Factors Differentiating the Morphology of Mandibular Edentulous Alveolar Ridges: A Pilot Study

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The aim of this study was to determine the morphologic factors that characterize mandibular edentulous alveolar ridges. The shapes of casts and waxed complete dentures were digitally scanned and the extracted shapes of the ridges were uniformly divided both mesiodistally and buccolingually. Principal component analysis was performed using the coordinates of the points on the grid as variables. Over 82% of the variables could be expressed using seven principal components. However, some of these were not taken into account by the existing criteria. Therefore, the influence of each principal component should be investigated. *Int J Prosthodont 2010;23:53–55.*

The morphology of edentulous alveolar ridges is important in the evaluation of edentulous patients.[1,2] It has been reported that the mandibular ridge form in the buccolingual section is correlated with the patient's satisfaction in wearing new complete dentures.[3] However, there have been no reports regarding how many factors are necessary to differentiate the three-dimensional morphology of edentulous alveolar ridges. The purpose of this pilot study was to determine the morphologic factors that characterize mandibular edentulous alveolar ridges so as to develop efficient and objective criteria for evaluation.

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This article was presented at the 12th Meeting of the International College of Prosthodontists, September 6, 2007, Fukuoka, Japan.

Materials and Methods

Sixty-five pairs of mandibular edentulous casts and waxed complete dentures were examined after try-in at the Department of Oral Rehabilitation, Hokkaido University Hospital, Sapporo, Japan. The procedure used to measure the cast and extract the shape of the ridge has been previously reported elsewhere.[4] Using a three-dimensional laser scanner (LPX-250, Roland DG), the shape of a cast mounted on an articulator with or without a denture, together with three spheres attached to the articulator for use as reference fields, was digitized at intervals of 0.06 mm, followed by superposing a pair of surfaces with reference to the calculated center of the spheres. From the surface of the cast, consisting of small quadrilateral sections, 61 cross sections of the ridge perpendicular to the occlusal plane assumed from the occlusal surface of the denture were extracted. Each cross section was divided linearly into 20 equal-length portions using c-spline interpolation. The distance from the origin displayed in Fig 1 and that from the occlusal plane to each of the 1,281 (61×21) points on the grid (Fig 2) served as the variables for principal component (PC) analysis. To unify the variance of the shape between sides, a mirror image reflecting the midsagittal plane was generated from each case and was used together with the original image. The SPSS 16.0J statistical software package (SPSS Japan) was used for the analysis.

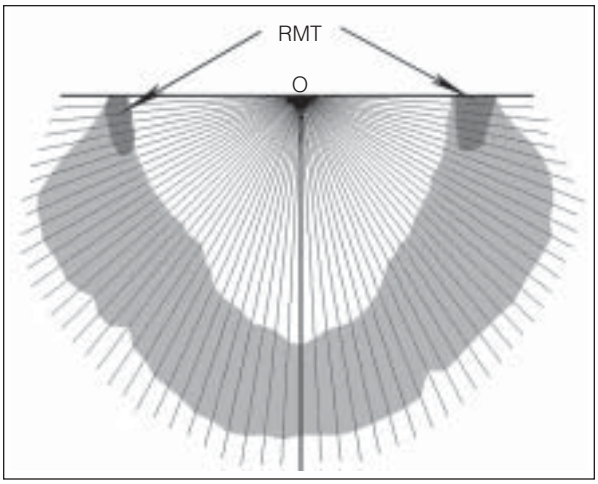

Fig 1 Cutting planes for the shape of an alveolar ridge (occlusal view). The origin (O) is the intersection of the occlusal plane, midsagittal plane, and the frontal plane, including the posterior ends of both retromolar triangles (RMT).

