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Applying the Overdentures in the Geriatric Patients with Residual and Reduced Dentition

**Zastosowanie całkowitych protez pokrywających
u pacjentów geriatrycznych
z uzębieniem resztkowym i zredukowanym**

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Abstract

Background. In a case of patients with residual dentition, prosthetic specialists face difficult decision pertaining the choice of the most beneficial prosthetic construction. With the majority of patients, there is the chance for maintaining the remaining few teeth in the mouth. This is possible thanks to the proper preparation of the teeth and construction of the overdentures.

Objectives. The purpose of the study was to present the results of the treatment of patients with overdentures made on residual and reduced dentition, and thus to establish the usefulness of the terminal dentition in rehabilitation of the stomatognathic system.

Material and Methods. The authors examined a group of 48 patients with residual and reduced dentition at the Department of Prosthodontics in Wroclaw. Age of the patients ranged from 50 to 70 years. All the patients underwent the stomatological examination. Majority of the patients had a very long prosthetic history using the partial removable dentures. The above mentioned dentures were the reason for the patients complaints during the anamnesis, as well as it was the cause of painful symptoms in the prosthetic foundation and inflammation of the periodontium. During the preprosthetic preparation, 41 teeth were removed (35 of them due to pathological mobility and 6 other teeth due to apical root changes). 114 teeth were treated endodontically and shortened to the gingival level. Among them, 112 roots were covered by metal copings, glassionomer or amalgam in order to use them as abutments for overdentures. The patients taken into treatment were provided with 96 dentures including 57 complete overdentures, 26 conventional total dentures, 5 removable partial dentures (4 metal framework and 1 acrylic). Moreover, 7 metal-ceramic crowns and 1 bridge were made. Also 3 types of prosthetic attachments were applied to increase retention, especially with the lower overdentures (magnetic, bars stud).

Results. The outcome of the treatment was estimated after 3-year period of observation. Success of prosthetic treatment was evaluated using the following criteria: subjective report of the patients on usage of their prostheses, the evaluation of the periodontium around and mobility of the abutment teeth, the hygiene of the oral mouth and dentures. Each of the above mentioned criteria was evaluated in 3 point scale. A maximum of 9 points was considered as a very good result of treatment and it was obtained by 38 patients (almost 80%).

Conclusions. Basing upon the conducted clinical research, it can be stated that the overdenture with and without attachments, applied in the treatment of patients with residual dentition are: especially useful in the extensive loss of teeth in the mandible, comfortable because they improve chewing, speech, good appearance, and moreover they slow down the transferring to complete edentulous state (**Dent. Med. Probl. 2004, 41, 2, 255–261**).

Key words: overdentures, residual dentition, attachments.

Streszczenie

Wprowadzenie. W przypadku pacjentów z uzębieniem resztkowym i zredukowanym lekarze protetycy często stoją przed trudnym wyborem najbardziej korzystnego uzupełnienia protetycznego. U większości pacjentów istnieje szansa na zachowanie pozostałych w jamie ustnej nielicznych zębów, dzięki odpowiedniemu ich przygotowaniu i wykonaniu protez pokrywających.

Cel pracy. Przedstawienie wyników leczenia, z zastosowaniem protez pokrywających, pacjentów z uzębieniem resztkowym i zredukowanym oraz ustalenie przydatności tych zębów w rehabilitacji protetycznej układu stomatognatycznego.

