



METHODS OF APPLICATION OF SINGLE-STAGE DENTAL IMPLANTS FOR DIFFERENT DEGREES OF ALVEOLAR ATROPHY

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Abstract

The function and condition of the oral organs are closely connected with other systems of the human body, and tooth loss is one of the most common pathological conditions and affects not only the function of mastication and work of the whole jaw system. Missing teeth impair a vital function in chewing, which affects digestive processes and causes other diseases. Dental, periodontal and oral mucosal health has been linked to the condition of other parts of the gastrointestinal tract as well as other body systems (motor, cardiovascular, endocrine), higher nervous activity, infections and cancers, sleep quality, obesity and general defences. Oral health is regarded by scientists as a useful marker of general health and healthy ageing. In the absence of teeth, the structural, functional and aesthetic balance of the maxillofacial region and many body systems is disturbed, leading to social consequences and a reduced quality of life for the individual.

Keywords: radiography, odontometry, bone height.

Introduction

Implantology today is one of the most dynamically developing areas of modern dentistry, the use of modern technology has allowed a new level to approach the problem of treatment of missing teeth and partially missing teeth. Defective teeth must be restored in the shortest possible time and in the most functional way, and here dental implants and prosthetics are the most modern way to preserve the stable condition of the masticatory and oral system, and in the spectrum of high-tech treatment methods it justifiably occupies a priority position. According to researches of leading analytical agencies in Europe and USA, the demand for dental implants is expected to exceed the demand for all other kinds of dental treatment. And the market for dental implants and bone grafting materials is the fastest growing segment in dental technology analytics.





According to leading global analytical agencies, prices in the implant market have been steadily declining and this trend is not expected to change yet, which is conducive to the spread of this treatment method. Due to the trend of steadily ageing populations in the developed world and the accumulation of unmet needs for dental restoration, a large number of companies see an opportunity to develop these promising and sophisticated dental treatments. The market for dental implants and bone grafting materials is the fastest growing segment in dental technology and we are constantly being offered new products. Being under pressure from manufacturers, one of the most important tasks of practical dentistry today is to objectively and unbiasedly improve treatment tactics and methods of restoring the function of the dento-alveolar system in case of tooth loss, timely and high-quality restoration of dental defects and prevention of complete loss of natural teeth. We should also remember that dental implants are not a full-fledged substitute for natural teeth and should by no means be removed prematurely (as is often the case in the recent past). The survival rate of dental implants, according to some studies, does not exceed that of even problematic but successfully treated natural teeth. Thus, the high clinical prevalence, practical relevance and insufficient scientific understanding of the treatment and rehabilitation of patients with missing teeth were the scientific and theoretical prerequisites for our chosen research.

Purpose of the Study:

To improve the effectiveness and quality of treatment of patients with dental defects and varying degrees of alveolar atrophy using a single-stage dental implant technique and single-stage dental implants.

Materials and Methods:

Patients were divided into 3 groups depending on the degree of atrophy and the types of dental implants and surgical treatment protocols used (Table 1).

Table 1. Distribution of study prospective patient groups by sex and age (2019-2022)

Gender	Total number of patients	Group 1	Group 2	Group 3
Male.	30 (50%)	8 (40%)	5 (25%)	10 (50%)
Female.	30 (50%)	12 (60%)	15 (75%)	10 (50%)
TOTAL:	60 (100%)	20 (33,33%)	20 (33,33%)	20 (33,33%)



There were no statistically significant differences between the groups.

The first group consisted of patients in whom a single-stage surgical protocol for dental implantation and one-piece dental implants were used. These patients had dental defects of varying lengths and sufficient bone volume. There were 20 patients in this group.

The second group consisted of patients with dental defects in whom a one-stage surgical protocol of dental implantation and one-piece dental implants were used. In these patients, different degrees of maxillary atrophy were observed. The group included 20 patients.

This group included a subgroup of 5 patients in whom we used our proposed minimally invasive method of placement of the dental implant and our patented new dental implant design (see below). These dental implants were demountable, but were placed by us according to a single-step protocol, simultaneously with gingiva shapers and/or abutments and modern crowns.

The third (control) group consisted of patients with dental defects in whom the traditional two-stage surgical protocol of dental implant surgery and collapsible dental implants were used. These patients had dental defects of varying lengths and varying degrees of atrophy of the maxillary alveolar bone. There were also 20 patients in this group. These 60 patients aged 18 to 59 years old had 103 dental implants placed: 24 in mandibular premolars position, 16 in maxillary premolars position, 27 in mandibular molars position, 16 in maxillary molars position, 12 in maxillary frontal teeth position, 8 in mandibular frontal teeth position.

