Journal of Population Therapeutics & Clinical Pharmacology

RESEARCH ARTICLE
DOI: 10.47750/jptcp.2022.939

Clinical classification of torus and effectiveness of two-layer bases in removable dentures

Nurmukhamet Ruzuddinov*[1], Saurbek Ruzuddinov[2], Igor Voronov[3], Kubeisin Altynbekov[2], Kalamkas Ruzuddinova[4]

[1]Faculty of Medical Sciences, Al-Farabi Kazakh National University, Kazakhstan

[2]Department of Orthopedic Dentistry, S.D. Asfendiyarov Kazakh National Medical University, Kazakhstan

[3]Department of Dentistry, The Peoples' Friendship University of Russia, Russia

[4]Faculty of Medical Sciences, Kazakh National Medical University named after S.D.Asfendiyarov, Kazakhstan

***Corresponding author**: Nurmukhamet Ruzuddinov, Faculty of Medical sciences, Al-Farabi Kazakh National University, Kazakhstan. Email: scholar.tabriz@gmail.com

Submitted: 29 May 2022; Accepted: 16 June 2022; Published: 6 August 2022

ABSTRACT

Aim: To study and systematize the complaints of patients with removable prostheses, paying attention to the clinical manifestation of the torus and its sensitivity, and to determine the effectiveness of the use of two-layer bases in removable prosthetics.

Methods: In the clinic of orthopedic dentistry, 104 people were examined and received orthopedic treatment, including 37 patients in the comparison group. The main number of patients up to 55.3, complained of poor fixation and violation of the chewing process. In order to improve the functional efficiency of the removable prosthesis, two-layer bases using soft linings, Gossil (Russia), Furji (Japan), and Mucopren (Germany), are proposed. Clinical and laboratory studies were conducted (Estesmary, gattingeri, physico-mechanical studies of soft linings). The effectiveness of using soft pads in removable prosthetics is shown. The conducted research allowed creating a clinical classification of the torus depending on the pain sensitivity of the oral mucosa—type I-painless torus, type II-moderately painful, and type III-painful when touched. The features of the technology for manufacturing two-layer bases for type II and type III of torus are recommended.

J Popul Ther Clin Pharmacol Vol 29(3):e87–e93; 6 August 2022.

Results: It was found that 47.9% of patients in the comparison group and 55.3% of those examined in the main group complained about impaired chewing and poor fixation of dentures on the upper and lower jaws, depending on the condition of oral tissues. The patients did not always objectively assess the condition of their dentures. Patients complained about lack of stabilization, poor-quality dentures, and the need to replace the old denture with a new one in 13.8% of cases in the control group and 31.9% in the main group of patients examined.

Conclusion: In the case of removable denture wearers with a total lack of teeth, there were 55.3% complaints of chewing disorders and poor fixation of dentures, and in the case of partially removable denture wearers, the greatest number of complaints of clasp fixation disorders were found in 42.1% of cases. Physico-mechanical study of soft linings from different countries, Gossil (Russia), Fuji (Japan), Mukopren (Germany), showed their effectiveness and the possibility of their use orthopedic dentistry.

Keywords: *Clinical classification, Patients, Prostheses, Removable dentures, Soft lining.*

INTRODUCTION

People lose their teeth for a variety of reasons. In modern dentistry, complete dentures are performed in two ways: The first is implantation followed by dentures. The second is the restoration of the row of teeth with removable dentures.[1]

Implantation is an expensive procedure. However, sometimes it cannot be performed due to clinical findings. An alternative remains the removable denture, which is affordable, but requires a certain period of adaptation. Part of the population will need removable dentures due to financial capabilities, social status in society, age, and religious beliefs. Therefore, the quality of the removable denture is of paramount importance.[2] Sometimes, due to anatomical and age-related characteristics of the oral tissues, fully removable prostheses constantly need to be improved in terms of function. At the same time, a methodological approach that takes into account the clinical condition of the torus and its sensitivity as a factor influencing the quality of the removable denture is missing in the practical work of the doctor. It is known that it is necessary to isolate the torus on removable dentures.[3] In addition, the physical and mechanical properties of the plastic that ensures its hardness cause a lot of trouble for dentists and patients cannot use the denture successfully. Solving these problems and issues of quality torus isolation improves the quality of removable dentures.