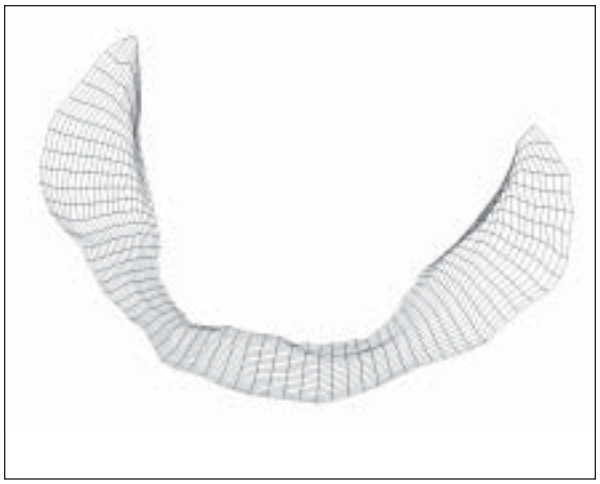

Fig 2 Division of the shape of the ridge. Coordinates of all points on the grid were used.

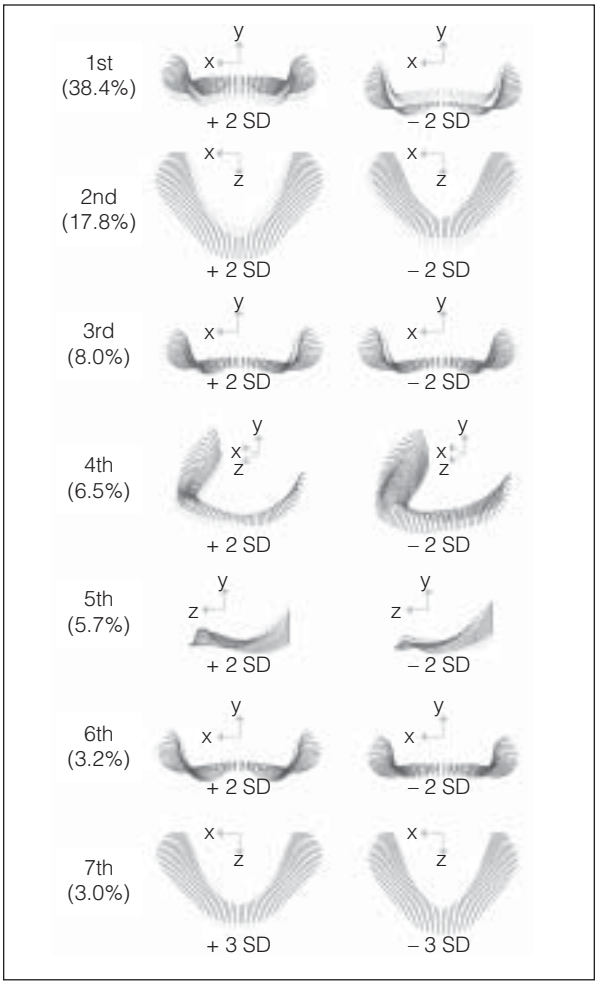

Fig 3 Morphologic characteristics explained by each PC. The percentages in brackets are contribution rates. Dotted lines show the average shape of the PC and solid lines show the shape after the change of a PC score. x = right, y = anterior, and z = upward, perpendicular to the occlusal plane.

Results

PC analysis showed that over 82% of the variables could be expressed by a search up to the seventh PC. In accordance with the shape assumed and an increase or decrease of each PC (Fig 3), the extracted morphologic characteristics of the ridge were as follows: first PC = clearance between the occlusal plane and ridge, second PC = size of the ridge projected in the occlusal plane, third PC = difference of the arch width between sides, fourth PC = ridge height, fifth PC = anteroposterior inclination, sixth PC = buccolingual inclination, and seventh PC = ratio of arch width to arch length.

Discussion

The criteria of the American College of Prosthodontists[5] include examinations of the height of the ridge and attachment of the musculature as the morphologic characteristics of mandibular ridges, which apply to no more than the fourth PC in this study. One of the probable reasons for the absence of other PCs was the standardized location in relation to the occlusal and midsagittal planes. This enabled the authors to clarify the third and fifth PCs and distinguish between clearance to the occlusal plane (the first PC) and ridge height (the fourth PC), which can be confused with one another. Although both probably have an influence on the stability of dentures, the use of the former may be related to more technical problems involving such factors as the space for the arrangement of artificial teeth.

