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SEVERITY OF ADENTIA AS A RISK FACTOR OF REPEATED DENTAL IMPLANT OPERATIONS

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Risk factors for dental implantation can be divided into general and local, early and late. Our experience shows that the length of the edentulous jaw affects the quality and predictability of the first stage of dental implantation. Conducted a retrospective analysis of data from clinical journals of dentistry. To facilitate the data accounting process, we have introduced conditional definitions of dentition defects by their length: mild, moderate and severe defects of the dentition, complete adentia. Found that the value of the relative risk of re-dental implantation in the group of dentitions with severe defects and with complete adentia (OR=0.36) is approximately 4.2 times less than in the group with mild defects (OR=1.5), p<0.05. Total 157 (17.1 %) edentulous areas out of 917.

Key words: dental implants, risk factor, osseointegration, dental implantation.

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ПРОТЯЖНІСТЬ ДЕФЕКТУ ЗУБНОГО РЯДУ ЯК ФАКТОР РИЗИКУ ПОВТОРНОЇ ОПЕРАЦІЇ З ДЕНТАЛЬНОЇ ІМПЛАНТАЦІЇ

Фактори ризику імплантації зубів можна розділити на загальні та місцеві, ранні та пізні. Наш досвід вказує, на наявність впливу довжини беззубої щелепи на якість і передбачуваність першого етапу дентальної імплантації. Проведений ретроспективний аналіз даних клінічних журналів стоматології. Для полегшення процесу обліку даних ми ввели умовні визначення дефектів зубних рядів за їх довжиною: «дрібні», «середні», «значні» дефекти зубних рядів, повна адентія. Встановлено, що значення відносного ризику повторної імплантації зубів у групі зубних рядів з «великими» дефектами та з повною адентією (OR=0,36) приблизно в 4,2 рази менше, ніж у групі з «дрібними» дефектами (OR=1,5).), р<0,05. Всього 157 (17,1 %) беззубих ділянок із 917.

Ключові слова: зубні імпланти, фактор ризику, остеоінтеграція, імплантація зубів

Dental implants have become a common choice among treatment options in the rehabilitation of secondary adentia. Cases of failed implantation according to various data range from 1 % to 19 % [2, 3]. To date, peri-implantitis is the leading cause of implant loss (81.9 %). Implantation in previously failed sites, regardless of early or late failure, results in survival of 71 % to 100 % for 5 years [13].

Risk factors contribute to the development of inflammation in the bones around the implant on the soft tissues. Risk factors in dental implantation can be divided into general and local, early and late. In order to increase the effectiveness of dental implants, in recent years, much work has been devoted to the study and development of methods to eliminate these factors [11, 12].

Our experience shows that the length of the dentition defect has a significant impact on the course of the surgical stage of dental implantation and should be considered a risk factor in planning.

The purpose of the study was to evaluate the influence of the length of the dentition defect on the complexity of the surgical stage of dental implantation.

Materials and methods. A retrospective analysis of information from clinical journals of dentistry was performed for the period 2014–2021, which included only clinical data and did not contain personal data of patients.

To facilitate the data accounting process, we have introduced conditional definitions of dentition defects by their length:

 – areas of adentia of the dentition length of one missing tooth, we identified as "mild" defects of the dentition;

 – areas of adentia of the dentition with the length of two missing teeth, we defined as "moderate" defects of the dentition;

 – areas of adentia of the dentition with a length of 3 or more missing teeth – as "severe" defects of the dentition;

– dentition with complete adentia.

Defects of the dentition, which were separated from each other by a real tooth, we considered a separate defect. We also considered the absence of central incisors of the right and left halves of the upper or lower dentition to be a separate defect of the dentition. One defect we considered the complete absence of teeth on one jaw.

Statistical analysis was performed using the statistical software package Statistica version 8.0. The dates were presented in absolute terms (abs.); the relative indicators – percent (%) and their 95 % confidence intervals (95 % SI). Odds and ratios were used to determine the statistical significance of the relationship between factor and outcome levels.

To quantify the strength of the connection, confidence intervals (OR 95 % SI) were calculated.

The difference in values was considered statistically significant at $p<0.05$.

