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QUALITY OF LIFE IN PATIENTS WITH TEMPOROMANDIBULAR JOINT ARTHROSIS AND ORTHOPEDIC TREATMENT OF MISSING TEETH DEPENDING ON THE SEVERITY OF ARTHROSIS AND IMPLANT VOLUME

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Abstract

Temporomandibular (TMJ) arthrosis severely impacts everyday activity and has substantial negative consequences for the general health state, especially when local manifestations are orchestrated by pronounced pain syndrome. That justifies the necessity of investigating the quality of life (QL) of patients with TMJ arthrosis who are undergoing orthopedic treatment. The research aimed to investigate the QL of patients with unilateral and bilateral TMJ arthrosis before and 6-8 months after occlusion correction, which was achieved by placing a different number of implants. In total, 127 patients (75 women and 52 men) were observed in the study of quality of life indicators, which were divided into four groups: bilateral TMJ arthrosis with the implantation of 3-6 implants (36 patients); bilateral TMJ arthrosis with the implantation of 1-2 implants (30 patients); unilateral TMJ arthrosis with the implantation of 3-6 implants (29 patients); unilateral TMJ arthrosis with the implantation of 1-2 implants (32

patients). Each group was comparable in age, gender, duration, and manifestations of arthrosis. QL was measured using questionnaire SF-36. In patients who were diagnosed with bilateral TMJ arthrosis and underwent implantation of 3-6 implants in the postponed period, only pain (P) and SRF scales significantly exceeded initial values – by two times and by 23.2% correspondently ($P<0.05$). In patients with bilateral TMJ arthrosis and implantation of 1-2 implants showed significant increase on all scales except PF and MH. Thus, the implantation of a significant number of implants (3-6) in the setting of unilateral manifestations of TMJ arthrosis showed an improvement in the quality of life of patients compared to the baseline level on five scales - PF, P, Vit, SRF and RLEH ($P<0.05$). In patients with unilateral TMJ arthrosis and a small number (1-2) of implant insertions, initial QL was relatively better when compared with other groups, and posttreatment improvement was seen in all scales ($P<0.05$). The results indicated the effectiveness of improving the quality of life by correcting the occlusion using permanent implants in patients with manifestations of TMJ arthrosis. The severity of the therapeutic effect has an inversely proportional relationship with the severity of the manifestations of arthrosis and the amount of orthopedic care provided. The obtained results indicate the effectiveness of the SF-36 questionnaire in orthopedic patients with TMJ arthrosis and general distinct health disorders.

Key words: temporomandibular joint; arthrosis; malocclusion; teeth implantation; quality of life; SF-36.

The study of quality of life is a relevant and essential component of monitoring the condition of patients requiring long-term rehabilitation [5, 6, 20]. Patients who receive orthopedic dental care in this category need to monitor QL, which allows them to choose the most appropriate approaches to effective and safe treatment [3, 4]. Each patient assesses the impact of this pathology and therapy on their emotional, psychological, physical, and social functioning, which gives the patient the role of an active participant - a partner in determining the tactics of treatment and prevention measures.

The SF-36 questionnaire (Medical Outcomes Study Short-Form 36) is the most common nonspecific means of studying patient quality of life. It allows the assessment of various components of a patient's life in the context of illness [3, 8, 11]. To date, few scientific papers have been published that would assess the quality of life of patients with orthopedic dentistry problems, although there is an undeniable need to use the possibilities of QL assessment in patients undergoing multistage and long-term procedures to correct the dentoalveolar system.

One of the diseases that are a priority in dental orthopedists' activity is TMJ disorders. Thus, TMJ diseases of both inflammatory and dystrophic nature are severe diseases due to the complexity of the joint structure and constant load, which necessitates precise orthopedic measures to restore its function correctly [1, 7, 18]. The prevalence of TMJ dysfunction ranges from 5% to 12% of the population. In terms of unbearable pain and disability, TMJ lesions are the second most common after chronic lumbar radicular pain [21]. According to some reports, the prevalence of TMJ disease can cover 15% of the population, and some temporary manifestations of joint damage are observed in half of the adult population [14]. However, only 2% of patients with such manifestations receive treatment [15].