A surgical physiodispenser, surgical handpiece and original surgical implant system kits were used during the dental implant surgery.

Results of the study: We proposed a minimally traumatic one-stage dental implant surgery. This technique was used in an additional subgroup of 5 patients.

At the third stage of the study, a comparative analysis of the effectiveness of treatment of patients using different surgical techniques of dental implantation was carried out. A comprehensive study was carried out on the 103 dental implants placed at the previous stage of the study. We performed the study in the same 60 patients operated on earlier with application of different methods of dental implantation for comparative estimation of treatment results with application of different methods of surgical protocol of implant treatment with application of monolithic and collapsible dental implants in patients with defects of dental rows and different volumes of dental tissue. Out of 274 dental implants placed according to the one-stage protocol, 179 (65, 33%) were placed, out of them, 160 were monolithic (indestructible), which was 89, 38% of the number of the implants placed in a single-stage manner. Using the two-



stage technique, in cases of bone grafting operation in case of significant atrophy of the alveolar ridges and more multi-stage techniques, 95 dental implants (34, 67%) were placed, all of them being demountable. Thus, non-dismountable (monolithic, single-stage) dental implants accounted for 58.40%, while demountable implants accounted for 41.60% of the total number of implants placed. It should be noted that the survival rate of the one-piece dental implants was lower than that of the demountable implants placed using the two-stage protocol (92.94% and 95.86 respectively), but these differences were not statistically significant ($p > 0.05$). Of particular importance is the fact that about half of the lost implants were unlinked single retention elements for locking removable prostheses in bone of insufficient volume and quality. A comparison of the one-stage and two-stage surgical protocols for dental implants also showed no statistically significant differences in implant survival rates and were as follows: 93.6% for one-stage and 95.1% for two-stage surgery protocols. The overall survival rate of the implants placed and analysed in the retrospective group of patients was 94.16%. Although survival rates differed between the groups, overall, a comparable survival rate was demonstrated for both dental implant designs (92.94% and 95.86%) and no statistically significant differences between the one-stage and two-stage implant protocols were detected.

In turn, the results of the study of the survival rate of non-dismountable (monolithic) implants used as a support for fixed prostheses show their superiority over fixed demountable implants in the period from 2019 to 2022. This can be explained by the more frequent use of temporary dentures in the placement protocol and functional ligation (splinting) of non-dismountable dental implants, which leads to improved survival due to a more even distribution of functional loads.

While studying the long-term results of the dental implantation in patients up to 10 years after the surgery, 93,6% of one-step implants retained the ability to function (their clinical consistency corresponded to the evaluation 3-5 according to the five-point scale). The main cause of disintegration was inflammation around the implant (peri-implantitis), possibly due to inappropriate prosthetics and/or improper distribution of the masticatory load. It is worth mentioning that very rarely, implant mobility was also observed without symptoms of inflammation, which can be attributed to non-axial osseointegration, i.e., fibrointegration.



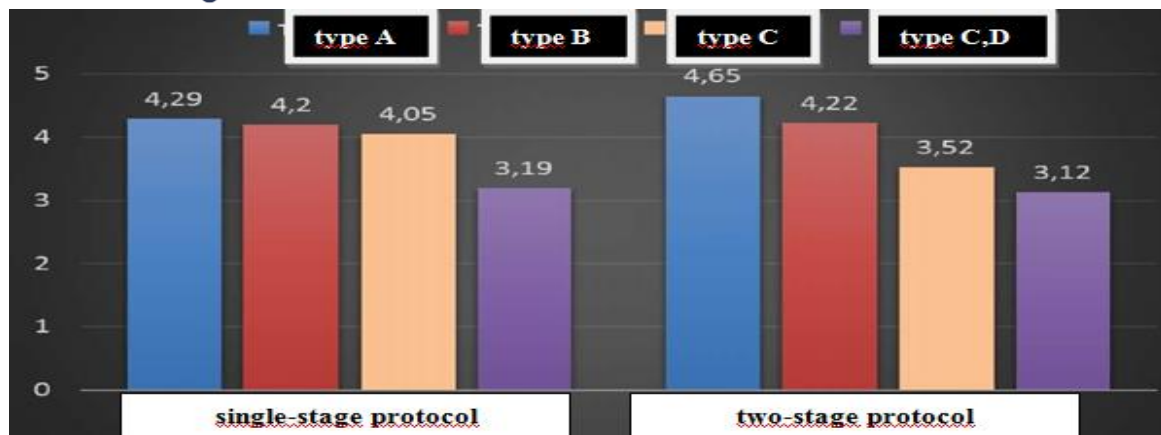


Figure 1: Assessment of the clinical consistency of the placed dental implants depending on the surgical protocol and the type of atrophy of the alveolar process (score from 1 to 5).

