Contribution of the Palate to Denture Base Support: An In Vivo Study

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The aim of this study was to examine the contribution of the palate to denture base support. Four subjects with tooth- or implant-supported maxillary overdentures were enrolled. Recordings (strain values converted to load values) were performed using miniature strain gauges and force transducers for the following conditions: metal framework only (A), denture base with full palatal coverage (B), and denture base without palatal coverage (C). The palatal-supporting ratio (PSR) was calculated using the equation PSR = (B – C) / A. The PSR values were less than 10% in all subjects, suggesting that the palate plays a minimal role in denture base support. *Int J Prosthodont 2014;27:328–330. doi: 10.11607/ijp.3804*

The palate is considered a key area of support for maxillary complete dentures and implant-retained overdentures. A major drawback of maxillary complete dentures is the so-called foreign body sensation when the palate is covered. If it could be proven that the palate plays less of a role in denture base support than previously believed, it would be unnecessary to cover the palate in all cases. Thus, this study aimed to evaluate the role of the palate in supporting the denture base.

Materials and Methods

Four people (two men and two women; mean age: 71.2 ± 5.6 years) participated in this study. All patients provided informed consent. Study approval was granted by the ethics board of Osaka University Dental Hospital, Osaka, Japan. Two participants had four natural abutments, whereas the other two had four implant abutments. All maxillary overdentures had bounded saddle configurations for attachment of a palatal denture base. Opposing dentition comprised only natural teeth, and all overdentures used lingualized occlusion.

In a previous study,[1] the current authors described the use of miniature strain gauges to measure the tissue-supporting ratio (TSR) following application of a load of up to 100 N (10-N increments) through a force transducer (LMB-A-100N, Kyowa Electric) located at the center of the framework. The mean strain value converted to load value was calculated from the output strain value according to the calibration.

Recordings were repeated three times with the metal framework only (A) and with two kinds of denture base: one with palatal coverage (B) and one without (C) (Fig 1). The TSR was calculated using the equation TSR = B / A. The palatal-supporting ratio (PSR) was calculated for each loading condition using the equation PSR = (B – C) / A. Statistical differences were analyzed with the Student *t* test (SPSS version 11, IBM; $P < .05$).

Results

The final TSR decreased to approximately 25% to 35% as the load increased, irrespective of tooth or implant support (Fig 2). The PSR was less than 10% and decreased to approximately 5% as the load increased (Fig 3). In all participants, at loads below 100 N, the PSR values were approximately 15% to 27% of the TSR values (Fig 4).

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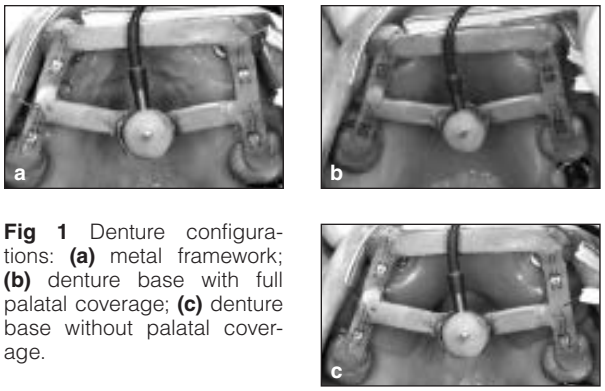

Fig 1 Denture configurations: **(a)** metal framework; **(b)** denture base with full palatal coverage; **(c)** denture base without palatal coverage.

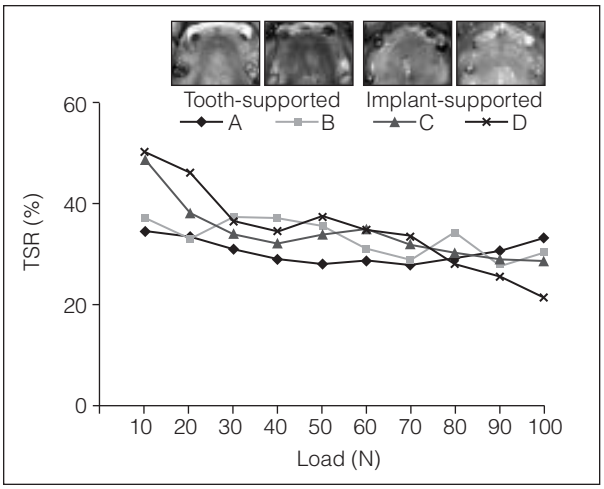

Fig 2 The TSR under different loads in each participant.

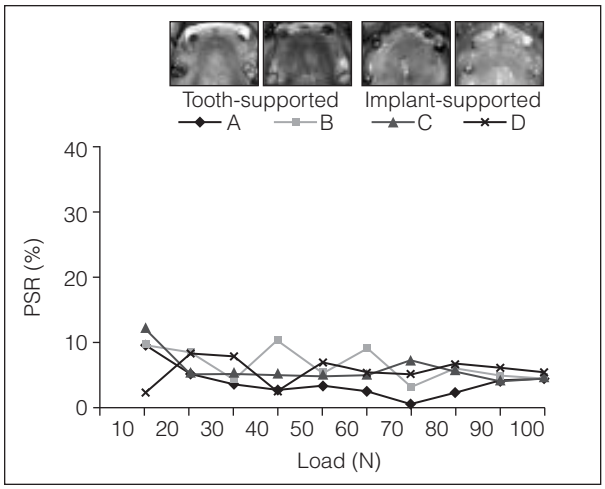

Fig 3 The PSR under different loads in each participant.

