

Use of elastic materials for relining removable dentures in edentulous elderly patients

Zastosowanie elastycznych materiałów do wyścielenia protez ruchomych w leczeniu bezzębnych pacjentów w wieku podeszłym

Klinika Gerostomatologii, Uniwersytet Medyczny im. Karola Marcinkowskiego w Poznaniu

Abstract

Clinical studies have shown that patients with an edentulous maxilla and/or mandible who demonstrate continuous, progressive and irreversible resorption of the alveolar ridge bone in the maxilla and mandible constitute a large group among elderly patients. That situation, occurring mostly in the mandible, is the reason why it is often very difficult to restore the function of the masticatory organ by using removable complete dentures without causing pain. It is therefore necessary for the dentist to take full advantage of the techniques and materials available in order to satisfy the patient in terms of comfortable use of a prosthesis. The article presents various methods of using soft elastic materials for prosthetic rehabilitation of elderly patients with an extremely difficult condition of the prosthetic base. The authors discuss the use of low- and high-temperature polymerized silicone elastomers as complete denture liners. On the basis of their own clinical experience they demonstrate that this approach is successful in treatment of dental patients aged above 65 by eliminating pain resulting from traumatic loading of the prosthetic base.

Keywords: geriatric dentistry, complete denture, soft lining materials, silicone elastomers, reline.

Streszczenie

W populacji osób starszych dużą grupę stanowią pacjenci z bezzębieniem szczęki i/lub żuchwy oraz nieodwracalnym procesem resorpcji kości wyrostków zębodołowych. W związku z powyższym rekonstrukcję z zastosowaniem całkowitych protez ruchomych stwarzają przywrócenia sprawności czynnościowej narządu żucia. Lekarz stomatolog staje zatem przed koniecznością wykorzystania technik i materiałów umożliwiających przywrócenie estetyki i czynności narządu żucia przy zapewnieniu pacjentowi optymalnego komfortu użytkowego. Artykuł Praca prezentuje różne metody wykorzystania miękkich materiałów elastycznych w rehabilitacji protetycznej pacjentów starszych, u których stwierdzono trudne warunki podłoża protetycznego. Użycie elastycznych materiałów protetycznych należących do grupy elastomerów silikonowych polimeryzujących w temperaturze jamy ustnej oraz w wysokiej temperaturze są przedmiotem tego artykułu. Materiały elastyczne kompensują małą resiliencję śluzówkowego podłoża pod całkowitymi protezami i mogą być użyteczne przy doraźnym oraz finalnym leczeniu protetycznym bezzębnych pacjentów. Zastosowanie materiałów elastycznych umożliwiło skuteczną rehabilitację narządu żucia, szczególnie w początkowym okresie adaptacyjnym do protez ruchomych całkowitych.

Słowa kluczowe: stomatologia geriatryczna, proteza całkowita, miękkie masy wyścielające, elastomery silikonowe, podścielenie.

Introduction

Processes connected with population aging cause patients' medicinal needs and requirements to change. Despite increasing awareness and appropriate health-promoting attitudes, the number of natural teeth is decreasing with age, and the number of individuals in need of reconstructive treatment using removable dentures is growing [1, 2]. Epidemiological research by Wochna-Sobańska and Borysewicz-Lewicka has shown that almost 4% of Polish people aged 35 to 44 do not have any teeth. In turn, the problem of edentulousness concerns 40% of Poles aged 65 to 74 [3]. The moment teeth are lost and the bone is not stimulated by the periodontal ligament an irreversible process of

resorption of the alveolar ridge bones, which constitute the main foundation for mucosa-supported removable dentures begins. Difficult conditions of the prosthetic base have a negative impact on stabilisation, retention and aesthetics of dentures, as well as comfortable use thereof. In recent years, the possibilities of rehabilitating the stomatognathic system have significantly expanded, even in patients with very difficult base conditions [4]. General and local contraindications, in addition to high costs of implant surgical procedures, still cause conventional removable dentures to be commonly used. Long-lasting edentulism, lack of control and regular replacement of dentures result in considerable destruction of the edentulous base, i.e. disappearance of the bony structures and chan-

ges in the soft tissues covering them. A thin, dry, low-resilience mucous membrane does not offer a good support for a complete denture nor does it allow to achieve an appropriate suctioning effect. A sensitive mucous membrane, susceptible to mechanical damages and infections, particularly in elderly people often suffering from xerostomia, is conducive to a number of ailments. During the process of chewing, a thin mucous membrane located between the hard bony bed and the hard denture saddle relocating horizontally triggers a lot of pain and injuries of the bed.