It should be noted that the consequences of TMJ arthrosis are accompanied by a direct loss of the ability to maintain the patient's daily physical and psychological fitness, the degree of which can be assessed by the study of quality of life indicators [9]. It is important to note that the annual cost of medical care to patients is significant. It is about four billion dollars in the United States, not including the cost of joint imaging [9]. Treatment costs include "joint axis realignment" through implants to correct the bite and restore adequate load to the joint [5].

Thus, tooth loss, which causes malocclusion, is considered one of the most significant causes of TMJ arthrosis, and the formation of malocclusion, in turn, exacerbates pathological changes and joint damage [5, 13]. However, the effectiveness of restoring the physical and psychological condition of patients who, after a long period of TMJ arthrosis, were treated with the elimination of the pathological mechanical factor on the condition of the joint still needs to be studied [7, 13, 16]. There is also no data on the results of such recovery, given the severity of TMJ damage - unilateral or bilateral, and orthopedic treatment with a different number of implants.

The aim of the work is to investigate the quality of life of patients with unilateral and bilateral TMJ arthrosis. It was conducted within 6-8 months after occlusion correction, which was achieved by placing a different number of implants.

Material and Methods

All studies were conducted in accordance with the requirements of the Order of the Ministry of Health of Ukraine No.417 of July 15, 2011, and approved by the Bioethics Committee of Odesa National Medical University (Protocol No.3 of May 05, 2022). All examinations were performed with the patients' comprehensive informed consent.

The diagnosis of TMJ arthrosis was made according to the current protocol based on the analysis of clinical and laboratory data and MRI images [1, 18]. The duration of the

disease was 2.5 ± 0.7 years. Patients complained of varying degrees of pain, which was both constant and occurred during chewing. The pain was moderate in all cases and was relieved by taking non-steroidal analgesic drugs. All patients were taking chondroprotectors during the examination period. The average age of the main group was 43.3 ± 2.2 years. All patients underwent MRI and X-ray examination of the affected joints to assess the capabilities of the masticatory system, as well as standard clinical and laboratory examinations.

In total, 127 patients (75 women and 52 men) were observed in the study of quality of life indicators, which were divided into four groups:

- bilateral TMJ arthrosis with the implantation of 3-6 implants (36 patients);
- bilateral TMJ arthrosis with the implantation of 1-2 implants (30 patients);
- unilateral TMJ arthrosis with the implantation of 3-6 implants (29 patients);
- unilateral TMJ arthrosis with the implantation of 1-2 implants (32 patients).

Each group was comparable in age, gender, duration, and manifestations of arthrosis.

Criteria for the inclusion in the observation:

- the joint regularly hurts when chewing; MRI shows signs of sclerotic changes and slight deformation of the articular head;
- malocclusion presence in patients that is plausible for the correction with dental implants;
- patients have no contraindications for teeth implantation;
- the presence of bite improvement after implantation, which was determined subjectively by the patients themselves and during an objective examination of patients using technologies for measuring cranio-jaw indices [1].

Exclusion criteria:

- manifestations of TMJ arthrosis with severe degenerative cartilage destruction, significant bone growths, joint deformities with significant limitation of joint motion, persistent and severe pain;
- uni- or bilateral arthrosis in patients with partial tooth loss classified the forms of disorders into asymmetric (B1M—single-sided molars and B3PMM—unilateral premolars and bilateral molars) and symmetric (B2PM—bilateral premolars and B2MM—bilateral molars). Implantation was carried out in accordance with protocols [10, 12,] using implants from Nobel Biocare, Bicon, Ankylos (USA), B&B Dental (Italy), and Straumann (Switzerland).

The quality of life of patients was assessed using the SF-36 questionnaire in the period of 6-8 months from the date of orthopedic care [3, 17].