Results of the study and their discussion. During the period 2014–2021, for dental rehabilitation of patients with a secondary adentia, 617 (100.0 %) persons underwent dental implants with a screw structure: the number of women (56.2 %) and men (43.8 %) was almost the same ($p>0.05$); the mean age of patients was 48.8±13.5 years. 617 patients had 917 dentition defects with secondary adentia, 1.5 dentition defects per patient.

A total of 1446 screw implants were used. 63 (4.3%) of them were found during repeated operations, due to unsuccessful results of the first stage. one (4.3 %) implant out of 24 was reinstalled.

The total number of operations "first stage of dental implantation" was 664; of these, 58 (8.7 %) were made repeatedly in the area of failed implantation. Thus, of the 11.4 implant surgery 1 (8.7 %), the operation was repeated.

The distribution of toothless sections of the dentition by length is shown in figure 1.

From fig. 1 it can be determined that among the areas of adentia in the complex rehabilitation in which dental implants were used, mild defects with a length of one missing tooth (n=655) were significantly ($p<0.05$) more. The moderate defects with a length of two missing teeth were almost by 4 times less (n=157) than mild. The severe defects with a length of 3 or more teeth (n=68) – almost by 9.5 times less than mild; dentition defects with complete adentia (n=37) – are almost by 17.7 times less.

In areas with complete absence of teeth were installed 186 implants; including 183 (98.4 %) implants were installed initially, another 3 implants (1.6 %) – afresh during 3 repeated operations. 721 implants were installed in mild defects; including the number of implants installed first, there were 687 (95.3 %), another 34 (4.7 %) implants were installed during 34 repeated operations. 326 dental implants were installed in moderate defects: 10 (95.0 %) – at first and 16 (5.0 %) – at 16 repeated operations; in severe defects – 207 (100 %), 203 (98.1 %) and 4 (1.9 %) implants, respectively (fig. 2).

According to fig. 2, it can be noted that in mild defects of the dentition, the number of repeated operations (5.2 %) is significantly greater than in severe defects (1.9 %), p=0.045 and in complete adentia (1.6 %), p=0.036.

Thus, there is a decrease in re-installed implants with increasing length of the dentition. The total number of repeated operations for severe defects and complete adentia was only 7, which is 4.8 times less for mild defects and 2.3 times less for moderate.
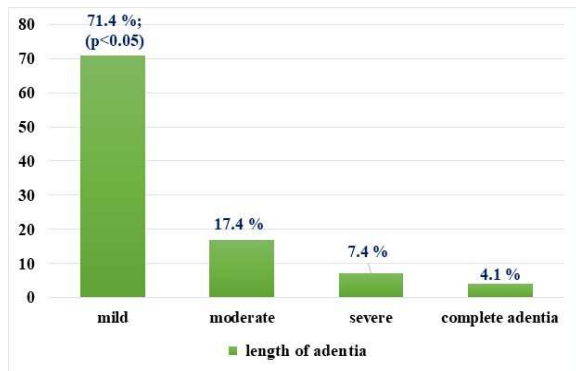

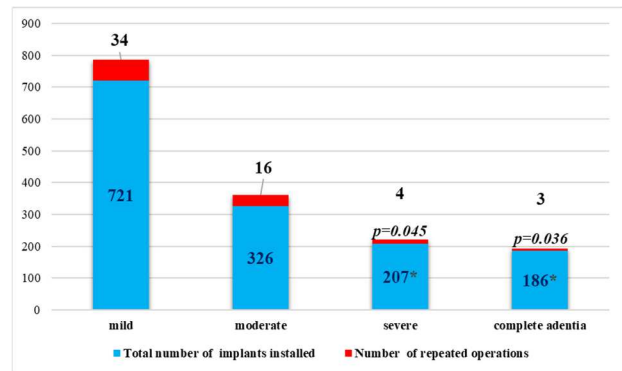Fig.1. Distribution of toothless sections of the dentition by length.

Fig. 2. Distribution of installed dental implants by study groups.

Calculation of the odds ratio (OR) with a 95 % confidence interval in a group of patients with a small length of the dentition showed that the chance (Odds) to find areas of the dentition length of one missing tooth in patients who underwent re-implant surgery is 1.48, and in the group of patients without re-implantation only 0.99 – the difference by 1.5 times; odds ratio OR=1.5 (fig. 3).