Materiał i metody. Materiał badawczy stanowiło 48 pacjentów w wieku 50–70 lat, z uzębieniem resztkowym i zredukowanym, którzy zgłosili się do Katedry Protetyki we Wrocławiu w celu leczenia protetycznego. Wszystkich pacjentów poddano szczegółowemu badaniu stomatologicznemu. W większości były to osoby z bogatą przeszłością protetyczną, posługujący się protezami częściowymi osiadającymi, które były przyczyną dolegliwości zgłoszonych podczas wywiadu oraz bolesnych zmian w podłożu protetycznym i w przyzębiu. W ramach przygotowania przedprotetycznego usunięto 41 zębów (35 z powodu patologicznej ruchomości, a 6 ze zmianami okolowierzcholkowymi). Przeleczono endodontycznie i skrócono do poziomu dziąsła 114 zębów, 112 pokryto metalowymi czapeczkami, cementem glasjonomerowym lub amalgamatem w celu wykorzystania ich jako filary pod protezy pokrywające. U przyjętych do leczenia pacjentów wykonano łącznie 96 prac protetycznych, w tym 57 całkowitych protez pokrywających, 26 konwencjonalnych protez całkowitych, 5 ruchomych protez częściowych (4 szkieletowe, 1 akrylanowa). Wykonano ponadto 7 koron metalowych licowanych ceramiką i 1 most lany licowany tworzywem akrylanowym. W celu zwiększenia retencji, zwłaszcza dolnych protez pokrywających, zastosowano 3 rodzaje zaczepów protetycznych (magnesy, kładki, zaczepy kulkowe).

Wyniki. Wyniki leczenia ustaloną na podstawie 3-letniego okresu obserwacji. Powodzenie leczenia oceniano posługując się następującymi kryteriami: subiektywnymi odczuciami pacjenta związanymi z użytkowaniem protez, oceną stanu przyzębia i ruchomości pozostawionych filarów, stanem higieny jamy ustnej i protez. Każde z wymienionych kryteriów było oceniane w skali trzystopniowej. U 38 pacjentów uzyskano maksymalną liczbę punktów – 9 (prawie 80%), co uznano za bardzo dobry wynik leczenia.

Wnioski. Na podstawie przeprowadzonych badań klinicznych można stwierdzić, że protezy pokrywające z zaczepami i bez zaczepów protetycznych, stosowane w leczeniu pacjentów z uzębieniem resztkowym i zredukowanym, są szczególnie przydatne w przypadku obecności nielicznych zębów w zuchwie, zapewniają komfort żucia i mowy, dobry wygląd oraz opóźniają całkowitą utratę zębów (*Dent. Med. Probl.* 2004, 41, 2, 255–261).

Słowa kluczowe: protezy pokrywające, uzębienie resztkowe, zaczepy protetyczne.

With the aging of the population, the needs of the elderly patients regarding the proper functioning of the stomatognathic system have been also increasing [1–5]. In a case of elderly patients with residual or reduced dentition, the prosthetic specialists face a difficult decision pertaining the choice of the most adequate prosthetic construction. With the majority of patients there is the chance for maintaining the remaining few teeth in the mouth [6–8]. This is possible thanks to the proper preparation of the teeth and construction of the overdentures. The recent studies indicated the value of the last remaining teeth in the oral mouth especially emphasizing their advantageous influence on maintaining the size and shape of the residual ridge [7, 9, 10]. Even in cases of endodontically treated teeth, the periodontal perception is maintained and thus they may be used as abutments to support the overdentures. Moreover, they can be used to anchor the prosthetic attachments which improve the retention of the lower total overdentures in so called “difficult cases” [11–14].

The goal of this research was to present the results of treatment of patients with overdentures made in residual and reduced dentition, and thus to establish the usefulness of the terminal dentition in the rehabilitation of the stomatognathic system.

Material and Methods

Material of the study was a group of 48 patients selected from patients referred to the

Department of Prosthodontics, Wrocław Medical University, for consultation or prosthetic treatment. Among them, there were 30 females and 18 males. Age of the patients ranged from 49 to 70 years. The most numerous group consisted of 30 patients (62%) aged from 50 to 70 (tab. 1). All the patients were informed about the purpose and methods of the study and signed the written consensus.