Soft lining materials, due to their elasticity, are helpful in using traditional prosthetic restorations by patients. These materials compensate for the resilience of the mucous bed under complete dentures, and are useful in short-term and final prosthetic treatment of edentulous patients. They are particularly applicable in those clinical situations in which edentulism lasting for many years has led to significant vertical and horizontal resorption of the alveolar ridge bones, and thus to considerable constriction of the bedding area of a mucosa-supported denture. A lost, not very adaptable prosthetic area impedes denture stabilisation, which results in significant mobility thereof, sometimes of several millimetres, in relation to the base (**Figure 1**). The surface area of the base in an edentulous mandible is often several times smaller than the prosthetic area of an edentulous maxilla, therefore pain is reported more frequently by users of lower complete dentures. Soft lining materials make a thin (at least 2 mm) elastic layer spreading over part of or the whole mucosa-supported denture area. They cause the forces triggered during the act of chewing to be moved through the denture body in an optimised way, minimising the traumatic impact of the restoration on the sensitive, rigid tissues of the prosthetic base [5–7]. Experimental research using numerical modelling by the finite element method (FEM), published by Żmudzki and Chladek, has emphasised particular effectiveness of elastic layers of mucosa-supported denture parts, especially in central saddle areas on bone bulges [8]. If pressure ulcers appear on the slopes of developed alveolar ridges, it may turn out that lining with a soft material will strengthen the shearing force affecting these regions and will facilitate deep pressure sores. As the authors inform, lining dentures with soft materials may have significant influence on increasing the shearing forces which are approximately twice as strong deep in tissues close to bones, up to 300 kPa. Such a situation results from greater tissue deformation, which is a consequence of pressure equalisation, i.e. shifting part of it from the central area to the alveolar slopes.

These materials may also be used to improve complete denture seal by taking advantage of retentive areas, e.g. in the cases of the so-called

overcontoured alveolar ridges or maxillary tuberosities, as well as in the postmandibular space near the base of the tongue. They allow to use a denture in the oral cavity in an atraumatic way, improving the functional adhesion at the same time (**Figure 2**).

Generally, soft lining materials are divided into silicone elastomers and plasticised acrylates; however, as far as the way of hardening them is concerned, materials polymerising at high temperatures are distinguished from those self-polymerising at oral cavity temperature (room temperature). Lining with the use of the latter may be conducted in a dental surgery by the so-called direct method or in a prosthetic laboratory by the so-called indirect method. Lining with the use of materials polymerising at elevated temperatures may only be performed in a prosthetic laboratory after a functional impression has been taken [9, 10].

Depending on the chemical composition and the way the hardening reaction proceeds, lining materials show different mechanical properties (resilience, stretching). In static compression tests, both silicone and acrylic soft prosthetic materials vulcanising at room temperature demonstrate greater elasticity than those hardened at high temperatures, but they display less resistance to stretching. On the other hand, acrylic soft lining materials display greater elasticity in comparison with silicone elastomers. Awareness of the abovementioned differences between the individual lining materials enables a practicing doctor to choose the right lining method and apply an appropriate material for a specific clinical situation [11, 12, 13] (**Figures 3–4**).

Aim

The aim of the study is to present cases in which elastic prosthetic materials were used in elderly patients wearing traditional, mucosa-supported complete removable dentures.

Case 1

A female patient aged 83 with maxillary and mandibular edentulism and advanced mucosal and bony atrophy reported to the Clinic of Geriatric Dentistry because of significant discomfort caused by 2 complete dentures. A characteristic overcontoured mandibular alveolar ridge offered a chance to radically improve the stability and retention of the lower denture. A hard bottom of the oral cavity, not very adaptable or elastic mucous membrane covering the lost base as well as low stability and horizontal mobility of the denture caused the patient permanent pain. In spite of a few adjustments, the dentures, particularly the mandibular one, did not ensure comfort due to the base ailments in different areas of the immobile mucous membrane.

A procedure of making complete dentures, oriented at elderly people, was applied, and both dentures were prepared on the basis of myody-



Figure 1. Non-impressionable oral mucosa, unfavorable to receive functional adhesion of the denture

Rycina 1. Małopodatna błona śluzowa jamy ustnej utrudniająca uzyskanie czynnościowego przysysania protezy górnej



Figure 2. Non-resorbed edentulous alveolar ridge in the anterior part of the mandible

Rycina 2. Niezresorbowany wyrostek zębodołowy w przednim odcinku żuchwy

dynamic impressions. As a result of the treatment, a fully satisfying aesthetic effect was achieved.