The condition of the jawbone was assessed mainly by means of the orthopantomograms available at the time of surgery, which unfortunately did not always provide complete and reliable information on the bone structure and density. Complications developed when the available anatomical conditions were optimistically overestimated, contraindications were not identified at the pre-operative stage or the masticatory loads during prosthetics were unequally distributed, due to lack of experience and insufficient patient examination the following was revealed: the highest satisfaction was observed in patients with fixed prosthesis constructions, with a one-stage surgical procedure being installed. There were no statistically significant differences between the surgical protocols and types of fittings ($p > 0.05$). The following was observed in the evaluation of patient satisfaction with the treatment: the greatest satisfaction was observed in patients with fixed prostheses, the fitted.

Table 2 Assessment of patient satisfaction with treatment according to prosthetic constructs, duration of complete treatment and dental implant methods used (2019-2022)

Surgical protocol	Designs	Patient satisfaction with the treatment provided				Average score
		Unsatisfactory.	satisfactory.	good	Fine	
One-stage protocol implantation	Fixed	-	5 (7,82%)	28(43,75%)	31(48,43%)	4,40
	Removable	1 (9,09%)	1 (9,09%)	5 (45,45%)	4 (36,37%)	4,09
	Fixed	3 (5,27%)	9 (15,79%)	22(38,59%)	23(40,35%)	4,14
	Removable		2 (40%)	2 (40%)	1 (20%)	3,8
Two-stage	137 (100%)	4 (2,92%)	17 (12,4%)	57 (41,6%)	59(43,08%)	4,1075

$p > 0.05$ no statistically significant difference was found between the one- and two-stage protocols.



The single-stage surgical protocol showed a slightly higher satisfaction score for implants compared to two-stage collapsible dental implants (mean score of 4.40 versus 4.14 on a five-point scale) (Table 13). In this regard, we can conclude that shortening the treatment period, abandoning multistage and osteoplastic surgery during the surgical phase of treatment by using a single-stage surgical protocol of dental implantation and non-dismountable dental implants leads to increased patient satisfaction with the treatment performed without significant differences or with advantages in the clinical soundness of the dental implants and orthopaedic constructions installed. The algorithm for choosing the optimal implant design and surgical technique of their installation in patients with maxillary atrophy has not been sufficiently developed so far; therefore, patients' satisfaction with the treatment performed is often insufficient. Examination and the results of the patient survey showed that in patients with sufficient bone volume of the maxillary ridges (atrophy type A, B) the clinical consistency of dental implants installed using the one-stage surgical protocol does not .

Conclusions:

Thus, the results obtained allow us to state the comparable results of the clinical evaluation of the dental implants placed according to the one-stage and two-stage surgical protocol in patients with sufficient bone volume in the alveolar processes of the jaw and increase the patients' satisfaction with the treatment performed while reducing its duration, in case of using the one-stage surgical protocol. The obtained data show that the degree of atrophy of the maxillary ridges has no significant impact on the clinical suitability of the placed dental implants. Retrospective studies have shown that single non-removable dental implants (end and inlay prostheses and removable denture retainers) are most at risk of failure (mobility).

The long-term results of implantation show that patients with varying degrees of alveolar atrophy have a favourable treatment outcome in 94.15-100% of cases if the correct technique of implant placement, immediate non-functional splinting prosthetics and adequate postoperative medication therapy are observed. Thus, if the indications and contraindications for surgery are correctly determined, the survival rate of one-stage dental implants, including monolithic implants installed according to the one-stage surgical protocol, does not differ significantly from that of two-stage dismountable implants ($p < 0.05$). The obtained retrospective data permit to consider the single-stage surgical protocol of dental implantation and non-dismountable implants as the objective self-sufficient method of dental implantation in patients with various degrees of the alveolar process atrophy.





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