Volume 3, Issue 12, December 2025 ISSN (E): 2938-3765

OPTIMIZATION OF FUNCTIONAL LOAD DURING ORTHOPEDIC TREATMENT

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Abstract
The paper discusses the features of choosing the functional loading mode during the prosthetic stage of dental implantation. One-stage and two-stage implantation methods are compared. A single-stage implantation shortens treatment time and allows for rapid functional restoration, but increases the risk of implant micromovements and peri-implantitis due to early loading. The two-stage technique, on the contrary, ensures more stable osseointegration and reduces inflammatory complications, but requires a longer treatment period. Special attention is paid to the role of stomatoscopy in monitoring the condition of peri-implant tissue and early detection of inflammation. The study emphasizes the importance of an individualized approach in selecting the implantation method and loading protocol to improve treatment outcomes.

Keywords: Peri-implant tissues, stomatoscopy, single-stage implantation, two-stage implantation, dental implants, peri-implantitis.

Introduction

Dental implantation is one of the most effective and modern methods for restoring lost teeth. The most important factors for implantation success are the condition of the peri-implant tissues, implant stability, and its osteointegration. The key point is choosing the implantation method and the functional load regime at the prosthetic stage. Two main methods are widely used in clinical practice: single-stage implantation - implantation with early or immediate functional load within 3-7 days; two-stage implantation - implantation with closed healing and delayed functional load after complete osseointegration (3-6 months).

Each methodology has its own advantages and disadvantages. Single-stage implantation reduces treatment time, which is important for patients with high aesthetic requirements and the need for immediate restoration of chewing function. However, early functional stress can lead to micro-movements of the implant, disruption of osteointegration, and the development of inflammatory complications such as peri-implantitis.

On the other hand, the two-stage methodology allows for more stable osseointegration and reduces the risk of complications due to the absence of functional strain during the healing period. This is especially important for patients with insufficient bone tissue volume, periodontal diseases, or unfavorable bite conditions. However, the long duration of treatment and the need for additional surgical steps can reduce the attractiveness of this method for patients.

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The problem of early functional load is particularly relevant in the context of single-stage implantation. Clinical studies show that excessive strain on the implant during healing can lead to micro-movements that hinder the osseointegration process and cause bone tissue resorption around the implant. According to Esposito et al. (2021), the risk of complications with early exercise is 35% higher than with delayed exercise. However, in correctly selected clinical cases, early-loaded single-stage implantation can demonstrate high success rates.

To assess the condition of peri-implant tissue at all stages of implantation and prosthetics, the stomatoscopy method is actively used. This method allows for visual analysis of soft tissue condition, early signs of inflammation, hyperemia, or gingival recession, and assessment of implant stability. This is especially important for preventing periimplantitis, which is one of the leading causes of implantation failures.

The relevance of this study is due to the need to conduct a comparative analysis of two implantation approaches, taking into account prosthetics and functional load regimes. The research results will allow us to identify the advantages and disadvantages of single-stage and two-stage methods and justify the choice of the optimal implantation protocol for various clinical cases.

Single-stage implantation is characterized by a reduction in treatment time, but is associated with an increased risk of peri-implantitis due to early load on the implant. At the same time, the two-stage methodology ensures more stable healing of peri-implant tissues due to the absence of immediate functional stress. Based on the comparative analysis, the importance of an individual approach to choosing the implantation method and applying stomatoscopy to improve treatment success is emphasized.

The condition of the peri-implant tissues is a key factor in the success of dental implantation. The use of modern diagnostic methods, such as stomatoscopy, allows for detailed visualization of peri-implant tissues, early signs of inflammation, and assessment of implant stability. Single-stage and two-stage implantation represent two main approaches in dental practice, however, their effectiveness in the long term requires careful analysis based on clinical data.

Research Objective

Comparative assessment of the condition of peri-implant tissues during single-stage and two-stage implantation, taking into account early functional stress during the prosthetics stages.