The purpose of the research was to study and systematize the complaints of patients with removable prostheses, paying attention to the clinical manifestation of the torus and its sensitivity, to determine the effectiveness of the use of two-layer bases in removable prosthetics.

MATERIAL AND METHODS OF RESEARCH

Hundred and four patients were examined at the clinic of orthopedic dentistry and received orthopedic dental treatment, of whom the comparison group consisted of 37 patients.

Patients aged under 60 years (27.9%), up to 70 years (37.5%), and over 70 years (34.6%) of those examined comprised the bulk of the patients. The largest number of those examined were women (61.5%).

We made a total of 191 dentures, of which there were 72 units in the comparison group and 119 dentures in the main group. In the main group, there were 74 dentures with a complete lack of teeth (62.2%), while 45 dentures had a partial lack of teeth (37.8%). In the comparison group, there were

43 dentures with complete absence of teeth (59.7%), of which 20 dentures were made on the upper jaw (40.3%), and 23 dentures on the lower jaw (53.0%). Twenty-nine dentures at the partial absence of teeth (40.3%) were made—on the upper jaw 13 dentures (45.0%) and on the lower jaw 16 dentures (55.0%).

In the main group of patients with a complete lack of teeth, 38 dentures with soft lining were made by GosSil (Russia), 19 units were made by Fuji (Japan), and 17 units were made by Mucoprene (Germany). With partial absence of teeth, 22 prostheses were made by GosSil, 14 by Fuji, and 9 by Mucoprene.

To accomplish the set tasks, we have carried out clinical, physical, and mechanical studies.

During clinical examination of defects in the dentition, we used the Kennedy classification, and in the complete absence of teeth, the Oxman classification, the oral mucosa according to the SUPLLE classification.[3] Each patient underwent an occlusiogram and, if necessary, studied diagnostic models. Along with the generally accepted research methods in the clinic of orthopedic dentistry, we carried out special studies: determination of pain sensitivity, gnatodynamometry, and physical and mechanical studies of soft linings.

Pain sensitivity was determined by advanced osteosiometer (KazNMU certificate No.570 dated December 20, 2006), which has sufficient measurement accuracy and small value.

The gnathodinamometer with a digital display showing the information at the moment of measurement in kilograms was designed and improved to measure the threshold of periodontal endurance to the masticatory pressure (certificate of competence No.568 dated December 20, 2006).

To study the strength of the soft lining connection to the denture base material, we conducted a physical and mechanical study of soft lining materials: GosSil (Russia), Mukopren (Germany), and Fuji (Japan). The study was conducted on the MI 40 kN apparatus, which was connected to a computer system. Each measurement was carried out five times, and the average figures were recorded. We investigated conditional elongation strength, coefficient of relative elongation, residual elongation, compressive strength, elongation stress, and degree of material failure.[4,5]

RESULTS AND DISCUSSION

It was found that 47.9% of patients in the comparison group and 55.3% of those examined in the main group complained about impaired chewing and poor fixation of dentures on the upper and lower jaws, depending on the condition of oral tissues. The patients did not always objectively assess the condition of their dentures. For example, there were patients who had been using dentures for 10 or more years and considered the dentures to be of high quality. Only with an objective examination was it possible to correctly assess the condition of the denture and recommend its replacement. Around 39.3% of comparison group patients and 46.8 % of the patients in the main group complained of aesthetics, speech impairment, and pain under dentures. Patients complained about lack of stabilization, poor-quality dentures, and the need to replace the old denture with a new one in 13.8 % of cases in the control group and 31.9 % in the main group of patients examined.

Thus, practically all of the patients examined had some complaint about removable dentures. All types of complaints studied in the main group were predominant compared to those in the comparison group. The nature and frequency of complaints corresponded to the degree of atrophy of the alveolar processes, the presence and severity of bone formations, especially torus, the quality of the manufactured dentures, and oral hygiene and dentures.

An analysis of complaints in patients with partial dentition showed that the greatest number of complaints was presented for clamping disorders and chewing disorders—31.5% in the comparison group and 42.1% in the main group. Speech and aesthetic disorders accounted for 27.6% in the control

group and 31.5% in the main group. Pain under the denture and poor-quality dentures were detected in the comparison group (6.6%) and in the main group (13.1%).