The results were statistically processed using the statistical package SPSS 21.0 (USA) for reliability Cronbach's- α and validity construct and discriminant values recalculation, the

ANOVA method, and the Newman-Keuls test. The level at $P < 0.05$ was accepted as statistically significant. The mean value, error of mean value, and standard deviation were calculated.

Results

In patients who were diagnosed with bilateral TMJ arthrosis and underwent implantation of 3-6 implants, the initial score did not exceed 50 points on most scales (six out of 8), which is remarkable for low QL (Fig.1). Just only mental health (MH) scale was 63.5 ± 7.0 points and - social role functioning (SRF) was 51.2 ± 5.8 points. While tendencies for improvement were registered on all scales in the postponed period, only pain (P) and SRF scales significantly exceeded initial values – by two times and by 23.2% correspondently ($P < 0.05$) (Fig. 1).

Thus, the implantation of a significant number of implants (3-6) in the setting of bilateral manifestations of TMJ arthrosis showed an improvement in the quality of life of patients compared to the baseline level on two scales – P and SRF ($P < 0.05$).

The study of quality of life indicators in patients with bilateral TMJ arthrosis and implantation of 1-2 implants showed low QS before orthopedic treatment (Fig. 2). Only physical functioning (PF) and mental health (MH) data were higher than the 50 score value and were $52.1 \pm 6,3$ and 64.5 ± 6.8 points, respectively.

These scales (PF and MH) did not increase significantly after treatment (Fig. 2). Thus, the increase in the PF scale, which compared with that before surgery, was 17.4% ($P > 0.05$) and MH – 15.0% ($P > 0.05$) (Fig. 2). All the rest scales significantly exceeded the pre-treatment level, and the maximal increase was observed in the pain scale (P) - 1.63 times compared with the preoperative index ($P < 0.05$).

Hence, the implantation of a significant number of implants (3-6) in the setting of bilateral manifestations of TMJ arthrosis showed an improvement in the quality of life of patients compared to the baseline level on six scales – RLPH, P, GHP, Vit, SRF and RLEF ($P < 0.05$).

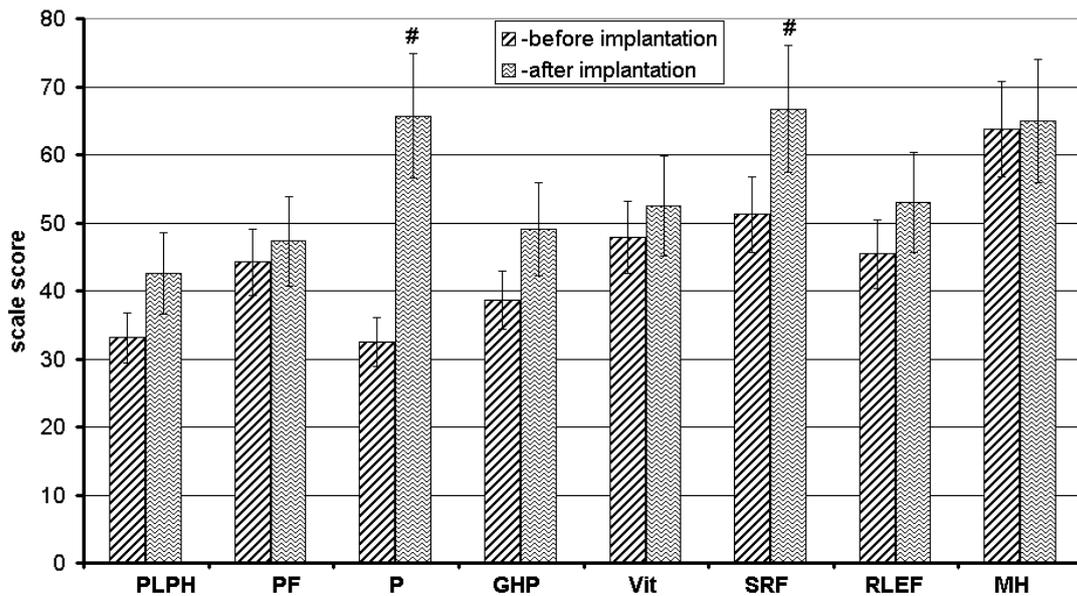


Fig.1. Quality of life of patients with bilateral TMJ arthrosis and 3-6-implants insertion.