According to fig. 3, it can be noted that the probability of encountering dentition defects of medium length in patients with reimplantation is less than 1.0. Despite the value of OR=1.3, this value is not statistically significant (p>0.05). The association between the mild defect and the observed reimplantation is statistically significant (p<0.05).

The odds ratio (OR) in the group of patients with a severe length of the dentition and complete adentia is 5, the odds ratio OR=0.36 is significantly less than 1.0 (p<0.05). This permits to consider the factor of the large length of the dentition of patients as a factor that significantly reduces the risk of re-implantation. The value of the relative risk of re-dental implantation in the group of dentitions with severe defects and with complete adentia (OR=0.36) is approximately by 4.2 times less than in the group with mild defects (OR=1.5), p<0.05.

In "small" defects, the risk of reoperation increased; with the loss of one implant, the relative number of support loss was 100 %. The calculation of 95 % confidence intervals showed that the implants were installed according to formula of "implant isotopy" X=N in 92.1 % [90.3; 93.9] of cases of edentulous areas; according to the formula X=N+1 – in 3.7 % [2.4; 5.0], to X=N–1 – in 2.3 % [1.3; 3.3], X=N–2,3,4… – in 0.3 %.

In the event of the disintegration of one implant, the risk of losing 100 % of the supports would arise during the reconstruction of 598 mild and 6 moderate defects (p<0.05). Total 605 (66.0 %) edentulous areas were detected out of 917.

The risk of losing 50 % of the supports with the loss of one implant would be observed with 151 moderate and 6 severe defects (p<0.05). Total 157 (17.1 %) edentulous areas were detected out of 917 (table 1).

Tаblе 1

Number to implants installed

Number of implants installed	Installation frequency %			
	Complete adentia	Severe defects	Moderate defects	Mild defects
1	0	0	5.8 %	95.1 %
2	10.8 %	16.7 %	94.2 %	4.9 %
3	8.1 %	70.5 %	0	0
4	24.3 %	16.1 %	0	0
5	10.8 %	1.5 %	0	0
6	35.2 %	0	0	0
8	10.8 %	0	0	0

To analyze the dependence of the likelihood of reoperations on the number of implants delivered and to predict possible risks, a multiple regression model was built.

The risk factors in the constructed model were the length of the dentition defect X_1, as well as the number of installed X_2 implants. The predicted frequency of possible reoperations was taken as the response variable (effect).

In general, the multiple regression equation is represented by a formula

$$0.009 X_1 - 0.34 X_2 + 0.31 = Y$$

Note: Y – the predicted frequency of possible re-operations;

X_1 – the length of the defect of the dentition (complete adentia, mild, moderate, mild);

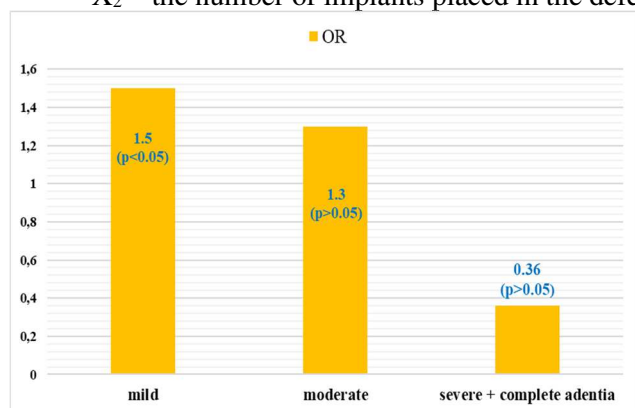X_2 – the number of implants placed in the defect (fig. 4).
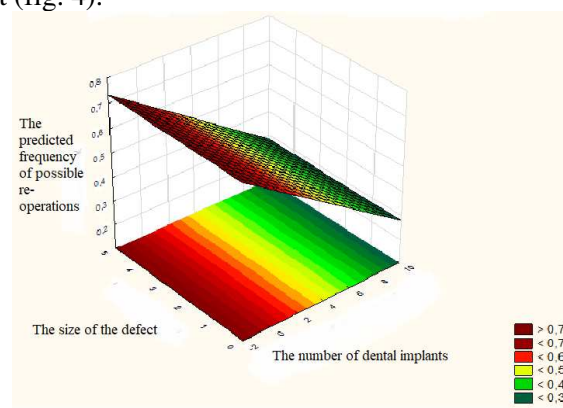

Fig. 3. The ratio of the chances of repeated operations

Fig. 4 Graph of the surface of the variable Y depending on X_1 and X_2.

