohore ose ne rastet e parafunksioneve.

Fjalet kyce: materiale provizore, forca perkulese, mostra.

HYRJA

Nje restaurim provizor i mire duhet te plotesoje keto kushte: Te mbroje pulpen dentare, te kete pershtatje te mire marginale, te ruaje qendrueshmerine e pozicionit, te kene qendrueshmeri dimensionale, te realizoje funksionin okluzal, te kete force dhe retension, te jete lehtesisht i pastrueshem dhe te sigurojne estetiken.^{1,2} Gjate funksionit, punimet provizore duhet te perballojne

THE COMPARISON OF FLEXURAL STRENGTH BETWEEN TWO DIFFERENT PMMA BASED MATERIALS

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ABSTRACT

Introduction. Flexural strength is important to define the strength of prosthetic construction, especially in a long term one.

The aim: The comparison of flexural strength between two restorative provisional materials: polymethyl methacrylate and urethane dimethacrylate.

Methods: In this study were included 20 specimens, 10 for each group. These specimens were stored in artificial saliva for 7 days, then they were rinsed and dried. Flexural strength were calculated by using 3 point test in the universal machine. The data were analyzed with t-test. Results. The average value of flexural strength of specimens made of polymethyl methacrylate (134,4 MPa) was higher than the flexural strength of specimens made of urethane dimethacrylate (107,5 Mpa).

Conclusions. Inside the limits of this study we could conclude: the flexural strength of Polymethyl Methacrylate is higher than the flexural strength of urethane dimethacrylate. Polymethyl methacrylate can be used as a better provisional restorative for a long period of time, for long span prostheses or in patients with parafunctional habits.

Key words: provisional materials, flexural strength, specimens.

INTRODUCTION.

A good provisional restoration should fulfil these criteria: protect dental pulp, good marginal adaptability, to keep the position stability, realize occlusal function, force and retention, easily cleaned and good esthetic.^{1,2} During the function temporary restoration should face occlusal forces without breaking or move. This is very important in long-time provisional restorations, long span bridges, during restorative phase of reconstruc-



forcat pertypese pa u thyer ose zhvendosur. Kjo behet shume e rendesishme sidomos ne punime provizore afatgjata, ne ura me numer te madh elementesh, gjate fazes restorative te procedurave rikonstruktive te implanteve, ne rastet e nje pacienti me parafunksione.^{3,4,5} Nje nga karakteristikat e vetive mekanike te materialeve eshte forca perkulесе. Forca perkulесе eshte aftesia e materialit per ti rezistuar nje ngarkese te caktuar pa u thyer apo u deformuar. Nga ana kimike kemi dy grupe kryesore: 1. Rezinat Metakrilate ku hyjne metilmetakrilati, etilmetakrilati, vinilmetakrilati, butilmetakrilati. 2. Rezinat Kompozite: bis-GMA, bis-akriliket, uretan-dimetakrilati. Forca perkulесе e punimeve provizore varion brenda materialit, materialeve te nje klase kimik, ndermjet klasave te ndryshme kimike. Ne baze te menyres se polimerizimit i ndajme: rezine vetepolimerizuese, rezina polimerizuese me nxehtesi, rezina fotopolimerizuese, rezine duale (me drite ose me nxehtesi)^{6,7}. Klinikistet tipikisht zgjedhin nje produkt duke u nisur nga lehtesia e manipulimit, cmimi, estetika. Kur fortesia eshte primare, eshte e dobishme te njihet cili material siguron nje punim provizor me rezilient. Prandaj u realizua nje studim per te krahasuar forcen perkulесе ndermjet materialeve te perkohshem: rezines vetepolimerizuese, polimetil metakrilatit dhe rezines fotopolimerizuese, uretan dimetakrilatit.

QELLIMI

Qellimi i ketij studimi eshte krahasimi i forces perkulесе ndermjet dy materialeve te perkohshme. Pra nepermjet konkluzioneve te ketij studimi, mjeket stomatologe mund te zgjedhin cili eshte materiali me rezistent ndaj thyerjes apo deformimit, sidomos ne raste te vecanta klinike si psh. ne rastet e nje ure me numer te madh elementesh, ne rastet e nje pacienti me parafunksione si psh. ne rastet e nje bruksizmi apo ne fazat restorative te implanteve, ku kerkohet mbajtja e nje punim fiks provizor per nje kohe te gjate.