Since appropriate occlusal relationships were kept, and the height of occlusion did not require correction, a decision was made to reline the lower denture with an elastic material. The silicone material Mucopren from Kettenbach, undergoing a condensation polymerisation reaction at oral cavity temperature, was used in the treatment. Before taking the impression relining with the elastic material, the removable denture was prepared according to generally accepted procedures (per-

forations, roughening of mucosal and vestibular denture surfaces, reduction of undercuts). After establishing the lining boundary (determining the thickness of the lining material layer), a number of point openings were made on the whole mucosal surface of the denture with a round bur of 2 mm in diameter. Next, the excess of the hard acrylic material was removed, not exceeding the bottom of the previously prepared grooves (**Figure 5**). Three support points (stoppers) were maintained, whose function was to hold the denture on the mucosal-bony base without a change in the established

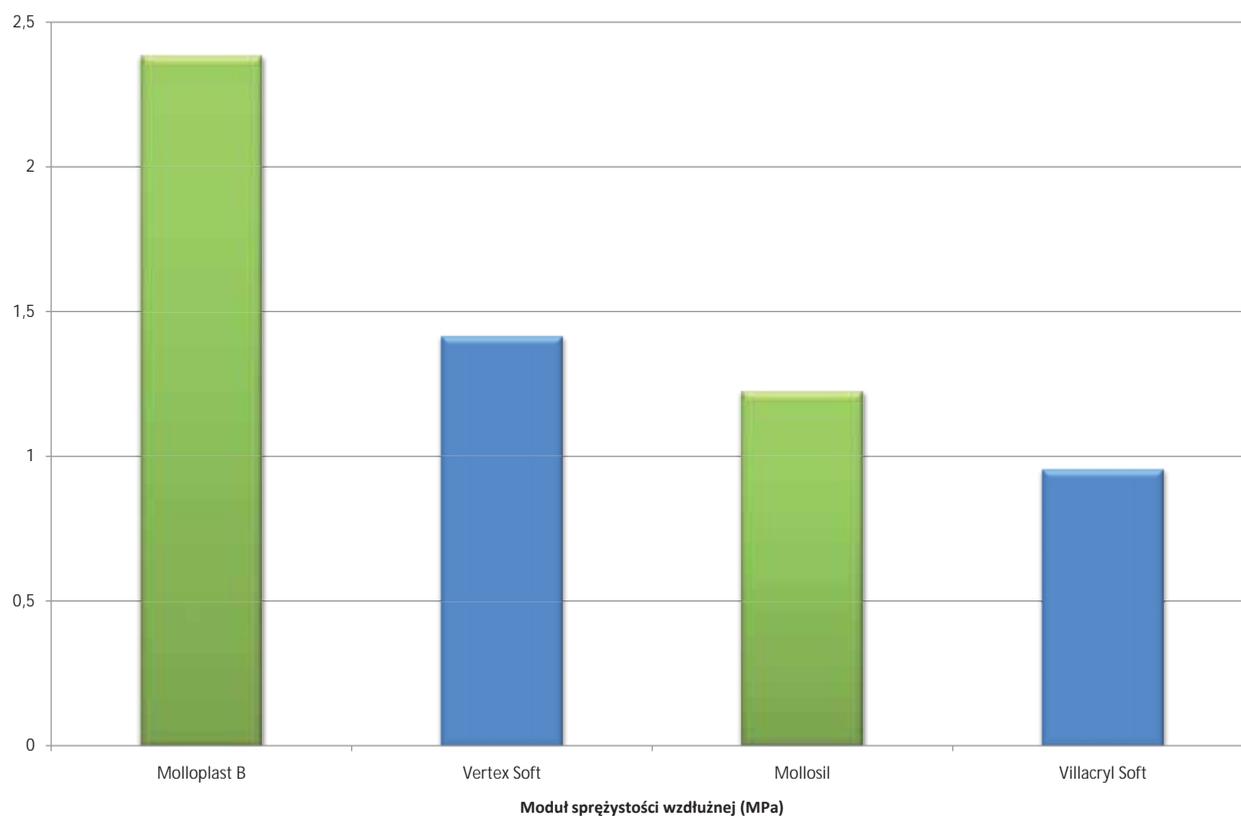


Figure 3. Mean values of modulus of elasticity obtained in the compression test

Rycina 3. Średnie wartości modułu sprężystości wzdłużnej uzyskane w teście ściskania

