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# 論　文　内　容　の　要　旨

| 氏　名　（　張　元翰　） | |
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| 論文題名 | Influences of mandibular residual bone morphology and tray modifications on pressure distribution during impression and function<br>（下顎の歯槽骨形態とトレー設計が印象圧と機能圧へ及ぼす影響） |

論文内容の要旨

**<Introduction>**

The selective-pressure impression technique with two-step procedure has been widely used. This method is generally started by a primary impression which is taken with a stock tray for fabricating a study cast. Then an individual tray is designed and fabricated on the study cast with the "selective-pressure concept" for the final impression. However, there are still some unclear issues. The procedure to determine the pressure distribution in this method is a lack of considering the bone morphology. Additionally, it has been reported that mechanical stress loaded on bone surface causes bone resorption by several researches. However, there has been no study to clarify the influence of anatomical factors on impression and functional pressure. Moreover, the influences of tray modifications on the pressure distribution on bone surface remains unclear.

Based on these, the objectives of this study were to clarify the influence of residual bone morphology on the pressure distribution on bone surface during impression and function and to examine the influence of tray modifications on pressure distribution.

**<Methods and Results>**

**Experiment 1,**

**Impression pressure and functional pressure for models with various bone morphologies**

Seven models (18 mm in width, 30 mm in length and 11 mm in height) which simulate a section of molar area of mandibular residual ridge were fabricated. The mucosa and bone were fabricated by silicone material and hard plaster, respectively (Figure). All of them were fabricated with the same contour of mucosa of residual ridge but different underneath bone morphology.

A pressure sensor sheet (10 mm in width × 10 mm in length × 0.1 mm in thickness) was placed from the top of ridge to the border on the bone surface. A customized tray with entirely 1.4 mm spacer was fabricated. Impression material was applied to the tray and the tray was placed down with 4.0 N loading, and the impression pressure was measured. The above procedures were done five times on each model.

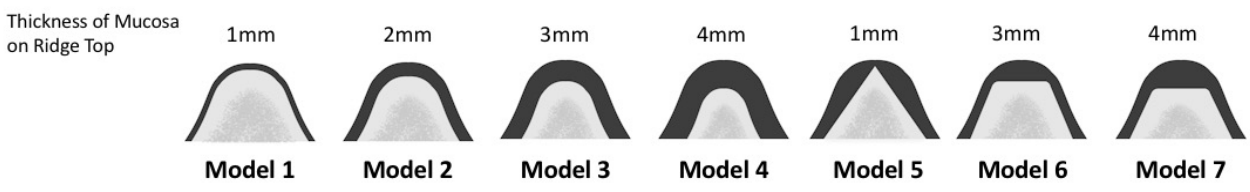


**Figure**. Cross sectional drawings of the mandibular residual ridge models.

Denture base analogs shaped like the mandibular molar section of a complete denture were fabricated on the models from each impression with acrylic resin. Each analog was seated on the original model and the functional pressure was measured under 4.0 N and 49 N loading.

The measurement data from the sensor sheet were divided into five areas from the top of the ridge to the border, and the mean pressure was calculated for each area. The Kruskal-Wallis test was used to clarify the differences in the mean pressure among the 5 areas within each model. Spearman's correlation coefficient was used to evaluate the correlation between impression pressure and functional impression on each area of the 7 models. Two-sample Kolmogorov-Smirnov test (K-S test) was applied for determining the fitness of data distribution of impression pressure and functional pressure for each model. All analyses were conducted with a significance level of 1%.

The results revealed the distribution of impression pressure was influenced by bone morphology and mucosal thickness even with the same contour of mucosa of residual ridge. Impression pressure was concentrated on the sharp edges and on where the tangent lines changed drastically of residual ridge. Additionally, impression pressure and functional pressure were significantly correlated in each model.

**Experiment 2, Influences of tray modification on impression and functional pressure**

In addition to the original tray used in experiment 1, two types of modified individual trays were fabricated. The tray with additional relief (AR tray), which was included additional spacer (1.4 mm thickness and 4 mm width) by a sheet of wax on the ridge top area; and the tray with escape holes (EH tray), which included two additional escape holes (1.8 mm diameter) on the top of the ridge.

Five measurements of impression pressure were taken with each tray on Model 5. Denture base analogs were also fabricated from these impressions, and functional pressure under 4.0 N and 49 N loading were measured.

Kruskal-Wallis test was used to compare the differences of impression/functional pressure among 3 types of trays in each area of Model 5. And Mann–Whitney U test with Bonferroni correction was used to determine the differences between each 2 trays. Spearman's correlation coefficient was used to evaluate the correlation between impression pressure and functional pressure generated on the same alveolar bone area. All analyses were conducted with a significance level of 1%.

The results showed both the impression and functional pressure around the modified area decreased significantly with the EH/AR tray. Additionally, impression pressure and functional pressure were significantly correlated.

**<Discussion and Conclusions>**

The results revealed the distribution of impression pressure was influenced by bone morphology and mucosal thickness even with the same contour of mucosa of residual ridge. And, the tray modifications such as additional relief and escape holes could decrease the pressure around the modified area.

Based on them, when facing a variety of bone morphologies underneath the mucosa in clinic, dentists should more carefully examine the bone morphology and take it into account when designing and fabricating an individual tray for final impression.

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論文審査の結果の要旨及び担当者

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**論文審査の結果の要旨**

本研究の目的は、下顎欠損部顎堤の骨形態ならびに粘膜の厚さとトレーの設計が、骨面における印象圧と義歯による機能圧に与える影響を検討することである。

顎堤の外形が同じで、骨形態が異なる下顎臼歯部顎堤模型を製作し、印象時と義歯による荷重時の骨面に相当する模型表面の圧力を測定した。

その結果、顎堤の外形は同じでも骨の形態によって印象圧や機能圧が異なり、粘膜が厚い場合、圧力は均等になる傾向がみられるが、骨の鋭縁部や勾配の変化が大きい所に圧力が集中することが明らかになった。一方、トレーに逃路を付与する、あるいはトレーのリリーフ量を大きくすることで、圧力は分散することが示された。

本研究は，骨面における印象圧、および義歯による機能圧について、骨形態とトレーの設計の影響を示唆したものであり、その臨床的意義は大きいと考えられる。よって、本論文は、博士（歯学）の学位論文として価値のあるものと認める。