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Comparative Assessment Of Quality Of Life In Patients With Partial Removable Dentures Using Artificial Teeth Of Varying Hardness

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Abstract: Partial tooth loss remains a common problem that negatively affects patients' quality of life. Restoration of masticatory function is typically achieved using removable dentures, while the properties of artificial teeth, particularly their hardness, can affect the wear resistance of the denture, distribution of masticatory pressure, and clinical outcomes. Data on the impact of artificial tooth hardness on the quality of life of patients with partial removable dentures is needed. The aim of the study is to compare the clinical outcomes of prosthetic treatment with partial removable dentures using artificial teeth of varying hardness by assessing patients' quality of life. Data on the impact of artificial tooth hardness on the quality of life of patients with partially removable prostheses is necessary. The purpose of the study is to compare the clinical outcomes of partially removable dentures using artificial teeth of varying hardness, assessing the quality of life of patients.

Keywords: Partial removable dentures; artificial teeth; tooth wear; quality of life; OHIP-14.

Introduction: Removable prosthetics remains one of the main methods of rehabilitation for complete and partial edentulism, especially in conditions where implantation is difficult due to systemic or economic reasons. A properly manufactured removable prosthesis allows for the restoration of chewing efficiency and aesthetics; however, its functionality largely depends on the materials and design. The most important clinical and biomechanical aspects are the retention and stability of the prosthesis on the jaw, occlusal adjustment, and wear of artificial teeth over time. If the prosthetic teeth are significantly worn down, the established jaw relationship is disrupted, the vertical dimension of occlusion decreases, leading to a deterioration in chewing function, overload of the masticatory muscles, and patient discomfort. Excessive wear of the occlusal surface is also associated with decreased prosthetic stability and progressive resorption of the alveolar ridges due to uneven load distribution. Ultimately, excessively worn teeth can render the prosthesis unusable, requiring relining or replacement. Additionally, changes in occlusion due to wear can be associated with temporomandibular joint (TMJ) dysfunction: for example, according to some data, patients with complete dentures and acrylic teeth exhibited a higher frequency of TMJ symptoms compared to prostheses with wear-resistant teeth. This emphasizes the importance of maintaining occlusal relationships throughout the use of the prosthesis.

There is relatively little literature data specifically on partial dentures. Most studies were conducted on complete removable dentures, where there are no natural opposing teeth, meaning there is no risk of their wear, but the role of the denture base and stabilization is more significant. Our results regarding the wear resistance of materials align with the review by Mudliar et al. (2022): they concluded that although porcelain shows the highest hardness in laboratory tests, the actual wear of various materials in vivo depends on complex factors.

METHODS

The main group included adult patients aged 40 to 65 with partial edentulism of one dental arch (at least 3 missing adjacent teeth, Kennedy Class II), who sought a removable partial denture and had no contraindications. The inclusion criterion was a satisfactory oral condition: absence of acute inflammatory diseases, successfully treated oral cavity, healthy or adequately treated roots of remaining teeth, and absence of severe periodontitis (mild to moderate forms were acceptable). 60 patients were divided into three comparable groups of 20 people each.

Group 1 (control) - 20 individuals with intact dentition, not requiring prosthetics. Group 2 consisted of 20 patients with unilateral terminal defects of the dental arch ranging from 4 to 6 teeth, who were fitted with a partial removable plate prosthesis with high-hardness artificial teeth. In this group, industrially manufactured composite teeth with increased wear resistance were used as artificial teeth. Their Vickers microhardness is 65-80 HV, which is comparable to dentin hardness and approaches the lower limit of enamel hardness. Group 3 consisted of 20 patients with partial defects similar in location and extent, who were fitted with partial dentures of similar design, but using traditional acrylic plastic teeth. The hardness of these teeth is significantly lower - about 45-50 HV, which is approximately 1.5 times less than that of composite teeth, and significantly lower than enamel hardness. The distribution by sex and age did not differ between groups 2 and 3: the average age was 54.1±6.3 years and 55.7±5.8 years, respectively (p=0.39), and the proportion of women was 60% and 65% (p=0.77). The comparative demographic and clinical characteristics of the sample are presented in Table 1. Groups 2 and 3 did not have significant differences in terms of the duration of tooth absence before prosthetic treatment, the initial state of the mucosa, the number of remaining teeth in the jaw, and the degree of wear of antagonist teeth.

