Distribution of Forces in Distal-Extension Removable Partial Dentures With and Without Retromolar Pad Coverage: A Pilot In Vivo Study

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This study compared the distribution of forces in relation to the area covered by the denture base. Seven participants were fitted with a loading device on the maxilla and were guided to bite on an experimental mandibular denture. The denture base was progressively shortened from full coverage of the retromolar pad. One-way analysis of variance ($P < .05$) was performed, and no significant difference was found among the four denture base lengths in relation to force distribution. Within the limitations of this study, the authors conclude that the area covered by the retromolar pad has little influence on force distribution during loading. *Int J Prosthodont 2015;28:386–388. doi: 10.11607/ijp.4239*

Removable prostheses are commonly prescribed to treat edentulous patients,[1] and many factors, including occlusal force distribution, influence the outcome. From a biomechanical viewpoint, oral forces should be evenly distributed between the underlying supporting tissues and prosthesis[2] since localized concentration of forces may result in residual ridge resorption.[3] Mandibular denture bases are generally designed to provide maximum supporting tissue coverage that includes the retromolar pad. This is presumed to offer the largest possible area for support, especially in mandibular complete dentures.[4] However, the biomechanical benefit of covering the retromolar pad is not fully understood in distal-extension removable partial dentures (DERPDs).

It is widely believed that coverage of the retromolar pad area in DERPDs influences the distribution of occlusal forces to the supporting tissue and the prosthesis. In this pilot study, we evaluated the coverage extention of DERPDs in the mandible in relation to force distribution.

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Materials and Methods

This study was approved by the Ethics Committee of Osaka University Dental Hospital. A convenience sample of seven partially edentulous mandibular participants (Kennedy Class I or II) including three men and four women with an age range of 62 to 80 years (mean: 70.4 years) were enrolled in this study after giving informed consent.

The experimental prostheses and loading devices were fabricated in the Osaka University Dental Hospital dental laboratory. Three load cells were placed on the experimental denture and framework. The first load cell recorded the occlusal force. The second recorded the force transferred to the abutment tooth, and the third recorded the force transferred to the mucosa (Figs 1a, 1b). The experimental dentures, including the metal framework with the load cells (Fig 1c), were calibrated with a known load. The output from the load cell was transferred to an A/D converter through an amplifier (PCD-300A, Kyowa). The linearity of the output indicated an error of less than 5%. Four denture base lengths were evaluated: full coverage of the retromolar pad (control) and three progressively shorter denture base lengths (3, 6, and 9 mm shorter than the control) (Fig 2). The loading device and the experimental denture with the load cells were fitted for each participant and modified with self-curing resin (Unifast, GC) to confirm that the device was working correctly (Fig 1d). All participants were guided to bite the framework five times for each of the four denture base lengths. To compare the trials, we used scatter graphs and trend lines of the corresponding data (Fig 3), defining the inclinations as the denture base supporting ratio (DBSR).