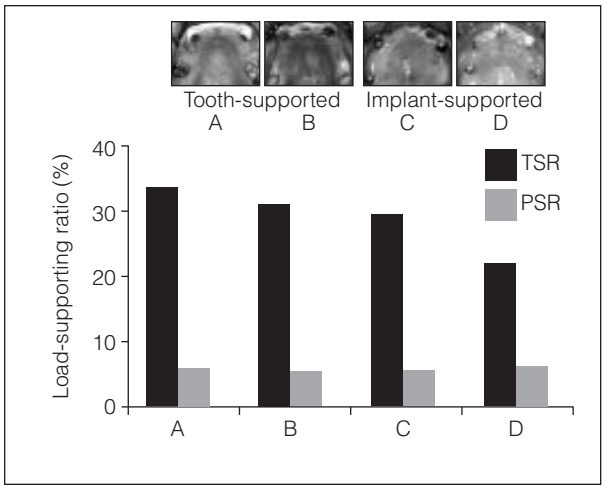

Fig 4 The TSR and PSR in each participant at a load of 100 N.

Discussion

Patients with maxillary complete dentures demand good retention, support, and stability during function. To achieve adequate retention, the posterior palatal border must be well sealed, particularly in patients with a severely resorbed residual ridge. However, this requirement must be balanced against the discomfort caused by full palatal coverage. Such discomfort may be alleviated by removing some of the palatal base plate, but only if this does not negatively impact denture support in areas where the ridge is only mildly resorbed.[2] Ochiai et al[3] used photoelastic analysis to show that the palate may provide decreased stress around denture-bearing implants. The residual ridge under tooth- or implant-supported overdentures has been reported to offer significant support capability.[4,5]

In the present in vivo study, when the TSR of maxillary overdentures was 30% to 40% under a vertical load of 50 to 100 N, the corresponding PSR was < 10%. Thus, the functional loads were mainly supported by the abutments and residual ridge; the palatal area did not bear much load. Therefore, in overdentures in which retention and support are provided by abutments (natural or implants) and a rich posterior residual ridge, respectively, the need for full palatal coverage is greatly reduced. When an oblique load is applied, the lateral palatal wall could effectively resist denture base movement and reduce stress to the abutments; however, the midline and posterior areas may provide less support to the denture base against such a load.

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Conclusions

Within the limitations of this pilot in vivo study, it was concluded that the palate provides limited support to overdenture bases.

Acknowledgments

The authors reported no conflicts of interest related to this study.

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Literature Abstract

The association of chronic apical periodontitis and endodontic therapy with atherosclerosis

The objective of this retrospective cross-sectional study was to provide an estimation of the extent of the association of chronic apical periodontitis (CAP) and endodontic treatment with atherosclerosis (ATS) in a large patient population. This study comprised 11,191 teeth in 531 patients, ages 8–89 years old, with a prior whole-body computed tomography (CT) scan. These 0.625 mm collimated source images, conducted on a 16- or 64-slice spiral CT scanner, were previously obtained for medical reasons. An objective calcium scoring method quantified the atherosclerotic burden of the abdominal aorta. Radiolucency associated with a root that was more than twice as wide as the adjacent periodontal gap on the crown side was assessed as a CAP lesion. Estimation of horizontal bone loss was quantified by measuring the height of the alveolar ridge and distance between crown and bone. Two investigators evaluated the jaws and teeth separately, without awareness of the aortic ATS burden. Results revealed that the volume of the aortic atherosclerotic burden for patients with at least one CAP lesion was 0.32 ± 0.92 mL, higher than for patients with no CAP (0.17 ± 0.51 mL; $P < .05$). The atherosclerotic burden increased with age and number of CAP lesions without root canal treatment, but not with number of CAP lesions with endodontic treatments ($P < .05$ each). In logistic regression models, age (Wald 90.8), CAP without endodontic treatment (Wald 39.9), male gender (Wald 9.8), and caries per tooth (Wald 9.0) correlated positively. In conclusion, a positive correlation, independent of the effect of marginal periodontitis and caries, is observed between CAP and the aortic atherosclerotic burden. Given the limitations of this study, the question of causality remained unanswered and could only be clarified by further research.

Petersen J, Glaßl EM, Nasseri P, Luger AK, Schoenherr E, Glodny B. *Clin Oral Investig* 2013 Dec 12 [Epub ahead of print]. **References:** 42. **Reprints:** Department of Radiology, Innsbruck Medical University, Anichstrasse 35, 6020 Innsbruck, Austria. Email: bernhard.glodny@i-med.ac.at
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