All the patients underwent the stomatological examination. Clinical examinations were supplemented with radiological data (pantomograph and intra-oral isometric ortoradial X-ray). Majority of the patients had already the rich experience in using partial acrylic removable dentures. They were not satisfied with using the dentures and complained of difficulties during mastication as well as the pain in the mucous membrane, periodontium or some remaining teeth. Disturbed aesthetics of dentures was a cause of considerable discomfort too. Anamnesis revealed also frequent fractures of dentures in the area of abutment teeth. A great disturbance of occlusal plane and changes in vertical dimension of occlusion were also observed as well as an increased accumulation of dental and denture plaque. On a basis of clinical examination, the following pathologies were found: periodontitis, stomatitis, root caries and increased mobility of some abutments. The number and percentage of teeth with and without pathological mobility before oral mouth sanitation is presented in tab. 2. 14% of teeth were in the 3rd degree of mobility, and thus qualified for extrac-

Table 1. Distribution of 48 overdenture subjects according to age and gender**Tabela 1.** Podział leczonych pacjentów ze względu na wiek i płeć

| Sex (Płeć) | Age – years (Wiek w latach) | | | | | | | |
|------------------|-----------------------------|----|-------|----|------|----|---------------|-----|
| | < 50 | | 51–70 | | > 70 | | total (razem) | |
| | n | % | n | % | n | % | n | % |
| Female (Kobiety) | 5 | 17 | 19 | 63 | 6 | 20 | 30 | 62 |
| Male (Mężczyźni) | 1 | 6 | 11 | 61 | 6 | 33 | 18 | 38 |
| Total (Razem) | 6 | 13 | 30 | 32 | 12 | 25 | 48 | 100 |

tion. The teeth with 1st and 2nd degrees of mobility (31%) were planned to be treated endodontically due to using them as abutments for the prospective overdentures. Majority of teeth (55%) did not reveal pathologic mobility, however, they also required pre prosthetic treatment due to elongated clinical crowns. Increased caries incidence was especially seen in the area of the crown-root border. The same table presents that 31 (21%) teeth had already been devitalised before the treatment and 114 (79%) teeth required endodontic treatment. Oral mouth and denture hygiene maintenance were checked as well. The hygiene was assessed in 3 degree range: very good – no dental or denture plaque; good – trace amounts of dental and denture plaque; unsatisfactory – significant amounts of dental and denture plaque. The data from the study revealed that the hygiene before the treatment was very good in 25%, good in 52% and unsatisfactory in 23% of cases. The patients with poor oral hygiene (about 25% of cases) were obliged and motivated to improve their hygienic habits, because it was considered as a must for performing further prosthetic treatment and maintaining the long-lasting result of treatment.

Table 2. Status of oral mouth before treatment**Tabela 2.** Stan jamy ustnej przed leczeniem

| Examined parameters (Badane parametry) | n | % |
|--|-----|----|
| Mobility of teeth by Entin (Ruchomość zębów wg Entina) | | |
| without (bez patologicznej ruchomości) | 134 | 55 |
| I°–II° | 76 | 31 |
| III° | 35 | 14 |
| Teeth devitalized before treatment (Zęby zdewitalizowane przed leczeniem) | 31 | 21 |
| Teeth planned to be endodontically treated (Zęby planowane do leczenia endodontycznego) | 114 | 79 |
| Hygiene of oral mouth before treatment (Higiena jamy ustnej przed leczeniem) | | |
| very good (bardzo dobra) | 12 | 25 |
| good (dobra) | 25 | 52 |
| unsatisfactory (dostateczna) | 11 | 23 |

All the patients were divided in accordance with residual dentition location (tab. 3). It reveals that residual dentition in the mandible was preserved almost in half of the patients (49%) while in 6 other patients (13%) this type of dentition was found only in the maxilla. In other 20 patients (38%), residual dentition appeared in both the maxilla and mandible.

Clinical Procedure in Patients with Residual and Reduced Dentition

Treatment procedure in patients with residual and reduced dentition can be divided into several stages. They all should be connected one with another and performed in a proper sequence. At first, on the basis of the patient's history, clinical and radiological examination, the decision is made, together with the patient, which teeth should be extracted or left for endodontic, conservative, periodontic and pre prosthetic treatment. The teeth selected for extraction are those which are totally useless in further prosthetic treatment or could be harmful for the patient's health. They are usually at the 3rd degree of mobility with severely cariously damage of root in the cervical region as well as teeth with periapical lesions which exclude the possibility of resection, hemisection or radectomy.