In the examined patients, poor fixation and pain under removable dentures are often due to the severity and sensitivity of the torus on the upper jaw. Such bone formation is an unfavorable factor for dentures.[6]

In the report of Kulkarni,[7] the palatal roll is considered a variant of the normal structure, which is not only a consequence of the overgrowth of the palatine suture but also of other causes. Therefore, the author gave a classification of torus according to the form of bone formation: fusiform, ovoid, mixed, lobular, and atypical. According to the localization of the torus he distinguished as central, posterior, and total.

Subsequently, Tanrykuliyev[6] examined 600 skeletonized upper jaws and found torus of various forms, size, and localization in 90 jaws (15%). Depending on the height, width, and length of the palatal ridge, he classified them by the three points system:

First grade. The torus is characterized by its small size and height (up to 15 mm). It can have different shapes and can be located in different areas of the medial suture. It is not difficult to fix.

Second grade. Significant expression of the palatal eminence, the height of the bone protrusion is 10–20 mm. The torus is ovoid in shape, located in the middle of the hard palate.

Third grade. There is a large swelling of bone, covering a large area of the hard palate, reaching a height of more than 20 mm.

In our studies, we paid attention to the complaint of patients who, regardless of the shape and size of the torus, presented different complaints of varying intensity of pain. During objective examination, the frequency of complaints depended more on the sensitivity of the mucosa covering the bone formation. The more sensitive the mucosa, the more frequent and more intense the pain under removable prostheses. Therefore, we have proposed and implemented the determination of mucosal sensitivity of the denture bed mucosa. This osteosiometry technique has proven to be very important and effective for the quality fabrication of removable dentures for our patients.

Our studies to determine the pain sensitivity of the denture bed mucosa showed that the most sensitive areas were acute bone protrusions, exostoses, and the torus area on the upper jaw. In some cases, only touching determined the patients' pain. Therefore, esthesiometry values ranged from 0 to 10 or more g/cm^2.

The results of objective examination and the results of osteosiometry allowed us to distinguish in the clinic of orthopedic dentistry type III sensitivity of the oral mucosa covering the torus of the maxilla:

Type I – little sensitivity, but bone formations with unclear borders, mucosa is thick enough, and painful sensations appear at strong pressure; osteosymetry indexes are 10 g/cm^2 and more.

Type II – bone formation with not particularly clear, pronounced boundaries, mucosa is thin, painful when palpating; osteosymetry indexes up to 10 g/cm^2.

Type III – palatine torus has clear or pronounced borders, can occupy a large area of palatine suture, mucosa thin, atrophic, painful when touching, the relief of bone formation is noticeable on examination; indexes of esthesiometry are 0 g/cm^2.

This classification helped us in the fabrication of the following types of removable prostheses: in the case of type I palatal torus, we considered it possible to fabricate removable prostheses of acrylic plastic, only if the patient wished to fabricate two-layer bases. In the presence of the type II and

type III of the palatal torus, we recommended only removable plate prostheses with a soft lining.

The appropriateness of the use of soft plastics in dentures without dentures is recognized by many clinicians.[8] In their opinion, the use of elastic plastics allows in many cases to improve the fixation and chewing efficiency of dentures without resorting to surgical preparation of the oral cavity. The soft lining compensates for the lack of compliance of the thin mucosa and transfers chewing pressure painfully to the latter.[9]

However, many soft plastics in the oral environment gradually lose their elasticity, become rough, and irritate the mucosa of the denture bed. The hard plastic is most commonly peeled away from the basal hard plastic.

For clinical use, we decided to test the most widely used soft pads in Russia, Japan, and Germany. The following materials were subjected to clinical and laboratory testing: Relink soft, Fudji GC (Japan); Mucopren Soft, Kettenbach (Germany); GosSil, Medsil (Russia). For clinical studies, it was necessary to study the physical and mechanical properties of the soft pads used (Table 1).