Notes: I – role limitations due to physical health (RLPH); II - physical functioning (PF); III - pain; IV - general health perception (GHP); V - vitality (V); VI - social role functioning (SRF); VII – role limitations due to emotional functioning (RLEF); VIII - mental health (MH). The ordinate axis is the studied indicator (in % pertained to the total number of answers that was 100%). Results presented as $M \pm SD$.

#- $P < 0,05$ vs data before implantation (ANOVA+ Newman-Keuls test).

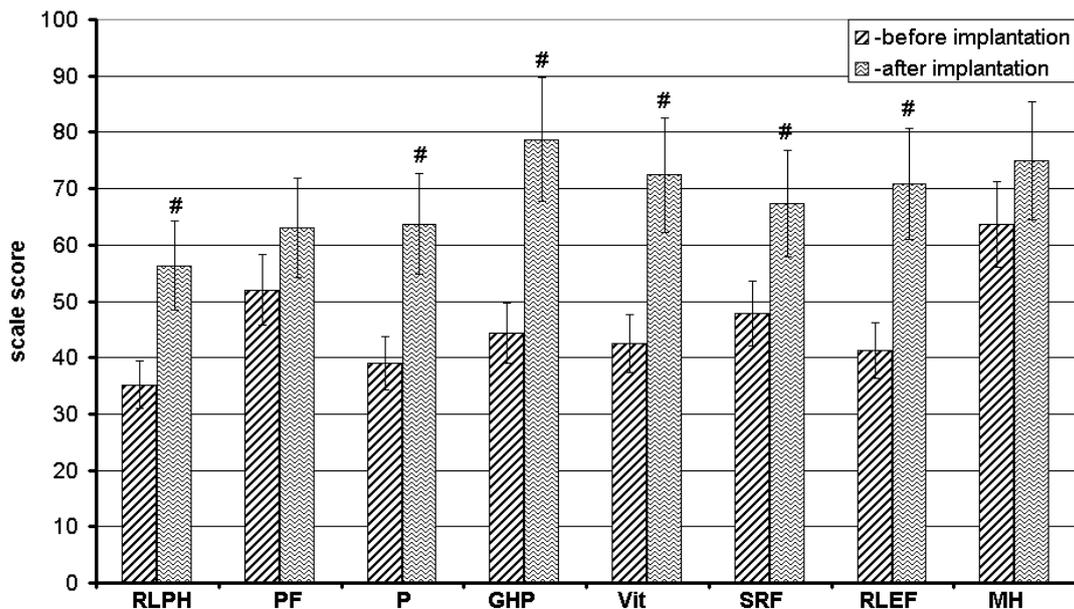


Fig.2. Quality of life of patients with bilateral TMJ arthrosis and 1-2-implants insertion. Notes: the same as in Fig. 1. #- $P < 0,05$ vs data before implantation (ANOVA+ Newman-Keuls test).