Gerber[2] reported that artificial mandibular molars should be arranged so that their occlusal surface is kept parallel to the surface of the ridge according to the

individual ridge contour to keep the complete denture stable under functional loads. This individual ridge contour was considered to correspond to the fifth and sixth PCs. However, to assign the order of priority to these PCs, their influences on function and prognosis should be investigated.

Conclusion

The approximate morphologic characteristics of the mandibular edentulous alveolar ridges tested in this study could be expressed by seven PCs. The results of this study raise the possibility that the criteria established so far are insufficient. The influence of each PC should therefore be investigated.

Acknowledgment

This study was supported by a grant for scientific research from the Japan Society of the Promotion of Science (no. 18592107).

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Literature Abstract

Five-year results of fixed implant-supported rehabilitations with distal cantilevers for the edentulous mandible

The aim of this prospective multicenter clinical study was to define the survival and success rates of mandibular cantilever hybrid prostheses over a 5-year observation period. Parameters studied included implant health, peri-implant soft tissue health, prosthodontic complications, and patient satisfaction. A total of 45 patients, comprising 26 women (mean age: 60.2 years) and 19 men (mean age: 58.8 years), were enrolled in the study. All opposing dentitions were maxillary complete dentures. A total of 237 ITI implants were placed in an upright position using a nonsubmerged technique, and no insertion torque measurements were made at the time of surgery. Four to six implants were placed in the anterior mandible of each patient and implant lengths varied from 8 mm to 16 mm. Immediately after implant surgery, the old dentures were relived and adjusted with a soft liner. Abutment and temporary prosthesis placement was completed at 3 to 5 months postsurgery. Screw-retained final prostheses were inserted 4 to 6 months after implant placement. The mean right and left cantilever extension lengths were 15.7 mm (range: 6 to 21 mm) and 15.6 mm (range: 7 to 21 mm), respectively. Forty-one patients received prostheses fabricated with metallic frameworks veneered with acrylic prosthetic teeth and bases, while four patients received metal-ceramic prostheses. The following biologic, implant, and prosthetic data were recorded at final prosthesis delivery, and 3 months and 5 years postloading: modified Plaque Index (MPI), sulcus Bleeding Index (SBI), keratinized mucosal and peri-implant mucosal levels, and implant mobility. Patient satisfaction data collection was done via questionnaires. Statistical analysis was conducted using the t test and χ^2 to evaluate changes in the biologic parameters, while descriptive statistics were employed to evaluate the other parameters. No implants were lost during the 5-year observation period (100% implant survival rate). Two prostheses (99.5% prosthesis survival rate) required replacement due to framework fracture. There were a total of 54 technical (68.4%) and 25 biologic (31.6%) complications, including 12 events of opposing maxillary conventional complete denture fracture. Thirty-nine patients (86.7%) were designated as having successful treatment at the end of the 5-year study. There was no statistical correlation relating the type of occlusion, number of implants, peri-implant soft tissue health, or length of distal cantilever extension to the number of complications experienced. Patient satisfaction was rated as good or excellent for all cases. The authors concluded that although there was a 100% implant survival rate, the overall treatment success rate was only 86.7%. They pointed out that technical complications formed the exclusive determinant of the long-term treatment outcome. Hence, as part of informed consent, clinicians should inform prospective patients who are considering such hybrid prostheses of such complications occurring, and in turn, the need for regular, long-term maintenance visits.

Gallucci GO, Doughtie CB, Hwang JW, Fiorellini JP, Weber HP. *Clin Oral Implants Res* 2009;20:601–607. **References:** 23. **Reprints:** Dr German O. Gallucci, Department of Restorative Dentistry and Biomaterials Sciences, Harvard School of Dental Medicine, Harvard University, 188 Longwood Avenue, 02115 Boston, MA. Email: german_gallucci@hsdm.harvard.edu—*Elvin W.J. Leong, Singapore*