In the study of the conditional elongation strength, the material "Gossil" had the maximum value 5.2+0.17 MPa. Silicone materials such as Fuji and Mukopren were somewhat inferior to Gossil. The highest coefficient of relative elongation (650%) was found in the "Mukopren" material, which characterizes its very high strength.

In the study of residual elongation, the material "GosSil" had a higher value of 3%; the minimum value of this indicator was in Fuji and Mukopren, 1%.

Approximately, the same values were obtained for Mukopren and Gossil material when measuring the elongation stress at 100%, while Fuji had a slightly higher elasticity of 1.2 MPa.

Thus, all of the materials used meet the standards of their respective countries on the basis of physical and mechanical testing and can be successfully used in orthopedic dentistry. Their further use will show their positive and negative sides in the dental prosthetics clinic.

In the fabrication of the soft pad, we suggested the following improved technique for the two-layer base, which consisted of creating an additional thickness of soft pad in the area of the pronounced bone protrusion, which increased the elasticity of the pad even under strong masticatory load. This thickness ensured sufficient elasticity and the absence of pain under the prosthesis. The denture base retained functional efficiency, contributing to the absence of valve area disruption.[10]

We have perfected the technological characteristics of soft pad fabrication. Thus, in the presence of type I palatal torus, we isolated the palatal torus over the entire area of the bone formation using one layer of bunion wax. In the case of the II-type of torus expression, we isolated it on two layers of bunion wax with the subsequent fabrication of a two-layer base. In the case of the third type of torus severity, the thickness of soft lining was one layer of baseplate wax. The remaining stages were according to the clinical and laboratory stages of fabrication of removable dentures.

TABLE 1. Physical and mechanical tests of elastic pads of different manufacturers

Indicators	**Study material**		
	Fuji	**Mukopren**	**GosSil**
Conditional elongation strength, MPa	4.4 ± 0.138	4.3 ± 0.156	5.2 ± 0.17
Relative elongation, %	360 ± 3.8	650 ± 4.5	460 ± 3.3
Residual elongation, %	1 ± 0.23	1 ± 0.31	3 ± 0.45
Stress at 100% elongation, MPa	1.2 ±0.065	0.7 ± 0.035	0.8 ± 0.041

This was practically realized as follows. To form a wax base and set the teeth, a wax plate with dimensions of 70×80×1.8 mm is used.[11]

After checking the denture design in the patient's mouth, the dental technician removes the wax base with the artificial teeth from the model. On this plaster model, a silicone plate is placed in the area of the torus along its border to the thickness of one cup wax (0.4 mm) in the case of type I torus, and in the case of type II we apply silicone to the thickness of two layers of cup wax (0.8 mm), and in the case of type III torus the silicone is applied to the thickness of one base wax (1.0 mm). A cellophane film is placed on the silicone surface to isolate it from the plastic. Then, two layers of partial denture wax are applied to the entire surface of the model along the boundary of the future denture. The wax base is then removed from the model and set aside.

Based on this method which the artificial teeth that have been stocked in the patient's mouth is reinstalled on the model, they prepares for replacement with plastic (lapping around the edges, shaping). Then, it is plastered into the cuvette and waxed out. The cuvettes are opened, doused with hot water, and treated with insulating material. After cooling, the wax cuvette with the model without the artificial teeth is covered with a fabricated wax pad of two-layer bunion wax with the shape thickened in the area of the silicone torus. It is pressed tightly to the surface of the model with a warm hair dryer. The acrylic plastic is molded and the two parts of the cuvette are joined and placed under the press. The cuvette is opened from the press and the wax base is squeezed out. The acrylic surface is in the usual manner treated with an adhesive and the soft plastic is molded and then cooked in the usual manner. With this work, the total thickness of the denture base will be equal to the thickness of one wax plate. This ensures a uniform thickness of the acrylic and the soft liner, which is very important for the prosthodontics clinic. This provides sufficient torus isolation to ensure pain-free use of removable dentures. This approach to the fabrication of double-layered bases provides clinicians with a successful outcome for their patients.

This technique was used for acute bone protrusions, exostoses, pronounced torus, and other bone formations that do not allow for conventional orthopedic treatment with removable plate prostheses.