Oral health-related quality of life, was assessed using the OHIP-14 questionnaire (Oral Health Impact Profile, a shortened 14-item Russian version). Respondents indicated the frequency of specified problems before prosthetic treatment and 6 months after using the prosthesis. Scores were summed: maximum 56 (worst quality of life), minimum 0 (no complaints). The indicator was calculated for groups 2 and 3 before and after treatment; for group 1 (control without prostheses) - once at inclusion (for comparison with postoperative values in prosthetic patients). The change in OHIP-14 over 6 months served as an integral criterion for prosthetic effectiveness. Additionally, during follow-up visits at 12 months, information was collected on overall satisfaction with the prosthesis using a visual analog scale (VAS, from 0 to 10), as well as on subjective chewing efficiency (as a percentage of 100% complete comfort).

RESULTS

In the observed groups 2 and 3, all patients completed 12 months of follow-up, and data from all 40 patients with prostheses were included in the analysis. Patients in groups 2 and 3 were comparable in terms of gender, age, and oral cavity parameters (Table 1). The average age was 55 years, with women predominating. All dentures were based on an acrylic base for the upper jaw and had the same type of retaining clasps on the supporting teeth. Artificial teeth in group 2 were composite multilayered, with an average hardness of 70 HV; in group 3 - standard acrylic, with an average hardness of 30-40 HV.

Table 1.

Baseline characteristics of patients (M±SD or n (%)). The groups are comparable in terms of main demographic indicators and oral cavity condition parameters.

Parameter	Group 1 (control, without prosthesis, n=20)	Group 2 (prosthesis, hard teeth, n=20)	Group 3 (prosthesis, soft teeth, n=20)
Age, years	50.3 ± 7.0	54.1 ± 6.3	55.7 ± 5.8
Women, %	60% (12/20)	60% (12/20)	65% (13/20)
Dental arch defect (Kennedy classification)	- (intact)	Class II - 100%	Class II - 100%
Number of missing teeth	0	5.1 ± 1.0	5.3 ± 0.8
Duration of tooth loss before prosthetic treatment, months	-	14 [8; 20]	15 [7; 24]

Oral Hygiene Index (OHI)	1.2 ± 0.4	1.3 ± 0.5	1.3 ± 0.4
Baseline OHIP-14 (points)	5.2 ± 3.1	32.1 ± 5.8	33.0 ± 5.1
Denture stomatitis (Newton II-III) before treatment	-	3 (15%)	4 (20%)

***Note: The differences between groups 2 and 3 for all the listed indicators are statistically insignificant; p-value for multi-group comparison (ANOVA/χ2) does not exceed 0.05 only when comparing with the control group using OHIP-14, which is expectedly higher in patients with adentia.**

Before prosthetics, patients with partial edentulism had high total OHIP-14 scores: 32.1±5.8 points in group 2 and 33.0±5.1 in group 3 (on a 0-56 scale, where a higher score indicates worse quality of life), reflecting significant limitations and discomfort associated with tooth loss. For comparison, in the control group with intact teeth, the average OHIP-14 was only 5.2±3.1 (significantly lower, $p<0.001$). Six months after prosthetic treatment and adaptation, a pronounced improvement in indicators across all OHIP domains was observed in patients with prostheses. In group 2 (hard teeth), the total OHIP-14 decreased to 9.8±4.0, in group 3 (soft teeth) - to 12.1±4.7. The difference compared to the initial values was statistically significant in both groups (paired t-test: $p<0.001$). This indicates a noticeable improvement in quality of life due to prosthetic treatment: patients reported a decrease in functional difficulties when eating, reduced social awkwardness, and less emotional discomfort due to missing teeth. The achieved OHIP scores after treatment approached the level of the control group, equal to 5.2±3.1. When directly comparing groups 2 and 3, the total OHIP-14 after 6 months did not differ statistically significantly ($p=0.28$). Analysis of the OHIP subscales showed that in both groups, physical pain sensations (decreased chewing pain), psychological state (increased self-confidence during communication), and functional limitations (easier chewing of various foods) improved most significantly. Minor differences between the groups were found at the level of individual items: patients with composite teeth reported difficulties chewing hard food somewhat less often (25% vs 40% noted at least "sometimes," $p=0.32$) and experienced discomfort less frequently due to the need to adjust the denture in the mouth during meals.