As can be seen from fig. 4, the probability of reoperation increases with decreasing number of implants and reaches a maximum when installing 1-2 implants – most often in small defects of the dentition.

In contrast to moderate and severe defects, when installing implants in mild defects, the principle "one operation in the adentia area – one installed implant" operated, and the loss of the minimum number of implants (one implant) in unsuccessful results of the first stage can led to loss of 100 % of supports.

The problem with implantation in small edentulous areas is not only in the minimum possible number of implants, the disintegration of which entails either reoperation or abandonment of the planned plan. Competent analysis and implant planning can be used to minimize unpredictable results of the surgical stage of implantation. But despite the experience of a specialist, there are problems that lead to the loss of the implant. More often disintegration occurs due to mucositis or peri-implantitis, which is accompanied by a loss of bone volume [4, 14].

There is no consensus in the literature on the width around the dental implant, the width norm is controversial [5, 15]. It is unambiguous that with small defects in the dentition, for example, by one tooth, a slight loss of bone volume can lead to the impossibility of reinstalling an implant without repeated bone reconstructions, which increases the cost of treatment and prolongs the time [1, 8, 15].

Reoperations can also cause discomfort for patients, re-resorption of bone and cause new surgical complications - nerve damage or morbidity, etc. [6]. With severe defects in the dentition, the number of implants installed increases. The loss of a single implant is often compensated for by a sufficient number of retained supports and does not necessitate re-insertion. If it is necessary to reinstall the implant in long defects, it is often possible to select a new, "healthy" bone site [7].

Our analysis of the data showed that the reason for refusing to re-install the dental implant was a questionable prognosis of reimplantation, due to the patient's general somatic pathology, or local problems associated with bone destruction due to peri-implantitis.

The number of repeated operations to install a dental implant was 47 in small defects (7.6 % of the total number of operations); 39 implants were re-installed, which was 2.7 % of the total number of implants in "small" defects, and 46.4 % of the number of non-integrated implants in this group. Re-installation was not performed in 5 patients; 3 of them (60.0%) suffered from type 2 diabetes, 2 - refused by bone reconstruction; methods of rehabilitation without the use of dental implants were proposed.

Failure at the first stage of surgical treatment of mild defects was the reason for changing the plan of orthopedic rehabilitation of 10 (1.6 %) patients with various reasons.

Analysis of the documentation showed that in 5 (31.2 %) of the 16 cases of disintegration of the implant in the group of moderate defects, re-installation of the implant was possible only after previous bone reconstruction. Refusal of reimplantation was noted in 1 (25.0 %) case out of 4, with loss of 100.0% (n=2) of implants in a patient with type 2 diabetes mellitus with questionable prognosis of result for

additional osteoplastic surgery. Further treatment of this patient was performed using an alternative orthopedic design.

The data of the literature review show that for the reconstruction of edentulous jaws, 2 or 4 implants are most often installed. Optimal is 5 on the lower jaw and 6 on the upper. Thus, a meta-analysis by other authors confirms the safety of treatment with an increase in the number of implants [9].

There were 7 cases of loss of implants in "large" defects, and repeated operations were performed 4 (57.1 %). Of the 11 "lost" implants, 4 (36.4 %) were re-installed. In one case, by patient with type 2 drugs disintegrated 6 implants out of 6 (100 %); due to the patient's refusal of re-operation, an alternative rehabilitation plan was chosen. In other cases ithe loss of the implant did not affect the orthopedic rehabilitation plan

Conclusions

To planning the timing and material costs of dental implantation, it is necessary to take into account the length of the edentulous part of the dentition, as a factor affecting the frequency of repeated operations. The value of the relative risk of re-dental implantation in the group of dentitions with severe defects and with complete adentia (OR=0.36) is approximately by 4.2 times less than in the group with mild defects (OR=1.5), $p<0.05$. When prosthetics on implants, it is advisable to install the maximum possible number of implants, inasmuch as the probability of reoperation increases with decreasing number of implants and reaches a maximum when installing 1–2 implants.

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