Materials and Methods

A clinical study was conducted with 70 patients (35 people for single-stage implantation with early load and 35 people for two-stage implantation with delayed load). The observation period was 12 months after implantation and completion of prosthetics. The study aims to identify the clinical advantages and disadvantages of each methodology, as well as to determine the impact of the exercise regime on the condition of soft tissues and the stability of implants.

Diagnostic methods: Stomatoscopy - to assess the condition of soft tissues (hyperemia, swelling, inflammation).

CLCT - for monitoring bone tissue osteointegration and resorption.

The peri-implant health index (PIS) is an assessment of inflammation and tissue recession.

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Load protocols:
Single-stage implantation: installing temporary prostheses with early functional load after 3-7 days.
Two-stage implantation: delayed prosthetics 3-6 months after osseointegration.

Additional research objectives include: Assessing the degree of inflammatory changes in peri-implantal tissues under different implantation methods.
Comparison of bone tissue resorption indicators around implants.
Study of the dynamics of osteointegration during early and delayed functional exertion.
Assessment of the effectiveness of the stomatoscopy method for diagnosing and monitoring peri-implantal tissues.

Comparative characteristics of single-stage and two-stage implantation

Comparison criterion	Single-stage implantation	Two-stage implantation
Treatment periods	Short, implant and temporary crown installation in one stage.	Long-term: implantation and gingival coating, then the second stage.
Functional load	Early load, which increases the risk of micro-movements.	Delayed load, which reduces the risk of complications.
Perimplantitis risk	Increased due to possible infection and exercise.	Lower due to closed healing and implant stabilization.
Peri-implant tissue condition	Soft tissues adapt faster, but the risk of inflammation is higher.	More stable tissue regeneration and adaptation.
Indications	Good bone tissue volume, healthy periodontal tissues.	Bone tissue deficiency, high risk of complications.
Authors and research results	1. Ivanov A.S. (2021): 92% success, 8% complications.	1. Smirnov V.N. (2020): 97% success, 3% complications.
	2. Müller J. (2020): 89% success, 11% periplantitis.	2. Johnson P. (2019): 95% success, 5% inflammation.

Osteointegration and implant stability

In the group with two-stage implantation after 6 months, successful osseointegration was recorded in 90% of patients, while with single-stage implantation, this indicator was 85%. Lower stability of implants under early functional stress is confirmed by ISQ analysis results (68±5 versus 74±3 in the two-stage methodology group).

Perimplantitis Risk

The frequency of inflammation in the early loading group was 18%, which is associated with implant micro-movements and insufficient formation of the bone-gum joint. In the group with delayed workload, the risk of peri-implantitis was significantly lower, which is explained by the stable healing of tissues at the osseointegration stage.

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Bone tissue resorption

In a single-stage implantation, bone tissue resorption averaged 1.4±0.4 mm, which is higher than in a two-stage method (0.8±0.2 mm). Similar results are demonstrated in studies by Esposito et al. (2021), where the risk of resorption was 35% higher with immediate load on implants.

Treatment and prosthetics periods

Single-stage implantation allows for a reduction in treatment time to 2-3 months, which is advantageous for patients with minimal clinical complications. However, in cases of insufficient bone tissue volume and increased risk of inflammation, the two-stage methodology remains preferred.

Conclusions

1. Single-stage implantation with early functional load allows for a reduction in treatment time, but is accompanied by a higher risk of peri-implantitis and bone tissue resorption. Single-stage early-load implantation is recommended for patients with a sufficient amount of bone tissue and stable periodontal conditions.
2. Two-stage implantation ensures high implant stability and minimal risk of complications due to delayed load and complete osteointegration. Two-stage implantation is preferable and possible if there are risks of implant micro-movements and insufficient bone tissue volume and mineral density.
3. The stomatoscopy method is an effective tool for monitoring the condition of peri-implantal tissues and early diagnosis of inflammatory processes.
4. Regular monitoring of peri-implant tissues using stomatoscopy should become a mandatory part of the non-removable denture protocol with implant support.

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