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Retrospective clinical evaluation of pterygoid implants: A patient study 6-96 months post-implantation

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SUMMARY

Purpose. The purpose of this study was to evaluate the success of pterygoid implants in clinical patient examination and to prove that pterygoid implants are a suitable alternative for restoring chewing function with implants in the atrophied maxilla.

Material and methods. The instantaneous study was conducted in October 2023 - April 2024 at the KDK Karpavičius D. Clinic. Patients who had pterygoid implants inserted 6-96 months ago were invited for a follow-up examination and clinical-radiological oral examination. All subjects gave their written consent and were guaranteed anonymity. The 37 respondents of the research consisted of patients from 40 years old to patients 78 years old. During the study, a clinical and radiographic oral examination was performed to assess the support of 47 implants, restorations, probing depth, bleeding, plaque, recession, keratinized gingival volume, marginal bone loss, signs of periodontitis at other teeth/implants, as well as the time since implantation, age, gender, and smoking habits were also recorded.

Results. No rejected pterygoid implants were identified. Thus, no implants were characterized by marginal bone loss or recession. It was found that smokers had poorer oral hygiene habits. Poorer hygiene led to bleeding gums at pterygoid implants, and it was also observed that older patients clean their teeth and implants less frequently and have more signs of periodontitis. Although there was no evidence of marginal bone loss, pockets were felt around the implants, which affected the thickness of the keratinized gingiva.

Conclusions. The success rate of pterygoid implants is very high, so these implants may be a good alternative for restoring the function of the atrophied maxilla. Poor oral hygiene habits, smoking, and age can affect the success of pterygoid implants.

Keywords: pterygoid, implants, maxilla, atrophy.

INTRODUCTION

Restoration of chewing function using implants in edentulous or partially edentulous jaws is currently the main applied method (1). Functional rehabilitation of the posterior part of the maxilla with implants presents a challenge for oral surgeons due to: the anatomy and position of the maxillary sinus (2), especially in cases with large jaw bone defects resulting from oncological lesions, trauma, aggressive generalized periodontitis, other infections, genetic disorders or syndromes (3); insufficient bone thickness due to alveolar ridge resorption and sinus pneumatization (4); bone density and poor quality for achieving primary implant stability (typically D3 or D4); difficult surgical access to the operative field (5).

Given these difficult conditions for implantation in the maxilla, many surgical reconstruction techniques have been developed to improve the conditions for implant placement and osseointegration success. Sinus floor elevation to create adequate bone thickness for implantation is the most commonly applied procedure, but it carries numerous potential complications, such as graft material loss, sinus floor perforation, bleeding, infection, or sinusitis. Bone augmentation using Le Fort I osteotomy is another technique to adjust bone dimensions, but it

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is highly invasive and has a difficult postoperative course. Less commonly used titanium mesh-guided augmentation also provides good conditions for implantation, but stretching of the oral mucosa during this procedure can lead to soft tissue tears and subsequent infections. All these procedures prolong treatment time, require multiple surgeries, and result in higher financial costs. To avoid such procedures, various modified implants have been developed, such as short implants, tilted implants, zygomatic implants, tuberosity implants, and pterygoid implants (3, 6).

Due to the high occlusal forces in the posterior maxilla, short implants (4 mm length) are not a suitable alternative for restoring chewing function. Tilted and zygomatic implants can restore function effectively but are often prosthodontically restored using cantilevered prostheses, which can result in prosthesis fractures and marginal bone loss around implants due to high forces on the cantilever areas. Tuberosity implants are placed in the maxillary tuberosity region, which is composed primarily of D3 or D4 trabecular bone and thin cortical bone, potentially compromising primary stability despite avoiding cantilevers (3, 6).