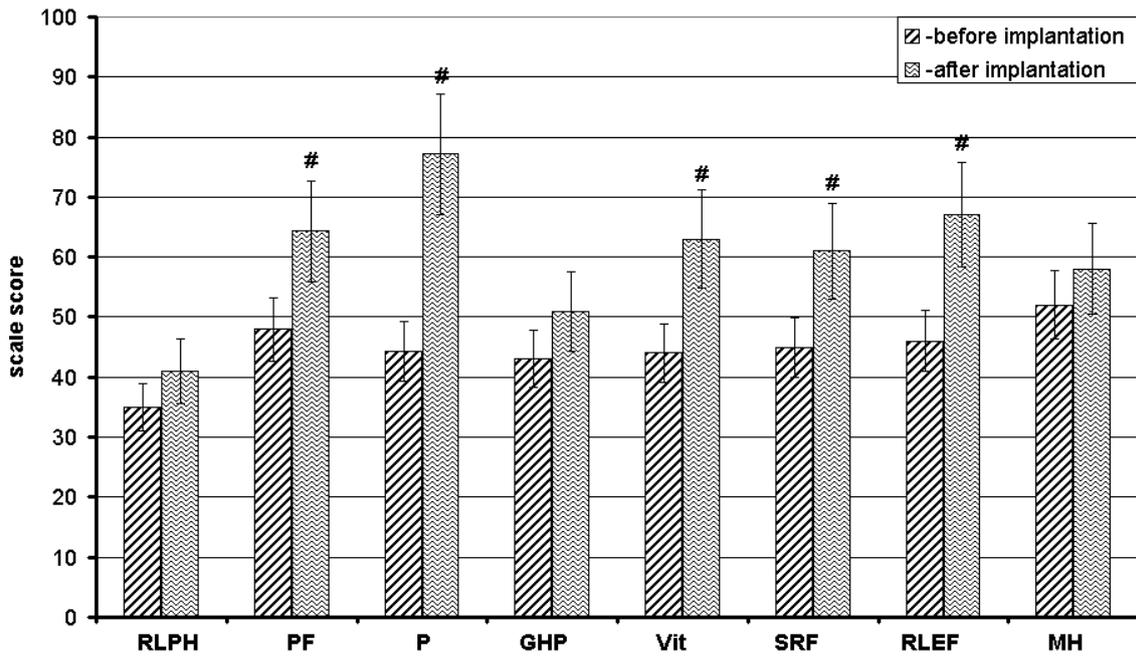


Fig. 3. Quality of life of patients with unilateral TMJ arthrosis and 3-6-implants insertion. Notes: the same as in Fig. 1. # - $P < 0,05$ vs data before implantation (ANOVA + Newman-Keuls test).

In the group of patients with unilateral TMJ arthrosis and insertion of 3-6 implants, MH scale was higher than 50 points before orthopedic treatment (Fig. 3). The average PF score achieved 64.3 ± 7.1 points after treatment and exceeded initial value by 24.3% ($P < 0.05$) (Fig. 3). The mean score of the pain scale (P) was 77.2 ± 6.8 points, which was also significantly higher than before surgery by 42.6% (44.3 ± 4.1) ($P < 0.05$). The vitality (Vit) scale increased by 30.2% compared to the preoperative level (from 63.2 ± 6.7 points to 44.1 ± 4.5 points), and the social role functioning (SRF) scale increased by 26.2% - from 43.9 ± 4.7 to 61.0 ± 6.3 points) ($P < 0.05$). In addition, the role limitations due to emotional functioning (RLEH) scale data increased by 31.4% (from 46.0 ± 4.5 to 67.2 ± 7.2 points) ($P < 0.05$) (Fig. 3).

Thus, the implantation of a significant number of implants (3-6) in the setting of unilateral manifestations of TMJ arthrosis showed an improvement in the quality of life of patients compared to the baseline level on five scales - PF, P, Vit, SRF and RLEH ($P < 0.05$).

QL in patients with unilateral TMJ arthrosis with fewer (1-2) implant insertions demonstrated scores higher than 50 points on three scales - PF, RLEF, and MH (51.2 ± 5.8 ; 53.3 ± 6.4 and 57.4 ± 7.3 points correspondently) before the treatment (Fig. 4). The significant improvement of all scales score was registered in 6-8 months after treatment. Thus, RLPH raised by 39.2% (up to 64.5 ± 8.3 points), PF - by 31.1% (up to 74.2 ± 9.3 points), GHP- by

43.7% (up to 80.6 ± 12.1 points), Vit – by 39.8% (up to 78.4 ± 11.2 points), SRF – by 38,7% (up to $81,2 \pm 12,5$ points), RLTF – by 29.7% (up to $76,2 \pm 10.8$ points) and MH by 22.0% (up to 73.4 ± 8.8 points) ($P < 0.05$) (Fig. 4).