After such oral cavity sanation, the quality of other abutments for future overdentures is assessed. The assessment usually concerns: periodontium condition, pulp vitality and susceptibility to teeth caries. As far as periodontium is concerned, the following parameters should be considered: abutment teeth osseous support, teeth mobility, periodontium inflammatory conditions

In the patients with residual dentition, the choice of abutments as the potential support or retention elements depends on prosthetic occlusal plane design and properly established vertical dimension of occlusion (15–17). Especially the vertical dimension is of great significance as it determines the distance between the alveolar processes and the method of the proper root carrying surface

preparation, and consequently, the kind of possible attachment [11, 14]. The above occlusal assessment is made on diagnostic models with occlusal wax rims. It should be noted that in patients with type C-2 dentition by Eichner and a great maxilla-mandible disproportion, there are some difficulties in establishing the proper location of occlusal plane and harmonized setting the artificial dental arches. In such cases, the treatment is confined to reduction of remaining teeth to about 2 mm above the gingival level [1, 10]. Endodontic treatment should precede the shortening of clinical crowns. The exception are the teeth with vital pulp and short clinical crowns as well as the teeth with attrition or obliterated pulp within the crown or root. Endodontic treatment should be performed in accordance to generally accepted methods, however, choosing the filling material should be dependent on processing techniques in the further procedures. This is why silver pins, resin cements and other completely hardening materials are contraindicated. If the root canal is obturated with not hardening material associated with gutta-percha (i.e. Endometnazon paste), special attention should be paid to the following: on the attachment patrices location preparation, gutta-percha cannot be completely removed from the root canal and the material cannot be accidentally pushed through the root apex [1, 18].

Next step is a clinical crown reduction which also improves the frequently disturbed biostatics of endodontically treated teeth (elongated clinical crown works like a single arm lever causing the tooth inclination and overloading the periodontal small support). Degree of crown shortening depends on kind of overdenture support design. If role of the tooth is to support the denture only, then it can be reduced to 1 mm above the gingival level. However, if it is to be used as abutment in order to improve stability on lateral forces activity, its height must be at least 3 mm. The tooth can never be reduced below the gingival margin, because then, inflammation of periodontium or various kinds of gingival irritation are possible [19–21].

If the reduced root is not to be covered with a cast coping, then the carrying surface should be prepared dome regularly shaped. The canal orifices should be protected with special materials (amalgam, glassionomer cement or composite). In the case of making a cast coping the rest of the root should be prepared in accordance to with the subgingival crown requirements. In 48 patients qualified for the treatment, 112 dental roots were protected for future overdentures as follows: metal coping were used in 74% (82 teeth), glassionomer cement in 22% (25 teeth), and amalgam in 4% (5 teeth), (tab. 4). Moreover, in the treated

Table 3. Number of patients according to location of residual dentition

Tabela 3. Liczba pacjentów w zależności od rozmieszczenia uzębienia resztkowego

| Residual dentition (Uzębienie resztkowe) | In maxilla (w szczęce) | | In mandible (w żuchwie) | | In maxilla and mandible (W szczęce i żuchwie) | |
|---|------------------------|----|-------------------------|----|--|----|
| | n | % | n | % | n | % |
| No. of patients (Liczba pacjentów) | 6 | 13 | 24 | 49 | 18 | 38 |

Table 4. Number and kind of carrying surface root protection

Tabela 4. Liczba i rodzaj zastosowanych zabezpieczeń powierzchni nośnych korzeni zębów

| Kind of protection (Rodzaj zabezpieczenia) | Cast coping (Lane czapeczki) | | Amalgam (Amalgamat) | | Glassionomer cement (Cement glasjonomerowy) | | Total (Razem) | |
|---|---------------------------------|----|------------------------|---|--|----|---------------|-----|
| | n | % | n | % | n | % | n | % |
| No. of protections (Liczba zabezpieczeń) | 82 | 74 | 5 | 4 | 25 | 22 | 112 | 100 |

