CLINICAL MANIFESTATIONS OF COMPLICATIONS ARISING THROUGH ORTHOPEDIC TREATMENT OF DENTITION ISSUES WITH REMOVABLE LAMINAR NYLON DENTURES

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ABSTRACT — The recent years have been witnessing the expansion of technologies for manufacturing removable dentures made of nylon materials. Aim of study: to identify the most significant complications affecting the effectiveness of dentition issues orthopedic treatment with removable laminar nylon dentures as well as to propose a respective prevention. Clinical methods were employed to examine 75 patients who underwent dentition orthopedic treatment with removable dentures of various designs. As a result, the clinical manifestations were identified for major complications when using nylon dentures, and a method for their prevention was proposed.

KEYWORDS — nylon dentures, dentition issues.

INTRODUCTION

Dentition issues are among the most common pathologies in orthopedic dentistry, while lack of timely treatment facilitates the development of deformed dentition, as well as temporomandibular joint and masticatory muscles pathologies [1–18, 28, 31, 35, 36, 39, 41, 45]. Despite the relatively high current level of orthopedic dental care and its continuous progress, rehabilitation of patients suffering from dentition defects still remains rather relevant [19, 20, 21, 22, 29, 32, 34, 37, 42, 44].

The treatment of dentition issues is based on various removable dentures [23, 24, 25, 26, 30, 33, 38, 40, 43]. Lately, technologies for producing removable orthopedic devices manufactured of nylon have become quite common. At the same time, there is no sufficient data regarding the effectiveness of removable nylon dentures, their fixation, their effect on the substructure tissues, as well as the type and severity of complications, the result of that being controversial recommendations and adverse clinical outcomes, which offers a rationale for this study.

Aim of study:
to identify the most significant complications affecting the effectiveness of dentition orthopedic treatment with removable laminar nylon dentures, and to propose a preventive method.

MATERIALS AND METHODS

75 patients (aged 40–80) with dentition issues were examined at the Orthopedic Dentistry Department of V.I. Razumovsky Saratov State Medical University through the years of 2010 – 2017. Depending on the proposed denture type, all the patients were divided into three groups. Patients of Group 1 were given conventional acrylic laminar prostheses fabricated with the Ftorax acrylic base material, with metal clammers (comparison subgroup). The patients of Group 2 had nylon laminar dentures made of Flexy-J material, with periodontal clammers, following the standard method. In Group 3, the patients were offered nylon laminar dentures (Flexy-J material, with periodontal clammers) subject to our proposed method, which allows preventing any damage to the gingival mucosa at the supporting teeth area. The point of the method implies shifting the support level of the clammer dental part towards the tooth equator, and the alveolar part – towards the alveolar processes or the alveolar part of the jaw, and creating a pre-set sub-clammer free space (Russian Federation invention patent #2557133) [27].

The patients underwent clinical examination prior to placing the dentures, on the day the dentures were placed, after 3 and 6 months, as well as 1 and 2 years after the dentures placement. The atrophy degree of the toothless prothetic bed area was evaluated following the Sadykov et al method. The study results were recorded in the individual examination cards and also entered a computer database in order to obtain a comparative evaluation and to sum up the final treatment outcome. The statistical analysis was performed with the statistical STATISTICA 12 package.

RESULTS AND DISCUSSION

To identify the relationship among the patients' masticatory system clinical features, age, gender and their distribution depending on the dentures type, we analyzed contingency coefficient in view of Cramer's V. The analysis revealed that there was a statistically significant link between the type of the dentures proposed and factors like age, gender and the character of dentition imperfection, which allowed identifying the main differences among the groups given the patients' distribution.

Analyzing the distribution by age, we could see that in all the three groups patients of an older age prevailed. However, in Group 1, prevailing were patients belonging to the age category of 71–80 (41.67%), while in Groups 2 and 3, those aged 61–70 represented the majority (38.46% and 56%, respectively). Analyzing the patients' distribution by gender, we could see that Group 1 had an equal number of males and females, while in Groups 2 and 3 females prevailed — 53.85% and 68%, respectively.

Analyzing the distribution of patients depending on the dentition issues showed that Group 1 had equal numbers of those with combined and terminal dentition defects; as for Groups 2 and 3, patients with combined dentition defects prevailed, thus comprising 50% and 44%, respectively.

A clinical examination carried out as part of dynamic follow-up observation 3 months after the dentures were placed revealed that three patients (12.5%) in Group 1 had inflammatory changes of the gingival mucosa at the retainer teeth, which was due to the traumatic effect of the curved part of the wire clammer (0.9±0.3, mild gingivitis according to the gingival index (GI)). An examination in Group 2 helped identify 2 patients (7.7%) with inflammatory changes in the gingival mucosa due to the traumatic effect of the nylon clammer shoulder (0.8±0.04, mild gingivitis, GI). In Group 3, though, the patients could have the dentures developing no issue.