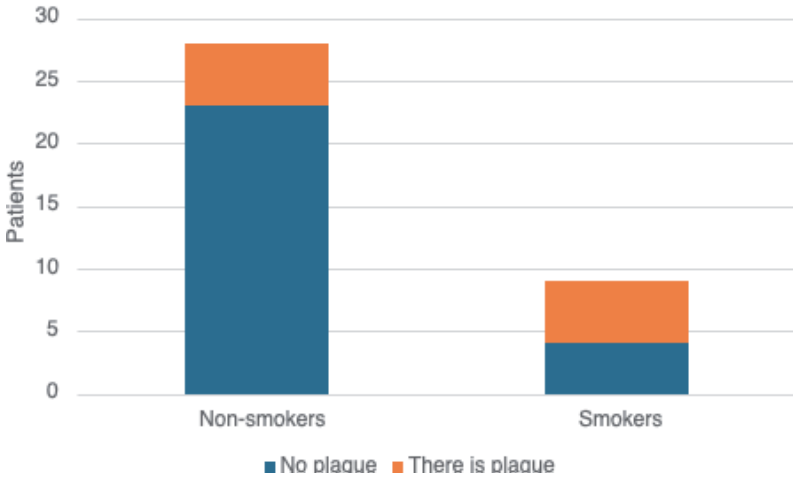

Fig. 1. The presence of dental plaque in smokers and non-smokers

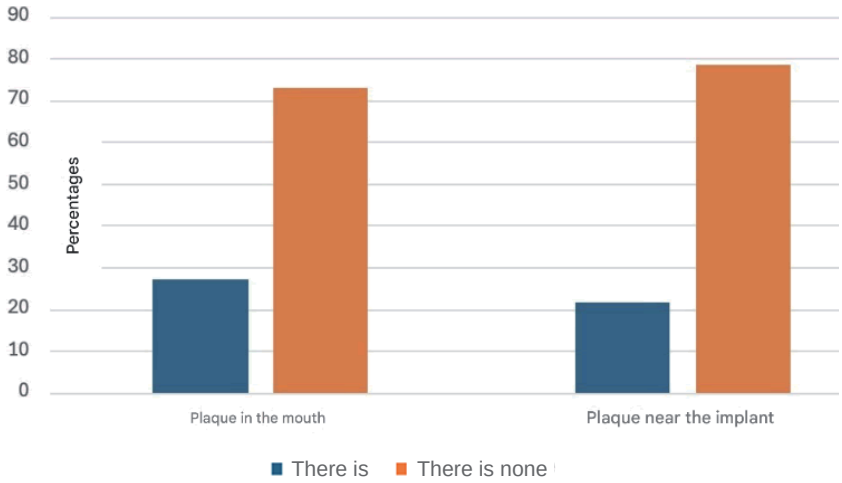

Fig. 2. Distribution (%) of plaque presence in the mouth and around the implant

The first pterygoid implant was placed in the 1980s by Dr. J.F. Tulasne, who initially observed an 80% success rate. Since then, many studies have been conducted, and the success rate of these implants has steadily improved, with some studies reporting up to 100% success (3, 7). Pterygoid implants do not require bone augmentation procedures, resulting in shorter treatment durations and lower costs. They offer excellent primary stability, as they engage not only the maxillary tuberosity but also the cortical bone of the pyramidal process of the palatine bone (D1 or D2) and the pterygoid process of the sphenoid bone (D1 or D2), allowing for immediate prosthetic loading. Another advantage is the absence of cantilevers in prostheses, reducing risks of prosthetic fracture, thread fracture, and marginal bone loss (1, 7). Furthermore, these implants do not require donor sites or biomaterials (8). However, the placement procedure is technically demanding due to the anatomy of the pterygomaxillary region, requiring highly skilled oral surgeons (9).

As with all surgical interventions, pterygoid implant placement cannot be performed in all cases. Main absolute contraindications include limited mouth opening (less than 35 mm) (10); bone deficiency in the pterygomaxillary region (7); impacted upper third molars; recent Le Fort or pterygomaxillary fractures (3, 11). Relative contraindications include diabetes, smoking, bruxism, and bisphosphonate use (6).

Due to the challenging access during pterygoid implant surgery, the procedure must often be performed under limited visibility, making surgeon experience and anatomical knowledge critical for successful outcomes (1, 10). Preoperative radiological planning is essential to determine the proper buccopalatal and mesiodistal angulation of the implant (1). Using a dedicated pterygoid implant kit, the osteotomy is prepared through the maxillary tuberosity, pyramidal process of the palatine bone, and ends in the cortical layer of the pterygoid process of the sphenoid bone (2). The implant site can be prepared using several techniques: freehand,