Table 5. Number and kind of prosthetic attachment applied in overdentures

Tabela 5. Liczba i rodzaj zastosowanych zaczepów protetycznych w protezach pokrywających

| Kind of attachment (Rodzaj zaczepu) | Stud (Kulkowe) | | | | Magnetics (Magnessy) | | Bars (Kładki) | | Total (Razem) | |
|---|----------------|----|----------|----|-------------------------|----|------------------|---|------------------|-----|
| | Flexi-post | | Rhein'83 | | | | | | | |
| | n | % | n | % | n | % | n | % | n | % |
| No. of attachments (Liczba zaczepów) | 32 | 57 | 13 | 23 | 7 | 13 | 4 | 7 | 56 | 100 |

patients, three kinds of prosthetic attachments were used (tab. 5). There were stud-type and bar-type attachments as well as magnetic attachments. On the total, two kinds of stud-type attachments were used: 32 Flexi-Post attachments (30 in lower dentures and 2 in upper dentures), 13 Rhein'83 attachments (9 in lower dentures and 4 in upper dentures); 7 magnetic attachments and 4 bar attachments (all in lower dentures). In accordance with the attachment kind, all the patrices were placed either inside or on the carrying surface of teeth roots. 50 patrices were seated in the mandible teeth, which is 89% of the total, and only 6 patrices were settled in the maxilla (11%). After attachments patrices seating on the abutment teeth, complete overdentures were performed. In 48 patients, 57 complete overdentures were made (tab. 6). In all the treated patients, lower dentures were made with the Wroclaw method by Plonka [22]. After the border functional extension of the lower trial denture, mucodynamic impression was done with the mouth closed. Although prosthetic attachments increasing the denture retention were used in many cases, the extension reached by the above impression was not given up. This method reveals the mucoperiodontal character of the overdenture. During the impression taking, the matrices were placed on the attachment patrices in order to make place in the denture base. At the stage of ready dentures, adjusted attachment matrices were seated in the denture base with the direct method employing (Vertex) rapid polymerisation material [20]. Among 57 overdentures, 33 (71%) were made in the mandible, 5 (10%) in the maxilla and 9 (19%) in the mandible and maxilla.

Results

Assessment of the treatment result was done on a basis of clinical examination noted during the follow-up visits performed every six months. The total time of clinical observation ranged from 2 to 6 years, and the average observation period was 3 years. All the patients were classified and divided

into three groups in accordance with the treatment results. The classification criteria were: 1) subjective report of the patients on usage of their prostheses, 2) the evaluation of the periodontium and mobility of the abutment teeth, 3) the hygiene of the oral mouth and denture.

Each of the above mentioned criteria was scored in 3 point scale. A maximum of 9 points was considered as a very good result of treatment, and it was obtained by 38 patients (almost 80%). Good result when the total score amounted to 6 points was achieved by 6 patients (17%), while the satisfactory result (3 points) was noted in 2 patients (4%). The last result was connected with the patient's mental condition (geriatric dementia). Tab. 7 presents the treatment results based on the above classification. Among the patient's with the

Table 7. Number of patients according to treatment results

Tabela 7. Liczba pacjentów ze względu na uzyskany wynik leczenia

| Result of treatment (Wynik leczenia) | n | % |
|--------------------------------------|----|----|
| Very good (bardzo dobra) | 38 | 79 |
| Good (dobra) | 8 | 17 |
| Unsatisfactory (dostateczna) | 2 | 4 |

Table 8. Mobility of teeth after treatment

Tabela 8. Ruchomość zębów po leczeniu

| Mobility of teeth by Entin (Ruchomość zębów wg Entina) | n | % |
|--|-----|----|
| Without (bez patologicznej ruchomości) | 189 | 90 |
| I°-II° | 21 | 10 |
| III° | 0 | 0 |