In the main group of patients with a total lack of teeth in the orthopedic dentistry clinic, we made prostheses with a two-layer base from Gossil, 38 prostheses; from Fuji, 19 prostheses; and from Mucoprene, 17 denture units. In the case of partial absence of teeth, 22 prostheses were made of Gossil, 14 of Fuji, and 9 of Mucoprene. A total of 119 dentures were made. Follow-up was conducted from 1 to 12 months.

In the initial days of the use of the soft-padded removable plate dentures, patients were anxiously awaiting the sensation of pain. The improved functional qualities enabled patients to use their prostheses fully from the initial days. The patients complained of pain in certain points under the prosthesis, which were easily resolved. The patients were able to perform the act of chewing to the fullest extent and felt comfortable. After 3–10 days, the patients had fully adapted, successfully used the prosthesis, and did not complain; noted better fixation of the prosthesis; no pain under the prosthesis, but some remained wary of pain or possible breakage of the prosthesis.

Clinical studies over time (6,90,365 days) showed that the use of soft pads in removable dentures resulted in good fixation of fully removable dentures in 72.7% of the cases, satisfactory in 27.3% of the cases.

We have had two negative cases in our practice. In the first case, the patient began to smell of laundry soap while using a two-layer base made of Fuji material. The dentures were remodeled with GoSsil. In the second case, the soft GoSsil lining on the edges of the denture had become frayed, i.e., part of the outer surface of the GoSsil lining had moved away from the main mass in the form

of broad strands. We cut off the threads and repolished the denture. The patient successfully used the prosthesis.

CONCLUSIONS

(1) In the case of removable denture wearers with a total lack of teeth, there were 55.3% complaints of chewing disorders and poor fixation of dentures, and in the case of partially removable denture wearers, the greatest number of complaints of clasp fixation disorders were found in 42.1% of the cases. (2) Physico-mechanical study of soft linings from different countries, Gossil (Russia), Fuji (Japan), and Mukopren (Germany), showed their effectiveness and the possibility of their use in the clinic of orthopedic dentistry. (3) Researches conducted allowed to create a clinical classification of torus depending on pain sensitivity of oral mucosa. Type I - painless torus, type II - moderately painful, and type III painful when touching. (4) The technology for manufacturing two-layer bases of removable dentures was developed and recommended for improvement.

FUNDING

No

AUTHORS CONTRIBUTIONS

All the authors have contributed equally.

CONFLICT OF INTERESTS

The authors declare no conflicts of interest.

REFERENCES

1. Ferracane, Jack L. Materials in dentistry: principles and applications. Lippincott Williams & Wilkins, 2001.
2. Akbarov AN. Clinical and immunological evaluation of FarGALS efficacy during the process of adaptation in patients with removable plate Prothesis depending on age. Journal of life Science and Biomedicine. 2017;7(4):37–41.
3. Lebedenko I. Yu., Kalivradzhyan E.S., Orthopedic dentistry. Moscow. 2012; C.640.
4. GOST 262-79. Rubber. Method for the determination of tear resistance. M. 1979
5. GOST 270-75 Rubber. Method for determining elastic tensile properties. M.1982
6. Sheikh O, Perry M. The Lips, Mouth, Tongue and Teeth: Part II. In Diseases and Injuries to the Head, Face and Neck, 2021 (pp. 1085–1168), Springer, Cham. https://doi.org/10.1007/978-3-030-53099-0_25
7. Kulkarni MR, Bakshi PV, Kavlekar AS, Thakur SL. Applications of a modified palatal roll flap in peri-implant soft-tissue augmentation - A case series. J Indian Soc Periodontol. 2017;21(4):333–336. https://doi.org/10.4103/jisp.jisp_87_17
8. Laney WR. Processed resilient denture liners. Dental clinics of North America. 1970;14(3):531–51. https://doi.org/10.1016/S0011-8532(22)01562-2
9. Windekner D. Rudalmasen alabelt teljes also fagrotlasok klinici vizsgalata. fogow. Szli. 1969;62:215–218.
10. Ruzuddinov N.S., the results of using various soft pads in removable prosthetics. Abstracts of the VII-International Congress of Science and practice of dentistry in Kazakhstan, Almaty, 2015.
11. Ruzuddinov S. Materials science in orthopedic dentistry Almaty, 2012. pp. 212.