

Ridge atrophy of the mandible in relation to prosthetic treatment



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BACKGROUND and INTRODUCTION

The mandibular posterior region is unique in the alveolar ridge, due to its crucial role in the stomatognathic system and the complexity of prosthetic therapies after tooth loss. The type of prosthetic treatment has a major impact on the further development of jawbone tissues, since the suprastructures absorb the forces and distribute them on all supporting tissues. Bone atrophy as a side effect of this pressure absorption is pictured by the model of Marxkors⁽¹⁾ in **Figure 1**. This model demonstrates that the lack of adequate support combined with an unbalanced distribution of force can lead to increased bone atrophy. The preservation of bone tissue is of high importance in order to maintain stomatognathic functions and keep sufficient bone volume for future implant treatment. Therefore the criteria for prosthodontic restorations stated by McNeill in 2000⁽²⁾ should always be followed:

- Restore anatomical form by restoring or replacing missing structure
- Establish structural stability by optimizing the force distribution
- Provide functional harmony for mastication, deglutition, speech and esthetics

The aim of this retrospective cohort study is to investigate the difference of the post-therapeutical alveolar ridge atrophy between implant-supported dentures and conventional dentures. Our findings should help making the best possible treatment decisions in regard to longtime bone preservation.

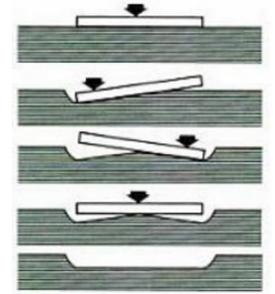


Fig. 1: Model for bone atrophy; Marxkors, 2007

METHODS

This retrospective cohort study included patients with tooth loss in the posterior mandible region, who received a prosthetic treatment and showed useable panoramic radiographs taken in the years 2001-2012. The data of the patients were collected from records of the Clinical Department of Prosthodontics at the Department of Dentistry and Maxillofacial Surgery of the Medical University of Graz, Austria. The patients were divided into groups according to their prosthodontic restoration.

To determine bone atrophy two panoramic radiographs at the time of prosthetic rehabilitation and after a minimum time lapse of 3 years were analysed and compared. To provide best comparability the classification of the American College of Prosthodontics was used to measure the mandibular bone height⁽³⁾. The anatomic landmark was the least mandible height as shown in **Figure 2**. SPSS (IBM), Excel (Microsoft) and Sigmaplot for Windows v12.5 (Systat Software Inc.) were used to statistically analyse the measurements.

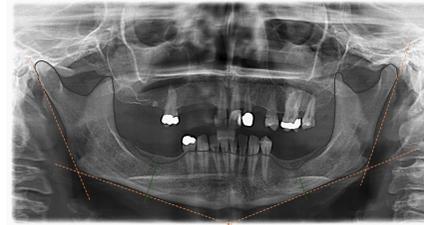


Fig. 2: 5 years after insertion of the partial denture (black contour line)
Least mandibular bone height is shown in green

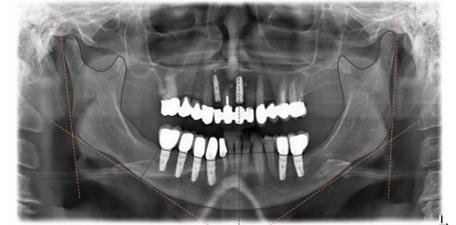


Fig. 3: 5 years after insertion of implants (black contour line)
Least mandibular bone height is shown in green

RESULTS

In total 479 patients, 284 females and 195 males fulfilled the inclusion criteria. The mean time difference between two measurements in all prosthetic treatments was 6.5 years. No significant alterations in the degree of atrophy in terms of age or gender distribution existed (**Figure 4A, 4B**).

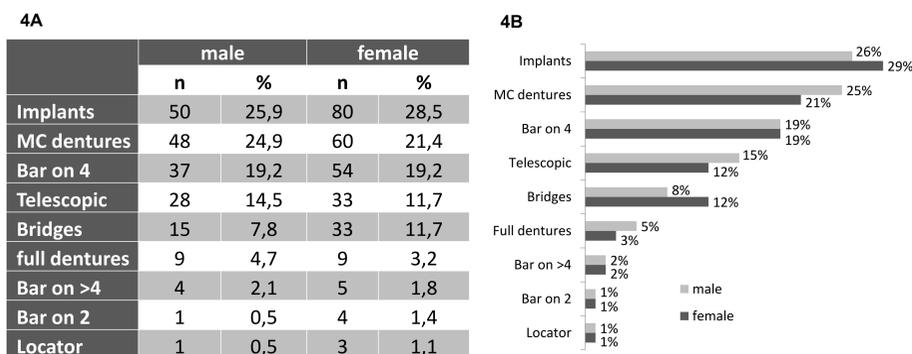


Fig. 4: Different prosthetic treatments shown in total numbers (4A) and calculated as percentage of total amount of treatments (4B).

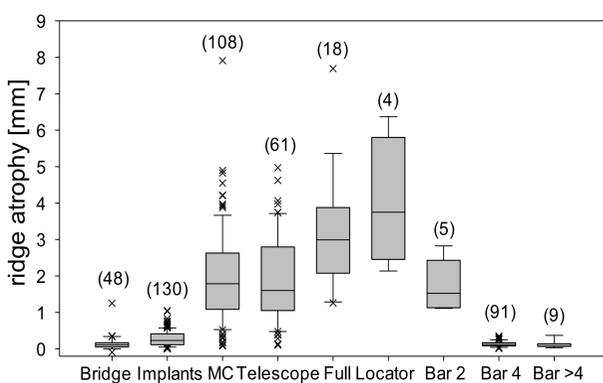


Fig. 5: Alveolar ridge atrophy according to prosthetic treatment.