However, for most items, the frequency of problems was similar. Thus, both prosthetic methods ensured an equivalent improvement in oral health indicators and patients' overall comfort by the 6th month of use. An additional survey at 12 months showed the preservation of the achieved level: OHIP-14 remained practically unchanged after 1 year (Group 2: 10.4±4.2; Group 3: 13.0±5.0). This result indicates stable adaptation: quality of life after the initial improvement remained high and did not deteriorate throughout the year. The slight tendency for OHIP increase in Group 3 (by 1 point) may be related to the accumulation of dental wear and the need for adjustments (see below), but it is not statistically significant.

DISCUSSION

This study presents the first comparative analysis in domestic literature of how artificial tooth material hardness affects the outcomes of partial removable dentures. Our key findings can be summarized as follows: although both groups of patients (with composite and acrylic teeth) showed similar levels of treatment satisfaction and quality of life improvement (OHIP-14) after one year, the objective indicators of prosthetic functional suitability differed significantly. Prostheses with harder teeth (close to dentin in hardness) proved to be significantly more wear-resistant - the loss of occlusal height was minimal (0.1 mm per year), while soft teeth were worn down by ~0.3 mm, leading to partial loss of contact and the need for occlusal adjustment. These results align with literature data on the advantages of wear-resistant dental materials. In the study by Sharma et al. (2023), which observed 60 patients with complete dentures, it was found that plastic acrylic teeth showed the highest degree of wear within 6 months, while composite teeth showed moderate wear, and porcelain teeth showed minimal wear. Although that study focused on complete dentures, the trend is similar: soft acrylics wear out quickly, providing "softness" when chewing and excellent adaptation, while hard teeth maintain their shape but require more careful adjustment due to brittleness or other properties. Our data confirm that for partial (free-end) dentures, the balance shifts in favor of preserving shape: significant wear of acrylic teeth led to occlusal disturbances on average after six months, although patients might not immediately notice this. Although that study was about complete dentures, the trend is similar: soft acrylics wear out quickly, providing "softness" when chewed and excellent adaptation, while hard teeth retain their shape but require more careful adjustment due to brittleness or other properties.

In our study, the overall quality of life indicator did not

reveal statistically significant differences between the use of hard teeth compared to soft ones - both types of prosthetics provided equivalent improvement in OHIP. This suggests that subjectively, patients have sufficiently adapted to both types of prostheses, and the resulting improvement is more a consequence of the prosthetic treatment itself rather than the influence of the dental material. Similar conclusions are presented in a recent randomized crossover study by Abozaed et al. (2025), which compared conventional and milled acrylic teeth in edentulous patients: overall satisfaction and OHRQoL did not differ significantly between dental variants, differences occurred only in individual parameters - chewing efficiency was slightly higher with harder (milled) teeth, while aesthetic satisfaction was slightly higher with standard teeth. This is similar to our observations: patients in group 2 rated chewing function somewhat better, while group 3 reported slightly better aesthetic comfort. However, none of these subjective aspects affected the total OHIP index. Thus, it can be assumed that in the short term (1 year follow-up), differences in the hardness of artificial teeth have little impact on patient satisfaction, as adaptation mechanisms compensate for minor functional deficiencies.

CONCLUSIONS

The quality of life of patients with partial edentulism significantly improves after prosthetic treatment - The OHIP-14 score decreased by more than 20 points (approximately 65%) in both study groups, reaching a level close to that of individuals with intact dentition. No differences were found in the overall quality of life index between prostheses with composite and acrylic teeth ($p>0.05$), indicating comparable subjective effectiveness of both options in the short term.

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