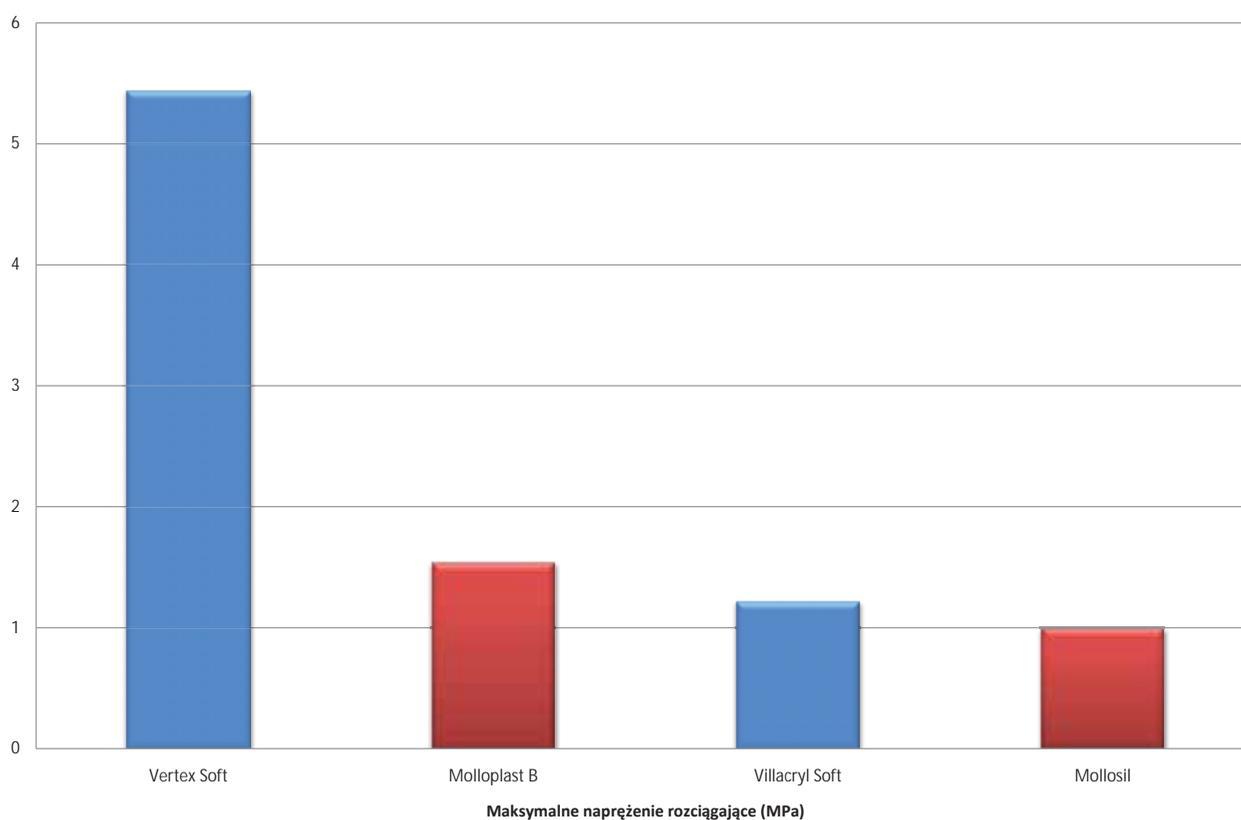


Figure 4. Mean values of maximum tensile stress obtained in the tensile test

Rycina 4. Średnie wartości maksymalnego naprężenia rozciągającego uzyskane w teście rozciągania



Figure 5. Soft lining material Mucopren (Kettenbach)
Rycina 5. Miękka masa wyścielająca Mucopren (Kettenbach)



Figure 6. Lower denture lined by Mucopren, used for 2 years
Rycina 6. Proteza dolna wyścielona materiałem Mucopren

height of occlusion accepted by the patient. In the further part of the clinical procedure, the stoppers were removed, and the resulting cavities were filled with the same material before putting the relined denture in the oral cavity again.

The free edge of the elastic material was placed on the vestibular and lingual surface of the denture so that its ventral edge was also covered. Such an extent of the elastic lining material ensured not only better durability of the connection with the basal acrylic, but also comfortable use and functional adhesion of the denture.

An appropriate aesthetic appearance is an advantage of the silicone material used for lining, besides good mechanical properties. Dosing the material with the dispensing gun makes using Mucopren in clinical practice easy, fast and effective.

After applying the material on a properly prepared mucosal denture surface the patient shaped its edge with a closed mouth carrying out functional excursions in tightening, stretching (according to Herbst tests) and swallowing saliva. Shaping the lingual part of the lower denture was possible when the patient made the recommended tongue

movements with an open mouth, with the doctor holding the denture in the initial phase of forming the impression.