A clinical examination carried out 6 months after placing the dentures showed that 6 patients (25%) of Group 1 developed inflammatory changes of the gingival mucosa at the retainer teeth through the traumatic effect of the clammer (1.1±0.02, moderate gingivitis, GI), and another 8 patients (33.3%) had their dentures not fitting properly to the supporting tissues. A similar examination in Group 2 helped detect 5 patients (19.2%) experiencing marginal periodontal inflammatory changes, which were due to the clammer traumatic effect (1.2±0.02, moderate gingivitis, GI). The patients of Group 3, though, used the dentures with no trouble experienced. A comparison of the average GI values revealed a statistically significant difference for the Fisher criterion $p = 0.0022$; for the Van der Waerden criterion $p = 0.0156$.

A clinical examination performed 1 year into wearing the dentures in Group 1 identified 7 people (29.2%) with inflammatory changes of the gingival mucosa at the retainer teeth (1.5±0.01, moderate gingivitis, GI). Also, four people (16.7%) had dentures fitting improperly the supporting tissues while another patient (4.2%) had the denture cracked at the base. In Group 2, 6 patients (23.1%) had gingival margin inflammation at the retainer teeth (1.7±0.02, moderate gingivitis, GI) with another 6 patients (23.1%) featuring improperly fitting dentures. In Group 3, 5 (20%) patients were found to have their dentures fitting improperly yet none of them had developed gingival margin inflammation at the supporting teeth. A comparison of the average GI values revealed a statistically significant difference for the Fisher criterion $p<0.0001$; for the Van der Waerden criterion $p = 0.0039$.

One more examination, carried out two years after the dentures were installed, showed that 9 patients (37.5%) in Group 1 had gingival margin inflammatory changes at the retainer teeth as a result of the traumatic effect wrought by the clammer curved shoulder (1.98±0.04, moderate gingivitis, GI). Six more patients (25%) had a mismatch between the denture basis and the supporting tissues area, while 2 more of the said group (8.3%) had the denture basis breakage, and another one (4.2%) — a clammer break. An examination in Group 2 showed that 8 people (30.8%) had gingival margin inflammatory changes at the retainer teeth caused by the nylon clammer shoulder (1.9±0.007, moderate gingivitis, GI). Besides, 5 patients (19.2%) had their dentures misfitting the supporting area tissues. Note to be made that 2 patients had lost some of the false teeth out of the denture base. In Group 3, four patients (16%) had a misfit between the denture and the supporting area with another patient having lost false teeth out of the denture. However, no patient was found to have developed any gingival inflammatory change at the retainer teeth. When compared, the average GI index revealed no statistically significant difference, which suggests that the changes were of a similar nature.

Apart from the above, in order to follow the progression of the gingival damage through wearing the removable dentures, we carried out an analysis of the contingency tables for the Interpretation of the GI sign with other signs revealing the quality of the orthopedic treatment. The analysis involved the data obtained through the entire follow-up period. It

showed that the patients of Group 1, wearing acrylic laminar dentures, had the largest number of cases, as well as the severity of gingival inflammatory issues at the retainer teeth, throughout the follow-up. Notable is the fact that through the entire observation period no patient of Group 3, where they were offered modified clammers, developed any respective gingival margin changes. We also found that an increase in the frequency and degree of gingival margin damage caused by the dentures resulted in the patients' poorer subjective assessment of the denture placement performance as well as triggered more complications.

A comparative analysis of the subjective and objective data obtained through the study showed that the patients of Group 3 performed the best in terms of aesthetics, comfort wearing the dentures, and the adjustment time, which was the shortest in their case (9.5±0.2 days; $p<0.0001$ for Fisher and Van der Varden). The two years of follow-up in Group 1 identified 26% of the patients to have gingival inflammatory changes at the retainer teeth due to the damage caused by the clammer curved shoulder, and another 8.3% of the cases with various types of denture breakage. In Group 2, gingival inflammatory changes at the supporting area were to be found in 20.2% of the patients as a result of the traumatic effect from the clammer, and 3.8% cases had their dentures failed. In Group 3, though, the two years of observation revealed no traumatic effect on the gingival mucosa at the supporting teeth, while only 2% of the cases had their dentures broken down.

It should be noted that through the follow-up period, 25% of Group 1 cases needed the denture basis to be relocated; the same procedure was required in Group 2 as well yet in 14.1% of the cases, while in Group 3 it was 12% of the cases only who required this. The comparative data for the degree of tissue atrophy at the prosthetic bed through the entire follow-up can be seen Table 1.