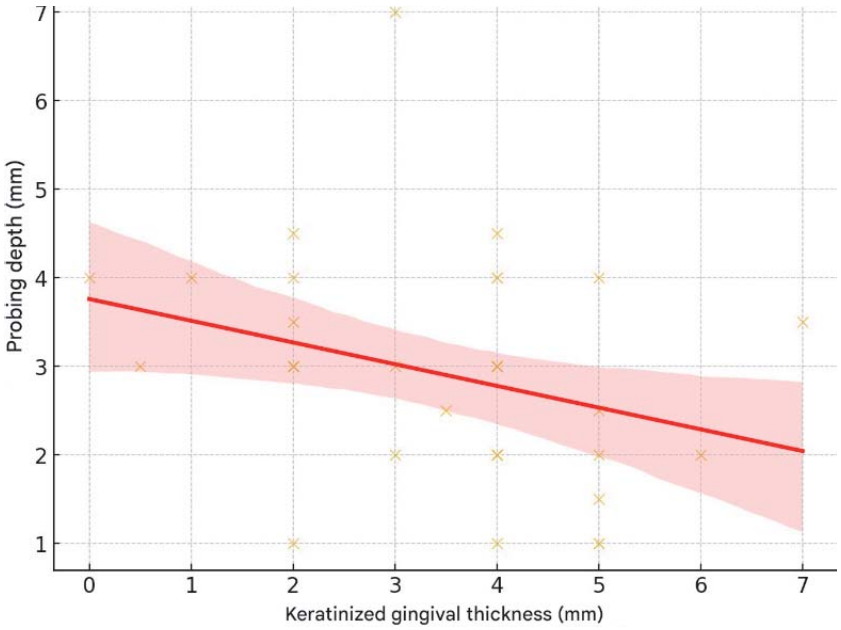

Fig. 3. The relationship between the thickness of keratinized gingiva (mm) and probing depth (mm)

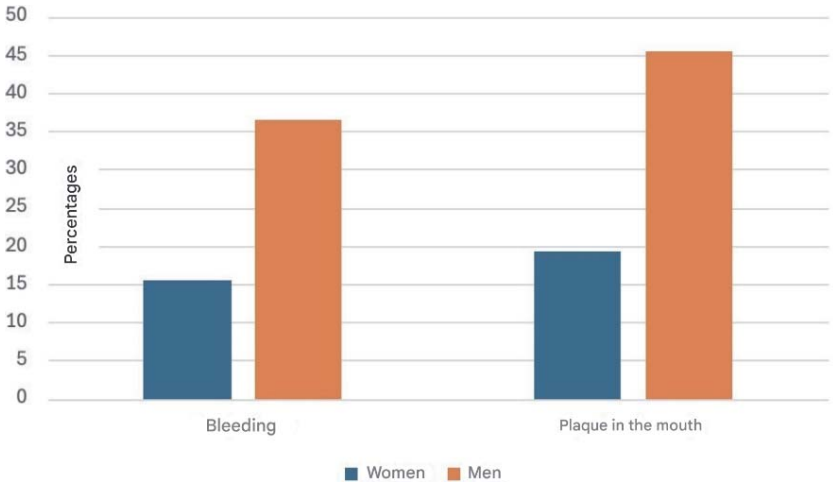

Fig. 4. The relationship between the thickness of keratinized gingiva (mm) and probing depth (mm)

dynamic navigation (guided implant placement), or autonomous robotic systems (1, 5, 12). The success of the final result depends not only on surgery but also on prosthetic restoration. It is recommended to connect pterygoid implants to other implants (traditional, zygomatic) in fixed prostheses rather than single crowns to prevent micromovements and better distribute masticatory forces (6). Restorations should have as smooth a surface as possible to reduce plaque accumulation (10). Postoperative care is also important to ensure long-term success. Patients are advised to rinse twice daily for one week with 0.2% chlorhexidine solution, use anti-inflammatory medications (Ibuprofen 600 mg twice daily or Paracetamol 1 g twice daily), and maintain a soft diet for two weeks (5). Maintenance includes using an irrigator twice daily and brushing with a soft manual toothbrush and non-abrasive toothpaste (3).