MATERIALET DHE METODA

Ne kete studim u zgjodhen dy lloje rezinash bazuar ne: menyren e polimerizimit dhe ne menyren e manipulimit. U prodhuan gjithsej 20 mostra, 10 mostra per secilin grup materialesh (fig.1). Te gjitha mostrat u formuan ne baze te intruksioneve te prodhuesit dhe procedurave standarte. Grupi 1- Rezine vetepolimerizuese e cila permban PMMA, Grupi 2- Rezine fotopolimerizuese e cila permban UDMA. Metoda me te cilen te dhenat statistikore u perpunuan eshte student "t" test.

tive procedures over implants or in patients with parafunctional habits.^{3,4,5} One of the mechanical properties of materials is flexural strength. Flexural strength is the ability of material to resist a certain load without breaking or being damaged. Regarding the chemical qualities, there are two main groups: 1. Methacrylate Resins where are included: methyl methacrylate, ethyl methacrylate, vinyl methacrylate, butyl; methacrylate. 2. Composite Resins: bis-GMA, bis-acrylics, urethane dimethacrylate. Flexural strength of provisional restorations are different in one material, inside one chemical class and between different chemical classes. Based on the way of polymerization there are different groups: auto polymerized resins, resins polymerized with heat, light-polymerized resins, dual resins.^{6,7} Clinicians typically choose a product based on the way of manipulation, cost and esthetics. When strength is the most important, it is useful to know which restorative material is the most resilient. This is the reason we conducted a study to compare flexural strength between two restorative materials: self-polymerizing resin, polymethyl methacrylate and light polymerized resin, urethane dimethacrylate.

THE AIM OF THE STUDY.

The aim of this study is to compare the flexural strength of two provisional materials. Through the conclusions of this research dentists can choose which material is the most resistant toward fracture or deformation, especially in certain clinical cases such as: in a long span bridge, in parafunctional habits patients for ex. with bruxism or in restorative phases over implants where a provisional fixed restoration is required for a long time.

MATERIAL AND METHODS

In this study two types of resin based on the way of polymerisation and the way of manipulation were chosen. 20 specimens were produced, 10 specimen for each group (fig. 1). All the specimens were made based on the instructions and standart procedures. Group 1, Auto-polymerised resin that contains PMMA, Group 2 that contains light polymerised resin. The statistical method that was used was student "t" test.



Fig.1. Mostrat e prodhuara.

Nepermjet student “t” test u krahasuan te dhenat mesatare ndermjet dy grupeve.

Prodhimi i formave metalike. Format metalike u pergatiten per te formuar mostrat. Permasat e formave metalike u bazuan ne specifkimet e Institutit te Standardeve Amerikane nr.27 me permasa: 25×2×2 mm. Format metalike jane prej alumini, ato u vendosen ndermjet dy pjatave te qelta qe te sigurojne shperndarje te njetrajtshme materialit.

Prodhimi i mostrave te Grupit 1. Rezina vetepolimerizuese, pluhur dhe likid u maten dhe u perzihen ne menyre uniforme ne raportin 2:1. Kur materiali arrin fazen e brumit, ai u mor u paketua ne format metalike dhe u mbulua me nje pjate e qelqte mbi te cilen nje presion uniform u ushtrua deri sa i gjithë polimerizimi perfundoi. Materiali u la ne format metalike per 15 min per polimerizimin e plote. Pasi perfundoi polimerizimi mostrat u terhoqen nga format metalike dhe u ekzaminuan per porozitet ose ndonje defekt tjeter. Lemimi dhe lustrimi u realizua me Strue Tegramin 25, me Disqe Magnetike (MD). Se pari u realizua ngjitja e mostrave me mbajtësen e tyre (Fig.2).



Fig.2. Mostrat e ngjitura.



Fig.1. The specimens produced.

Through student “t” test average values of the data were compared.

Metal molds were used to produce the specimens. The measures of metallic specimens were based in the specifications of American Standards Institute nr. 27 : 25×2×2 mm. Metal molds were produced by aluminum. They were placed between between two glasses plates in order to realize an equal disperse of the material.

The fabrication of the first group of specimens: auto-polymerised resin. Powder and liquid were measured in the ratio 2 : 1. When the material comes to the dough stage, it was placed in the metal molds and covered with a glass plate where a uniform pressure was performed until the whole polymerization was complete. The material was left for 15 minutes for the complete polymerization. After the polymerization was completed the specimens were examined for any porosity or defects. Grinding and polishing was made with Strue Tegramin, with Magnetic Discs. The specimens were attached with the holder. (fig.2) First grinding was made with MD Piano.



Fig.2. The specimens attached with the holder.