Table 9. Hygiene of oral mouth after treatment

Tabela 9. Higiena jamy ustnej po leczeniu

| Oral mouth hygiene (higiena jamy ustnej) | n | % |
|--|----|----|
| Very good (bardzo dobra) | 18 | 38 |
| Good (dobra) | 30 | 62 |
| Unsatisfactory (dostateczna) | 0 | 0 |

Table 6. Number and kind of performed prosthetic construction

Tabela 6. Liczba i rodzaj wykonanych uzupełnień protetycznych

| Kind of construction (Rodzaj uzupełnienia) | Overdentures (Protezy pokrywające) | | Conventional total denture (Protezy całkowite) | | Partial denture (Protezy częściowe) | | Fixed construction (Protezy stałe) | | Total (Razem) | |
|--|------------------------------------|----|--|----|-------------------------------------|---|------------------------------------|---|---------------|-----|
| | n | % | n | % | n | % | n | % | n | % |
| No. of constructions (Liczba uzupełnień) | 57 | 59 | 26 | 27 | 5 | 5 | 8 | 9 | 96 | 100 |

very good treatment results, 31 persons used dentures with prefabricated prosthetic attachments and 7 persons wore the dentures without them. In the patient's opinion, the satisfaction was the same regardless the prosthetic attachment used in the complete overdenture. It suggests that attachments even with the poorest retention provided adequate stability of overdentures which considerably exceed the food viscosity forces during the mastication. 8 patients with the good results of treatment would expect better retention in their dentures. They complained of the potential possibility of displacing their dentures due to movements of a tongue.

As far as biological protection criterion is concerned, at an average 3-year-follow-up period, in all the cases, due to the endodontic treatment and establishing the proper crown-root ratio biostatics of the teeth in their sockets was considerably improved. Teeth mobility test revealed good results. The teeth without pathological mobility before the treatment remained in the very good condition at the time of observation. Tab. 8 suggests that among of 76 teeth with I and II degree of mobility, 55 teeth got better condition, moreover 21 teeth revealed mobility similar to that before treatment (mobility of 15 teeth was not higher than I degree and 6 teeth remained at II degree). In some patients, shortly after overdentures seating, a little increase in gingival inflammation in the areas of abutments was observed, however, it diminished after corrections of dentures base during the follow-up visits. Table 9 presents oral mouth and dentures hygienic status found after treatment and during follow-up visits. The above mentioned parameters were considerably improved in all the patients. After treatment and proper instruction and patient's strong motivation, very good

hygiene status was found in 18 patients, in 30 patients oral mouth and denture hygiene status was evaluated as a good. Out of 30 patients with final good hygiene, 11 persons were qualified initially at the satisfactory hygiene level at the beginning of the treatment.

The value of residual dentition should not be underestimated. Periodontium receptors of even a single tooth are sensitive enough to send a signal to CNS about overloads caused by the dentures use and in this way they protect the alveolar process bone from the further atrophy. The idea to maintain the residual dentition may be realised by more common use of overdentures in the prosthetic treatment. In the treated patients, the pre prosthetic treatment, in majority of cases included: clinical crowns reduction, endodontic treatment as well as dental roots carrying surfaces protection. The better stabilization of abutments was achieved, their biostatics was improved and their connection with the overdenture as the functional unity was performed. It caused favourable distribution of chewing forces on the whole of the prosthetic basis resulting in alveolar atrophy inhibition. The above results of study are similar to those obtained by many other authors who reduced elongated clinical crowns in order to correct their vertical load by the overdentures and in consequence a positive influence on periodontium structure was achieved [1, 23–25].

Overdenture, with or without attachments, applied in the treatment of patients with residual dentition are especially useful in the extensive loss of teeth in the mandible. They are comfortable due to improvement of chewing, speech, and good aesthetic appearance of patients. They slow down the transferring to complete edentulous state. They improve psychological comfort of geriatric patients.

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