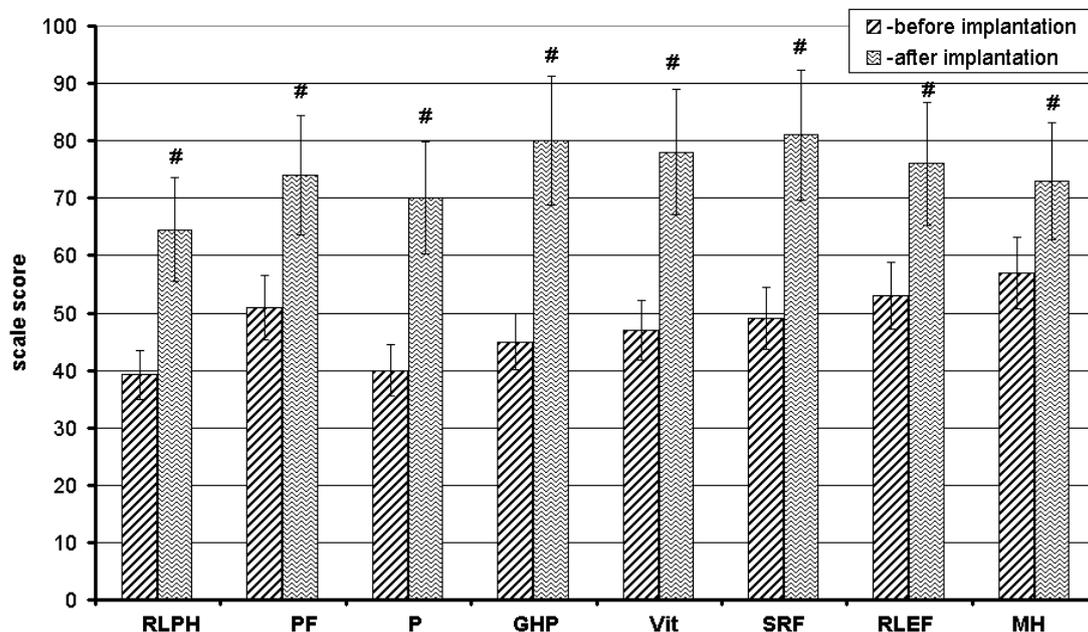


Fig. 4. Quality of life of patients with unilateral TMJ arthrosis and 1-2-implants insertion. Notes: the same as in Fig. 1. #- $P < 0,05$ vs data before implantation (ANOVA+Newman-Keuls test).

Thus, in patients with unilateral TMJ arthrosis and a small number (1-2) of implant insertions, initial QL was relatively better when compared with other groups, and posttreatment improvement was seen in all scales of SF-36.

Discussion

Thus, implantation as an auxiliary method of correction of occlusion asymmetry in patients with manifestations of TMJ arthrosis was accompanied by a significant improvement in quality of life, which was determined by all scales of the SF-36 questionnaire. In descending order of the number of scales that showed the effectiveness of treatment, the applied orthopedic technologies were arranged in the following order: unilateral arthrosis with implantation of a small number of implants (1-2) - improvement was recorded on all scales; bilateral arthrosis with implantation of a large number of implants (3- 6), when improvement was observed on 6 of the eight scales bilateral arthrosis with a significant number of implants (3-6) when improvement was observed in 5 of 8 scales and bilateral arthrosis with a significant number of implants (3-6) when improvement was recorded in 5 of 8 scales.

It should also be emphasized that the physical functioning (PF) scale showed no improvement in patients with bilateral arthrosis, and the mental health (MH) scale showed improvement only in patients with unilateral arthrosis and a small number of implants. Improvement was observed in all patient groups on the pain (P) and social role functioning (SRF) scales. According to the role limitations due to the emotional functioning (RLEF) scale, improvement was observed in all groups except for patients with bilateral arthrosis and a substantial number of implants (3-6).

At the same time, however, the general health perception (GHP) scale did not significantly change in the groups with bilateral and unilateral TMJ arthrosis and the implantation of 3-6 implants. This fact might be explained by the significant role of the implantation volume on a general perception of health. However, more time might be needed for better rehabilitation and adoption in posttreatment situations, as less implantation volume clearly demonstrated significant improvement in GHP scale data.