The oral surgeon must strictly follow the surgical protocol, maintaining the pre-planned radiological direction, depth, and angulation to avoid damage to nearby anatomical structures and reduce the risk of severe iatrogenic complications (12). Serious complications, such as implant displacement into the pterygoid fossa, infratemporal fossa, pterygopalatine fossa, sinus, severe bleeding from the posterior superior alveolar artery or descending palatine artery, or paresthesia from palatine nerve injury, are very rare (1, 3, 6, 13). The posterior superior alveolar artery or descending palatine artery may be damaged if the implant is positioned too apically; if it deviates laterally, it may enter the pterygopalatine fossa or pterygoid venous plexus, causing profuse bleeding (3). Mild bleeding in the pterygoid region is usually associated with injury to venous structures and can be controlled by fully inserting the implant into its final position (2). Other potential complications of pterygoid implant surgery include pain, sinus membrane perforation, fracture of the maxillary tuberosity or pterygoid complex, trismus, discomfort, implant mobility or rejection, sinusitis, mucositis or suppuration around the implant, and marginal bone loss (3, 6).

MATERIALS AND METHODS

The cross-sectional study was conducted from October 2023 to April 2024 at KDK Karpavičius D. Clinic. The sample included patients aged between 40 and 78 years (n=37), in whom maxillary function was restored using pterygoid implants (n=47). The time after implantation ranged from 6 months to 8 years. 70% of the participants were female and 30% male.

A clinical examination questionnaire was used for evaluation, including implant abutment type, restoration type and material, marginal bone loss (mm), bleeding, recession (mm), probing depth (mm), plaque on the implant and general oral plaque, and keratinized gingiva assessment. Smoking status

and presence of periodontitis signs at other teeth/implants were also recorded.

Approval for the study was obtained from the Bioethics Committee of the Medical Academy of Lithuanian University of Health Sciences. Data analysis was performed using IBM SPSS Statistics 24. The significance level for statistical hypothesis testing was α=0.05. Pearson's χ^2, Spearman, Kruskal-Wallis, and Student's t-tests were used for analysis.

RESULTS AND DISCUSSION

A total of 47 pterygoid implants were clinically and radiographically evaluated in 37 patients. No failed or rejected implants were identified – all implants were successfully integrated. No soft tissue recessions or marginal bone loss were observed. 24.3% of the participants were smokers (45.5% of men and 15.4% of women). A statistically significant association was found between smoking and plaque presence (p=0.027) (Figure 1).

27% of all patients had plaque in the oral cavity, and 21.6% had plaque specifically at pterygoid implants. Of those with general plaque, 75% also had plaque on their implants (p<0.001) (Figure 2).

Bleeding upon probing around pterygoid implants was noted in 8 patients, 75% of whom had plaque on their implants, showing a significant correlation between plaque and bleeding (p=0.028).

Among the prosthetic restorations, there were 25 bridges, 10 removable prostheses, and 2 single crowns. Four were made of acrylic, 13 of zirconium oxide, and 20 of titanium-acrylic. 43 implants were restored with multi-unit abutments and 4 with conometric connections. No significant association was found between prosthesis type/material or abutment type and clinical outcomes.

The mean age was around 61 years. Periodontitis signs at other sites were noted in 21.6% of patients, with a significant age difference between those with and without periodontitis (p=0.039), averaging 9 years older. Older patients also showed significantly more plaque (p=0.017), with the mean age in the no-plaque group at 58.86 years and 69.13 in the plaque group. A statistically significant correlation was found between probing depth and keratinized gingiva thickness (p=0.0205), and between plaque and gingiva thickness (p=0.031). The mean keratinized tissue thickness was 3.655 mm in the no-plaque group and 2.5 mm in the plaque group (Figure 3).

There was a significant gender difference in bleeding on probing (p<0.001) and plaque (p<0.001), with men twice as likely to have these signs. 36.4% of men and 15.4% of women had bleeding, and 45.5% of men versus 19.2% of women had plaque, suggesting poorer hygiene in men (Figure 4).

No significant relationship was found between time since implantation and clinical indicators (bleeding, plaque, probing depth, bone loss, recession).

CONCLUSIONS

1. Pterygoid implants demonstrated excellent success – all implants achieved osseointegration.
2. Older patients tend to have more difficulty maintaining oral hygiene, so more frequent professional cleanings should be recommended.
3. The risk of periodontitis increases with age, highlighting the importance of educating patients on preventive measures.
4. Women are generally more diligent in maintaining oral hygiene compared to men.

STATEMENT OF CONFLICTS OF INTEREST

The authors state no conflict of interest.

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