Lemimi fillestar (MD Piano)- Heq pjeset e demtuara dhe te deformuara te sipërfaqes se materialit, 35 mikron. Siperfaqet e te gjitha mostrave ne mbajtesin e mostrave jane te gjitha ne te njejtin nivel. Abrasivet te cilet vendosen ne disk pershpjetojne heqjen e materialit. (fig.3)



Fig. 3

It takes off the damaged and deformed parts of the material, the removal of the material was 35 micron. The surfaces of all specimens in their holder are all in the same level. Abrasives were sprayed in the disc to help to remove the damaged material. (fig.3)

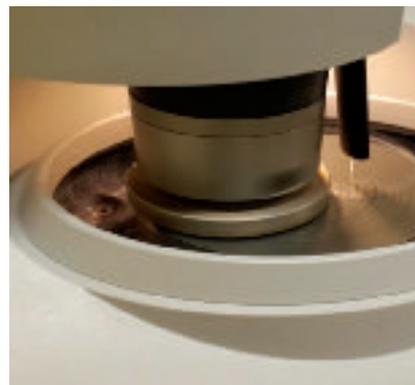


Fig. 3

Lemimi sekondar (MD Allegro): Qellimi eshte te heqin deformimet ekzistuese nga lemimi fillestar dhe pergatisin nje sipërfaqe gati per lustrim, eliminimi i materialit eshte ne sasinë 15 mikron. Abrasivet qe perdoren jane Diamantet Pro, ne forme spray. (fig.4)

Lustrimi. Lustrimi realizohet me MD Nap, me suspensione oksidi alumini.

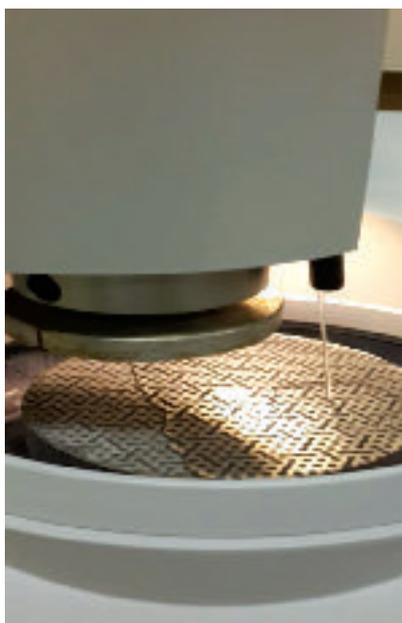


Fig. 4

Second grinding was made with MD Allegro. It helps to remove the left material from the first grinding and prepares the surface ready for polishing, the material removed was 15 micron. Abrasives that were sprayed are Diamant Pro.

Polishing was made with MD Nap with Oxyd Alumin suspensions. (fig.4)

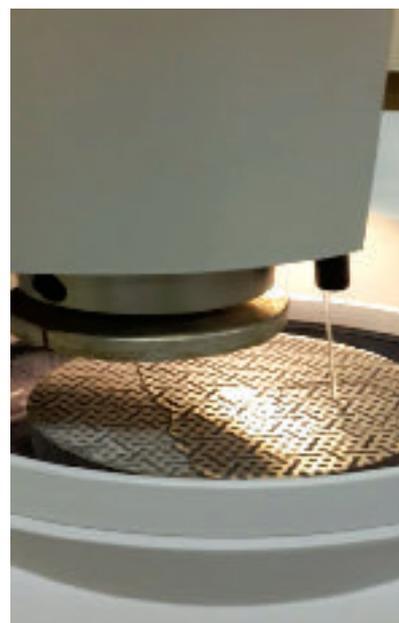


Fig. 4



Me ne fund mostrap e PMMA u maten duke perdorur Digital Caliper, Mitutoyo , per matje te sakte te ketyre permasave : 25×2×2 mm.

Pasi matjet perfunduan, mostrap u zhyten ne pesh-tyme artificiale dhe u ruajten per 7 dite, me pas u lane dhe u thane.

Prodhimi i grupeve “ 2” te mostrave: Materialet me UDMA vijne te mbrojtura nga drita, te paketuara. Ato vijne ne konsistence putty te cilat mund te paketo-hen lehtesisht. Materiali u vendos ne format metalike sa me shpejt te ishte e mundur dhe u mbulua me nje pjate te qelqte mbi te cilen nje force uniforme u aplikua per dy minuta. Format metalike u ruajten ne dhoma te mbrojtura nga drita dhe mostrap ne fillim u polimerizuan per 2 minuta. Materili i tepert u hoq nga anat dhe pastaj serish u polimerizuaran per 6 minuta. Lemimi dhe lustrimi u realizua me Strue Tegramin 25, me Disqe Magnetike (MD). Mostrap UDMA, u maten duke perdorur nje Digital Caliper Mitutoyo, per matjen e permasave 25×2×2 mm. Pasi matjet perfunduan u zhyten ne pesh-tyme artificiale per 7 dite. Pas 7 diteve, mostrap u nxoren, u lane dhe u thane.