Table 1 shows that the patients in Groups 2 and 3 had a lower degree of atrophy compared to those of Group 1. It was no earlier than 1 year into wearing the dentures that Groups 2 and 3 patients developed a degree of atrophy comparable to that in Group 1 proof to that being the lacking statistical significance of the average difference. Notable here is that the patients of Groups 2 and 3 revealed no significant difference in the atrophy rates through almost all the stages of observation, which indicates a similar pattern of change.

A Pearson correlation analysis was performed in order to evaluate the interrelation between atrophy and other indicators (Table 2).

Table 2 reveals a positively significant correlation between atrophy and GI indices in Groups 1 and 2, which means the progress of atrophic changes due to the damage caused to the gingival margin at the retainer teeth area, and which was not to be observed in patients of Group 3. Also, all the three groups had a positively significant relationship among atrophy processes. This suggests that the atrophic changes in the underlying tissues, regardless of localization, lead to misfit of the denture basis that in turn facilitates atrophy.

The above data stands proof to the fact that regardless of the denture type atrophic changes in the denture supporting tissues will not stop and affect the orthopedic treatment quality. During that, dentures made of thermoplastic polymeric material wrought a more gentle effect on the supporting area tissues and caused a lower degree of atrophy compared with acrylic dentures.

CONCLUSION

As could be seen from the data above, the analysis of treating dentition issues with removable dentures made of thermoplastic polymeric materials helped identify the most significant complications affecting the effectiveness of orthopedic treatment. Talking of removable laminar nylon dentures, major complications included damage to the mucous membrane underlying the clammer at the retainer teeth, which entails impaired aesthetics, worsening in the dentures fixation, and a misfit between the denture basis and the prosthetic bed tissues.

At the same time, when the removable nylon denture construction technology that we proposed was employed, it allowed avoiding complications that the dental alveolar clammer could have had on the gingival mucosa at the retainer teeth, also resulting in a lower need for reconstructing the denture basis (down to 12%), which is 13% and 2.1% below the similar factor in Groups 1 and 2, respectively, and which increases the efficiency of treating dentition issues with nylon polymers-based removable dentures.

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Table 1. *Average values for tissues atrophy at the prosthetic bed through different follow-up intervals*

Observation stage	Group (M ± m)			Wilcoxon criterion		
	1	2	3			
	n=24	n=26	n=25	p*	p**	p***
Atrophy volume (mm^3)						
After 1 day	14.7 ± 0.3	13.6 ± 0.2	13.5 ± 0.2	0.0018	0.0007	0.8842
After 6 months	145.9 ± 4.2	82.3 ± 3.04	81.8 ± 3.2	< 0.0001	< 0.0001	0.9596
After 1 year	196.6 ± 4.6	212.98 ± 4.6	206.2 ± 4.7	0.2657	0.5015	0.2783
After 2 years	302.9 ± 4.3	273.9 ± 4.6	267.6 ± 4.6	0.0002	< 0.0001	0.4606
Atrophy height (mm)						
After 1 day	0.012 ±0.0003	0.0085 ±0.0003	0.008 ±0.0003	< 0.0001	< 0.0001	0.4394
After 6 months	0.49 ± 0.01	0.18 ± 0.003	0.17 ± 0.003	< 0.0001	< 0.0001	0.0308
After 1 year	0.67 ± 0.02	0.52 ± 0.02	0.50 ± 0.02	0.0001	< 0.0001	0.8478
After 2 years	0.79 ± 0.02	0.66 ± 0.03	0.65 ± 0.02	0.0024	0.0008	0.9842

Note: *For Wilcoxon criterion:*
p – difference between Groups 1 and 2; p** – difference between Groups 1 and 3; p*** – difference between Groups 2 and 3.*

Table 2. *Correlation analysis to compare atrophy with the other quantitative indicators*

Quantitative indicators	Groups					
	Group 1		Group 2		Group 3	
	Atrophy volume	Atrophy height	Atrophy volume	Atrophy height	Atrophy volume	Atrophy height
Gingival index (GI)	r = 0.917 p < 0.0001	r = 0.735 p < 0.0001	r = 0.963 p < 0.0001	r = 0.851 p < 0.0001	——	——
Denture fixation index by Ulitovsky & Leontiev	r = 0.900 p < 0.0001	r = 0.919 p < 0.0001	r = 0.873 p < 0.0001	r = 0.853 p < 0.0001	r = 0.822 p < 0.0001	r = 0.810 p < 0.0001
Atrophy volume	——	r = 0.929 p < 0.0001	——	r = 0.933 p < 0.0001	——	r = 0.947 p < 0.0001
Atrophy height	r = 0.929 p < 0.0001	——	r = 0.933 p < 0.0001	——	r = 0.947 p < 0.0001	——

Note: *r – Pearson correlation coefficient; p – statistical significance for Pearson coefficient.*

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