After the final polymerisation of the lining layer in warm water (as recommended by the producer), the patient received the individually shaped denture relined with the elastic material (**Figure 6**).

Regular check-ups enabled to note that the pain eased to such an extent that the patient could use the dentures without the need to eliminate foods which had been the source of pain during the act of chewing.

Case 2

A female patient aged 86 with a considerably atrophic prosthetic base in an edentulous maxilla and mandible reported to the Clinic of Geriatric Dentistry because of intense and fluctuating pain in the mandible area covered by a complete denture. In an extra- and intraoral examination abnormal spatial parameters were found both in the vertical and horizontal plane (lowered height of occlusion, false prognathism), in addition to a lack of functional adhesion of the restoration. Since adaptation of the old restoration via relining turned out to be insuf-



Figure 7. Soft lining material Molloplast B (Detax)

Rycina 7. Miękka masa wyścielająca Molloplast B (Detax)



Figure 8. Mucosal surface of the lower denture lined on the entire surface by Molloplast B

Rycina 8. Dośluzowa powierzchnia protezy dolnej wyścielona materiałem Molloplast B

ficient, a decision was made to prepare new dentures. The lower one was relined with the elastic material Molloplast B from Detax (relining by the indirect method) (**Figure 7**).

Lost bone structures of alveolar ridges and a non-adaptable, dense mucous membrane of the oral cavity and its hard bottom do not facilitate a complete denture stability and hinder satisfying functional adhesion. The abovementioned conditions constitute an indication for new prosthetic restorations made with the use of myodynamic impressions. This method uses lip, cheek and tongue muscle groups passively and actively functioning against one another, in order to better maintain dentures on the base. In contrast to conventional dentures, the edge of myodynamic ones is formed in a different way. Occlusal templates are attached to custom trays, and, first, the spatial relationship between the maxilla and mandible is determined, and only then are functional impressions taken when the mouth is closed. All the aforementioned procedures (occlusal registration and functional impressions) are performed on the same day, which reduces the number of appointments.

The indirect lining method, applied in this case, resembles fabrication of classical removable restorations in terms of technical aspects. The only difference is inserting the so-called space maintainer during denture polymerisation, which usually comes in the form of a single wax plate (approx. 2 mm thick), into the prosthetic flask before the acrylic dough is stuffed into it. After initial polymerisation of the acrylic material, the elastic lining material is put into the place of the space maintainer. The laboratory stage is ended with the further phase of the polymerisation process conducted according to the producer's recommendations, and finishing the denture. What is particularly important is working on the elastic layer of the denture saddle with the use of special rotary instruments. A characteristically-shaped mill enables to remove larger fragments of the lining material, mainly from the transition area between the elastic material and the denture plate. A metal rotary brush placed in a technical straight handpiece was used to give the relined denture a final polish. It allowed to remove different types of scraps, particles and remnants of the material that stuck to the denture in the course of the previous procedures. Any attempts at jerking, pulling or prising might result in delamination or even tearing the material off the denture surface, thus destroying the reline.

After fitting the finished dentures, the lower one of which was additionally relined with the elastic material, one check-up was conducted, during which the patient reported slight pain within the rear boundary of the maxillary prosthetic area, whereas the mandibular relined denture offered comfort of use thanks to the cushioning silicone layer (**Figure 8**).

Conclusion

Soft lining materials facilitate effective rehabilitation of patients suffering from permanent pain connected with the use of conventional alveolar mucosa-supported removable dentures. It shall be emphasised that the complete denture base is not physiologically adapted to reception of direct occlusal forces, which means that it is at risk of injury even when the chewing forces are weak. Lining denture saddles with elastic materials seems to be an excellent alternative, especially in the cases of elderly people, as the risk of further losses making prosthetic treatment more difficult is particularly high. Supporting the saddle of a relined denture in the vicinity of mental foramina located, as a result of atrophy, on the reception surface of chewing forces does not cause irritation or pain of the mental nerves. It aids, then, better use of a complete restoration, most frequently supported on a non-adaptable mucous membrane covering the bony structures of the prosthetic base. Filling retentive spaces with soft materials makes it possible to optimally take advantage of the anatomical conditions of the prosthetic base (rounded maxillary tuberosities, postmandibular space), and seal denture edges effectively, which is a necessary condition for functional adhesion thereof.

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Adres do korespondencji:

Klinika Gerostomatologii
Uniwersytet Medyczny im. Karola Marcinkowskiego w Poznaniu
ul. Bukowska 70
60-812 Poznań
tel.: 61 854 70 78
e-mail: rafal.brozek@gerostomatologia.pl