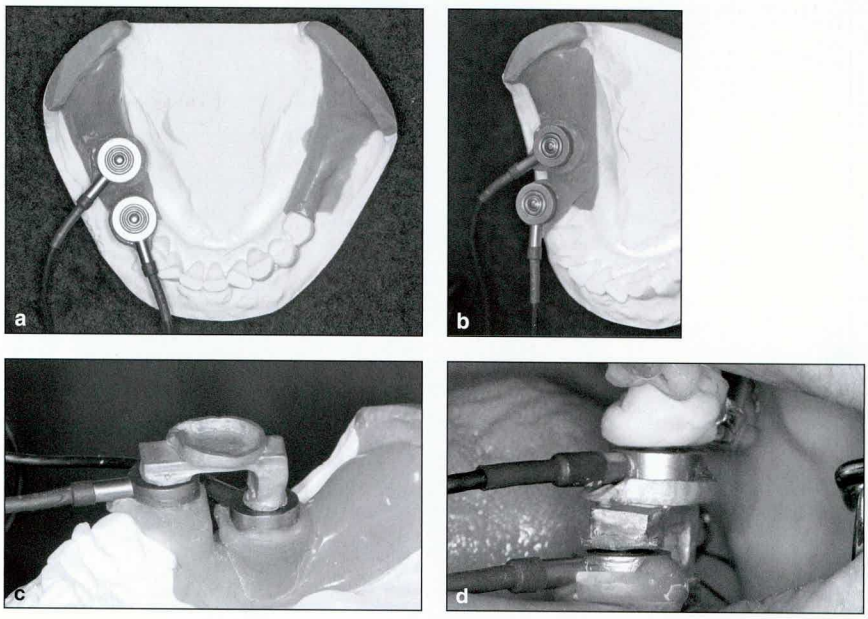

Fig 1 Experimental denture with load cells. **(a)** Occlusal view of experimental denture. **(b)** Two load cells recording the force transferred to the abutment tooth and mucosa. **(c)** Framework of the experimental denture. **(d)** Loading of the device in vivo.

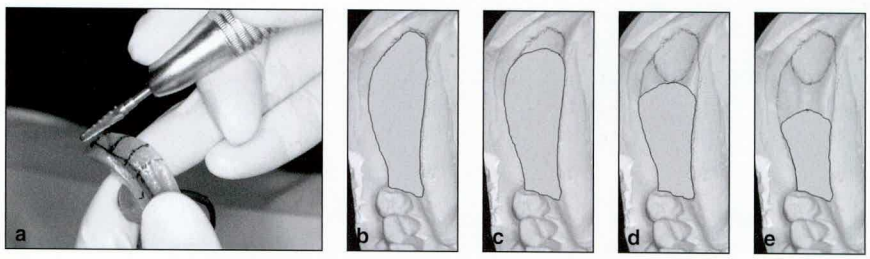

Fig 2 Four denture base lengths. **(a)** Shortening of the denture base. **(b)** Full coverage of the retromolar pad. **(c)** 3 mm shortening of the retromolar pad. **(d)** 6 mm shortening of the retromolar pad. **(e)** 9 mm shortening of the retromolar pad.

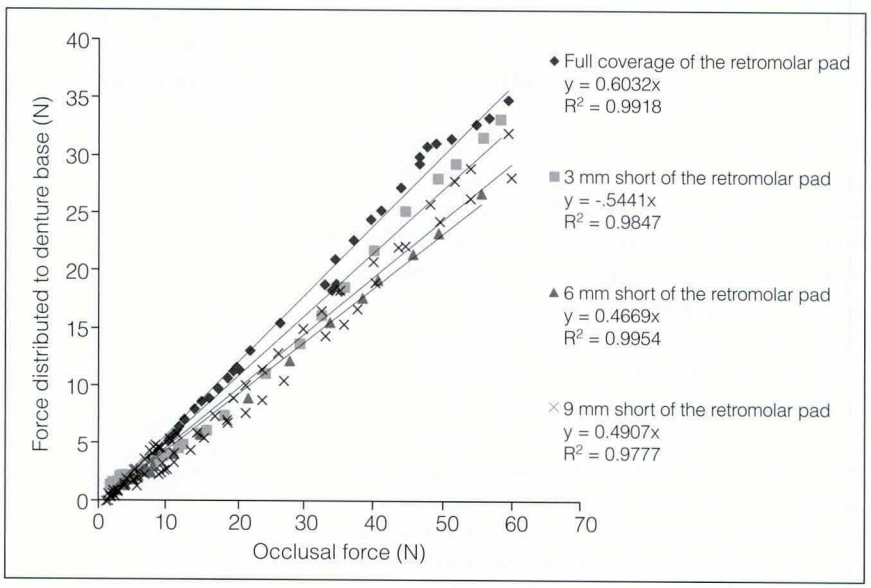

Fig 3 Relationship between occlusal force and force distributed to the denture base in one participant.