Matja e forces perkulese. Forca perkulese e mostrave u llogarit duke perdorur testin 3 pikesh ne makinën univ-ersale Zwick Roell, Z005. Mostrap u vendosen ne dy skajet, te cilat jane 20 mm larg njeri tjetrit. Shpejtesia e kokes e kesaj makine eshte 0,75 mm/min. Secili moster u ngarkua ne menyre graduale dhe pika ku perkulet dhe thyhet u shenua. Kjo eshte ngarkesa qe kerkohet per thyerjen e mostres dhe u perftua ne KN e cila u kthye ne N. (Fig. 5)



Fig. 5

Forca perkulese u llogarit duke perdorur formulën standarte: Forca Perkulese= $3 FL/2BH^2$; ku: F-Forca/ngarkesa qe nevojitet per thyerjen e mostres ; L-distanca midis skajeve-20mm; B-gjeresia e mostrave-2mm; H-lartesia e mostrave-2mm. Vlera e forces perkulese u perftua ne N/m² e cila eshte e barabarte me 1 MPa.

At the end PMMA specimens were measured using Digital Caliper, Mitutoyo for precise measurement: 25*2*2 mm.

After the measurement of the specimens, the specimens were stored in artificial saliva for 7 days, then they were rinsed and dried.

The fabrication of second group of specimens. Materials UDMA come protected by day light, molded. They come in a putty mode, that can be easily packed. The material was packed in metal molds as soon as possible and was covered with glass plate, over which a uniform pressure was applied for 2 minutes. The excessive material was taken off by the sides and then again polymerised for 6 minutes. Grinding and polishing were realized with Strue Tegramin, with Magnetic Discs.

UDMA specimen were measured using Digital Caliper, Mitutoyo for precise measurement: 25*2*2 mm. The measurement of flexural strength. The flexural strength was calculated using 3 point test in the universal machine Zwick Roell. Specimens were placed in two edges, with a distance of 20 mm from each other. The cross head speed of the machine is 0,75 mm/min. Each specimen was loaded in a gradual way and the point that bends and broken was registered. This is the load that is required to break the specimens, in KN which were turned in N. (Fig. 5)



Fig. 5

Flexural strength was calculated using the standart formula: Flexural Strength= $3FL/2BH^2$, where F-the necessary load to break the specimen, L-the distance between 2 edges, 20 mm; B-the width of specimens, 2mm; H- hight of specimens, 2mm. The value of flexural strength was gained in N/m² which is equal with 1 MPa.



REZULTATET

Nga perpunimi statistikor i te dhenave, rezultoi qe: Vlera mesatare e forces perkulese te mostrave te perbera nga Poli-Metilmetakrilati eshte 134,4 MPa, nderesa vlera mesatare e forces perkulese se mostrave te Uretan dimetakrilatit u llogarit 107,5 MPa. Diferenca e vlerave eshte statistikisht e rendesishme.

DISKUTIM

PMMA u shfaqen per here te pare ne 1940. Keto kane avantazhe: rezistence te mire, qendrueshmeri te mire te ngjyres, lustrim te mire dhe estetike te larte^{8,9,10}. Disavantazhet e PMMA jane: clirim ne sasi te larte te monomerit te lire, reaksion ekzotermik, tkurrje nga polimerizimi. Megjithese ky material ploteson shumicen e kerkesave dhe eshte i perdorur dhe ditet e sotme, perdorimi i tij eshte ne renie per arsye te disavantazheve te tij dhe zhvillimit te materialeve te reja e te permiresuara.

Materialet Fotopolimerizuese. Permbajne uretan dimetakrilat, nje rezin polimerizimi i te ciles katalizohet nga drita e dukshme dhe kamforokinoni si iniciator^{11,12,13}. UDMA zakonisht perfshin mbushes si psh. silika mikrofin per te permiresuar vetite fizike si tkurrja nga polimerizimi. Ndryshe nga rezinat e metakrilatit nuk prodhojne mbetje te monomerit te lire pas polimerizimit, gje e cila shpjegon ulje te toksicitetit te indeve.^{14,15,16} Arsyet e zgjedhjes se UDMA jane avantazhet si: Mungese e MMA, jo ere, jo irritime, jo reaksione ekzotermike, zvogelim i tkurrjes gjate polimerizimit, kohe te gjate punimi, lehtesisht te manipulueshme, e lehte per tu vendosur dhe per ti dhene forme. Vlerat e forces perkulese te realizuara ne laborator mund te mos reflektojne kushtet e kavitetit oral, megjithate eshte e dobishme te krahasojme materialet te testuara ne kushte te kontrolluara.