Mean bone loss in dental bridges was 0.15 mm, in single-tooth implants 0.28 mm. In partial model casting dentures mean resorption was 1.99 mm, in telescopic dentures 1.88 mm and in full dentures 3.18 mm. Restorations on 2 implants with Locator-attachments showed a mean resorption of 4 mm and bar-retained dentures on 2 implants without extension 1.73 mm whereas bar-retained dentures on 4 implants showed 0.13 mm and bar-retained dentures on more than 4 implants 0.12 mm.

Restorations on 2 implants with Locator-attachments (4 mm) and bar-retained implant supported dentures on 2 implants without extension (1.73 mm) caused a significantly higher atrophy than bar retained implant supported dentures on 4 implants (0.12 mm, $p < 0.01$) (**Figure 6A**). In mandible with partial tooth loss, bridge restorations (0.15 mm) and single-tooth implants (0.28 mm) showed significant less bone loss than model casting dentures (MC) (1.99 mm) and telescopic dentures (1.88 mm) (**Figure 6B**).

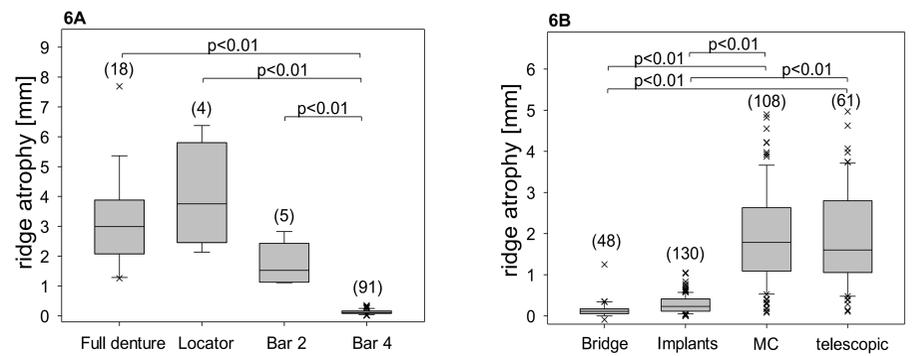


Fig. 6: Alveolar ridge atrophy (mm bone loss) in edentulous mandible (6A) and in mandible with partial tooth loss (6B).

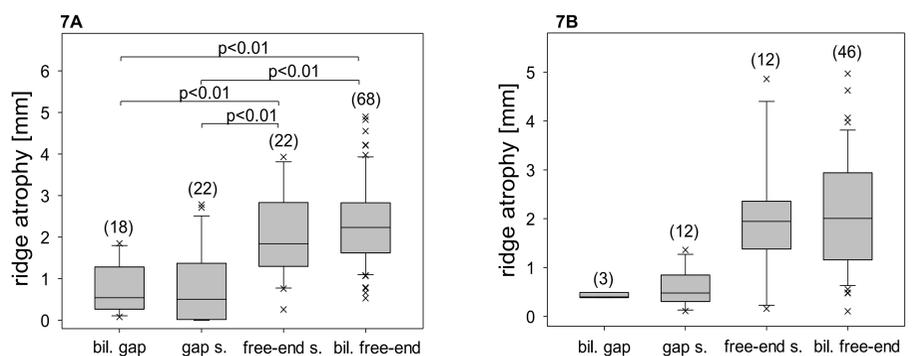


Fig. 7: Alveolar ridge atrophy (mm bone loss) in gap type in model casting dentures (7A) and telescopic dentures (7B). [bil. = bilateral, s. = side]

As shown in **Figure 7A** model casting dentures with free-end gaps caused significantly higher ridge atrophy than model casting dentures with interdental gaps ($p < 0.01$).

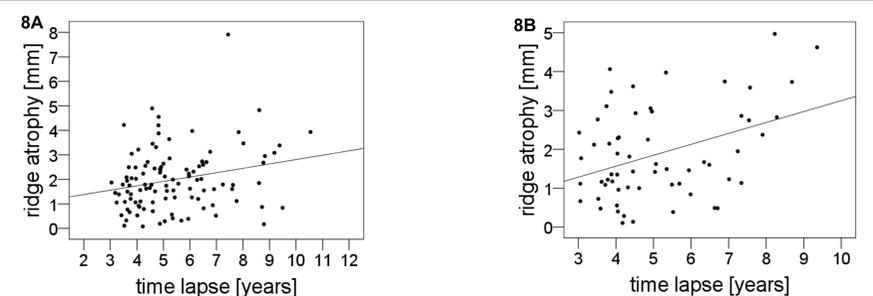


Fig. 8: Bone loss over time in model casting dentures (8A) and telescopic dentures (8B)

Figure 8 shows the loss of bone tissue in mm over time after prosthetic treatment with model casting dentures (**Figure 8A**) and telescopic dentures (**Figure 8B**). Pearson correlation analysis reveals a statistically significant linear resorption over time in partial model casting dentures ($r=0.262$, $p=0.006$) and telescopic dentures ($r=0.382$, $p=0.002$).

CONCLUSION

Our study demonstrates that the degree of bone atrophy in the posterior region of the mandible is highly dependent on the prosthetic treatment. Fixed partial dentures and permanent implant-supported restorations ensured long-term bone preservation. In edentulous mandibles, the bar-retained dentures supported on 4 or more implants showed the lowest grade of atrophy. Therefore, removable restorations supported on implants should be preferred to removable conventional dentures in terms of preserving alveolar bone volume.