DBSRs from each testing condition were compared statistically using one-way repeated measures analysis of variance ($\alpha = 0.05$). SPSS 20 (IBM) was used for the statistical analysis.

Results

In all participants and all denture base lengths, the forces distributed to the denture base increased

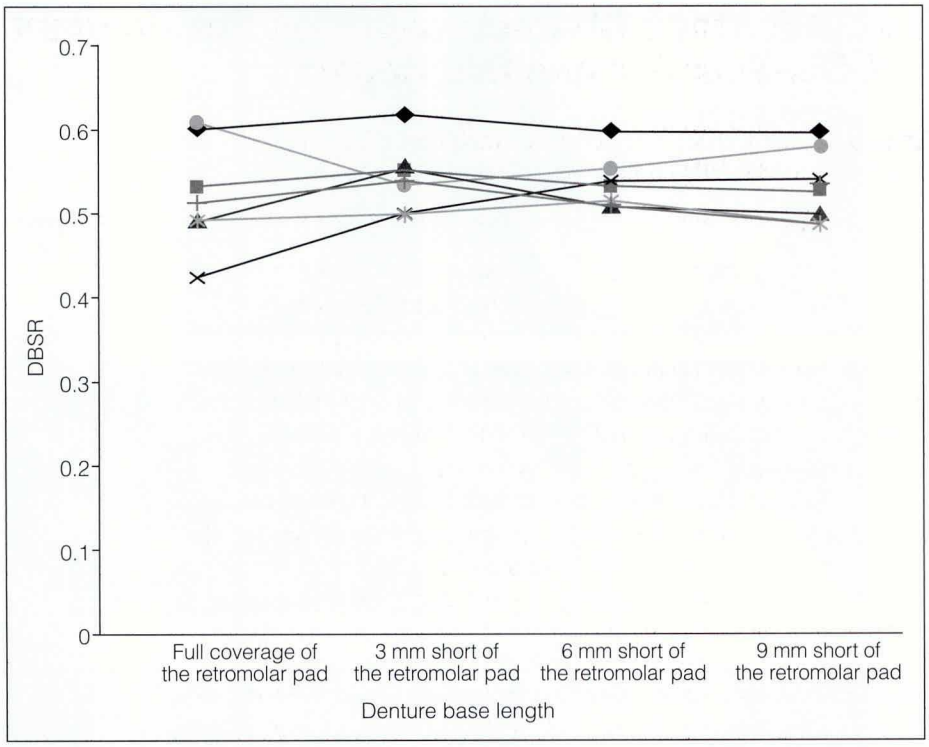

Fig 4 Relationship between denture base supporting ratio (DBSR) and the four denture base lengths in seven participants

proportionally with the occlusal force. A comparison among the four denture base lengths revealed no significant differences in relation to force distribution (Fig 4).

Discussion

In this study, no significant difference was found among the four denture base lengths in relation to force distribution. Occlusal force is not readily distributed to the denture-bearing area when the DERPD base is severely underextended.[5] However, from the aspect of the provision of support in a removable prosthesis, it could be concluded that extending the coverage of the denture base to include the retromolar pad has little influence on the force distribution.

All denture bases were fabricated using the same technique in the Osaka University Hospital dental laboratory, and all tests were performed in vivo. Because the denture bases were shortened from the control (full coverage of the retromolar pad) by 3, 6, and 9 mm, all tests were performed on the same denture base with the same testing devices, thus minimizing the risk of testing errors.

A limitation of the study was that the number of participants was small; hence, the power of the result was insufficient. Conducting a similar study with more participants would be necessary to validate our clinical observations.

Conclusions

Within the limitations of this study, we conclude that the coverage of the denture base to the retromolar pad area has little influence on force distribution during loading. The clinical relevance of this preliminary observation needs to be further considered.

Acknowledgments

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

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