IMPLIKIME KLINIKE

Eshte e rendesishme te vihet re qe forca perkulese eshte vetem nje nga vetite e materialeve provizore. Nje material i forte zoteron disa veti te tjera mekanike si: rezistenca ndaj krisjes, moduli i elasticitetit etj.

LIMITET E STUDIMIT

Se pari u perdoren mostra, dhe jo proteza fikse. Mostrat nuk imitojne saktesisht situaten klinike, por meqenese te gjitha mostrat ishin ne forme dhe madhesi unifor-

RESULTS

From the statistical results the average value of flexural strength of PMMA specimens was calculated 134,4 MPa, while the average value of flexural strength of UDMA was calculated 107,5 MPa. The difference was statistically important.

DISCUSSION

PMMA first appeared in 1940. They have these advantages: good resistance, good stability of colour, good esthetic, high polishing.^{8,9,10} The disadvantages of PMMA are: release of free monomer, exothermic reaction, shrinkage from polymerization. Although this material fulfills most of the criteria, and is used nowadays, it's use is in decrease because of its disadvantages and the development of new and improved techniques. Light polymerised Materials. They contain urethane dimethacrylate, a resin whose polymerisation is catalysed by visible light and kamforokinon as initiator.^{11,12,13} UDMA usually includes silica microfin to improve physical properties like shrinkage from polymerisation. Unlike resin of methacrylate, they do not produce free monomer after polymerisation, that explain the decrease of the toxicity of tissues.^{14,15,16}

The reason for choosing UDMA are the advantages like: absence of MMA, no irritation, no smell, no exothermic reaction, long time for manipulation, easy for manipulating and for shaping. The values of flexural strength in the laboratory may not reflect 100% the conditions of oral cavity, although it is useful to compare tested materials in controlled conditions.

CLINICAL IMPLICATIONS

It is important to clarify that flexural strength is one of the qualities of provisional materials. A strong material posses other mechanical properties like: resistance toward fracture, elastic module etc.

LIMITS OF THE STUDY

First of all, in this study were used specimens and not fixed prostheses. Specimens do not imitate exactly the clinical situation, but as all the specimens have standart sizes and shapes, the values and the comparisons are valid in this study. In the experiment the material was stored for 7 days in artificial saliva and then was



me, vlerat dhe krahasimet duhet të jenë të vlefshme në këtë studim. Në eksperiment materialin u ruajt për 7 ditë në peshtymë artificiale dhe pastaj u ushtrua forcë mbi materialin; ndërsa në situatat klinike materialin ngarkohet me forcë menjëherë pas cementimit. Bazuar në këtë studim nuk mund të thuhet që PMMA është më mirë se UDMA. Ka shumë faktore të tjera dhe situata të ndryshme klinike, të cilat përfundimisht zgjedhin materialin provizor me të pershtatshëm për secilin pacient.

KONKLUZIONE

Brenda limiteve të këtij studimi u nxor si konkluzion që: Forca perkulëse e polimetil metakrilatit është më e lartë sesa e uretan dimetakrilatit. Vlera e forcës që mund të perballojë mostrat e perbera nga PMMA pa u deformuar apo u thyer është 134,4 MPa. Si rezultat, Polimetil metakrilati mund të shërbejë si një punim restorativ i perkohshëm më mirë në rastet e punimeve afat-gjata, për një protezë fikse me numër të madh elementesh, në rastet e parafunksioneve si psh. në një pacient me bruksizem, ose në fazat restorative të implantëve ku kërkohej një punim provizor fiks për një periudhë afatgjatë.

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applied force over them; while in the clinical situation the material is loaded immediately after cementation. Based on this study we can not say that PMMA is better than UDMA. There are many factors and different clinical situations, that definitely choose which provisional material to use for each patient.

CONCLUSIONS

Besides the limits of this study we could conclude that the flexural strength of polymethyl methacrylate is higher than the flexural strength of urethan dimethacrylate. The value of flexural strength that PMMA can handle without breaking or deformed is 134,4 MPa. Polymethyl methacrylate can be used as a better provisional restorative for the long-term restorations, for a fixed prostheses with a large number of elements or in patients with parafunctional habits as in patients with bruxism or in restorative phases over implants where a fixed provisional bridge is required for a long time.

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