It should be noted that the lowest informational value in terms of statistical differences in the postoperative period was observed about the mental health (MH) score, which significantly increased only in the group of patients with a small number of implants and unilateral arthrosis. At the same time, the P and SRF scores are the most sensitive to the study of the quality of life of patients with MTJ arthrosis and implantation, with significant differences observed in all study groups. Accordingly, the different sensitivity levels of individual SF-36 scales indicate the feasibility of further improving questionnaires that could more effectively diagnose the state of quality of life in dental patients [7, 19].

It is advisable to divide QL indicators by their belonging to those that characterize physical health (PH) and mental state (MS); each includes four indicators of the SF-36 questionnaire [2]. In particular, PH includes RLPH, PF, P, and GHP, while MS includes Vit, SRF, RLTF, and MH. According to this classification, in patients with bilateral arthrosis and a significant number of implants, improvement occurred in one indicator of the first group (P) and one indicator of the second group of indicators (SRF). A similar proportional relationship was observed in patients with bilateral arthrosis and fewer implants when improvement was recorded in three indicators in the PH and MS groups. In patients with unilateral arthrosis and a significant number of implants, the indicators of the mental state group (MS) improved to a greater extent (three out of four). In contrast, with fewer implants, improvement was recorded on all scales.

In general, the data presented here indicate a proportional recovery of indicators characterizing the physical and mental health of patients with TMJ arthrosis under orthopedic treatment with dental implants.

Thus, the results indicate the effectiveness of improving the quality of life by correcting the occlusion with permanent implants in patients with manifestations of TMJ arthrosis. The severity of the therapeutic effect has an inversely proportional relationship with the severity of the manifestations of arthrosis and the amount of orthopedic care provided. The identified dependencies require further investigation through a more detailed study of the condition of the oral tissues and indicators of local and general immunological reactivity of patients.

Conclusions

1. Patients' quality of life in patients with TMJ arthrosis and dental implants aimed at occlusion correction improved within 6-8 months after implantation, depending on the severity of arthrosis (unilateral or bilateral), and has an inverse relationship with the number of implants (1-2 or 3-6).

2. According to the pain (P) and SRF scales, QL improvement was observed in all patient groups. According to the role limitations due to emotional functioning (RLEF) scale, improvement was observed in groups other than patients with bilateral arthrosis and a substantial number of implants. The mental health (MH) score significantly increased only in the group of patients with a small number of implants and unilateral arthrosis.

3. The most pronounced improvement in QL was observed in patients with unilateral arthrosis and 1-2 implants, while the least effective improvement was observed in patients with bilateral arthrosis and 3-6 implants. Improvement was observed in all and two of the eight QL scales, respectively. Improvement on 5 and 6 scales out of eight was recorded in the remaining study groups with bilateral and unilateral arthrosis and the use of 1-2 and 3-6 implants, respectively.

4. Stomatologists can use indicators of patients' quality of life determined by the SF-36 questionnaire scale in the early postoperative period to predict the effectiveness of restoring the health status of patients with TMJ arthrosis in the period after orthopedic bite correction.

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Author Contributions

Conceptualization, (Balykov Viktor, Associate Professor, PhD); methodology, (Shakhnovskyi Ihor, PhD); formal analysis, (Burdeinyi Viacheslav); data curation, (Cherednychenko Anzhela); writing—original draft preparation, (Lysenko Vladyslav); writing—review and editing, (Nazarov Oleksandr); supervision (Rozhko Pavlo, PhD).

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Institutional Review Board Statement

The experimental studies were carried out in the conditions of a chronic experiment in accordance with international standards of humane treatment of vertebrate animals and approved by the Ethics Committee of Odesa National Medical University (N3/05, May 2022)

Informed Consent Statement

The data of experimental studies are given. Written informed consent from the patients was not necessary to publish this paper.

Data Availability Statement

The data presented in this study are available on request from the corresponding author.

Conflicts of Interest

The authors declare no conflict of interest.