Abstract of Thesis

Name （PHAM NGUYEN QUAN）	
Title	Influence of peri-implant bone resorption and posterior residual ridge resorption on peri-implant bending strain under overdenture (インプラントオーバーデンチャーにおけるインプラント周囲の骨吸収と顎堤吸収がインプラントに生じる曲げひずみに与える影響)

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[Introduction and Purpose]

A two-implant overdenture should be the first choice of treatment for the edentulous mandible globally. Peri-implant bone resorption is regarded as the most important criterion in determining implant success. Cause of peri-implant bone resorption may be either microbial and/or biomechanical. When inflammation was present, overloading accelerated bone resorption. To reduce the risk of further bone resorption, in addition to management of infection around implant, peri-implant bending strain (hereafter referred to as bending strain) should also be controlled. Clinical study indicated that peri-implant bone resorption and posterior residual ridge resorption (hereafter referred to as PRRR) simultaneously occurred after long term using of implant overdenture.

Therefore, the purpose of this study was to examine the influence of peri-implant bone resorption, attachment features, posterior residual ridge resorption, and relining on peri-implant bending strain under overdenture.

[Methods and Results]

Experiment I. Influence of peri-implant bone resorption on bending strain

Two tissue level implants (4.1 mm in diameter × 10 mm in length) were used. Four strain gauges were attached to four sides of each implant. One mandibular and one maxillary edentulous models were fabricated and covered by silicone rubber with 2-4mm thickness to simulate the oral mucosa. Next, two implants were installed bilaterally in the area between the mandibular canines and lateral incisors. Maxillary conventional denture and mandibular overdenture were fabricated for fitting the edentulous models. Then, the edentulous models were mounted on an articulator. Three levels of peri-implant bone resorption were created sequentially: 0 mm, 0.8 mm, and 1.5 mm. Locator attachments (Blue type, 3mm abutment height) were used. A vertical occlusal force of 98N was applied to mandibular overdenture through the maxillary denture. Each measurement of bending strain was recorded for ten seconds in five times. Bending strains were compared among three levels of peri-implant bone resorption. One-way ANOVA and Bonferroni's correction for multiple comparison were conducted. A p-value of 5% was considered statistically significant.

Bending strain increased as peri-implant bone resorption increased. Bending strain was the smallest at no bone resorption and the largest at 1.5 mm among three levels of peri-implant bone resorption ($p<0.05$).

Experiment II. Influence of attachment features on bending strain

The same models, loading condition and measurements as Experiment I were used. Peri-implant bone resorption level was set at 1.5 mm. Locator attachments were used, including different abutment heights and replacement males with different retention. Bending strains were compared among different attachment features. One-way ANOVA and Bonferroni's correction for multiple comparisons were conducted.

In 1.5mm bone resorption level, with the same retention (Locator Blue type), larger bending strain was recorded in the case of attachment with a higher abutment. Moreover, with the same abutment height, larger bending strain was recorded in the case of attachment with a smaller freedom of rotation, and larger retention. Therefore, attachment with low abutment height, large freedom of rotation, and small retention can minimize bending strain.

Experiment III. Influence of posterior residual ridge resorption (PRRR) and relining on bending strain

The same models, loading condition, and measurements as Experiment I were used. Locator Blue type with 3mm abutment height was used. To focus on PRRR, peri-implant bone resorption was set at 0mm. Two PRRR levels (0mm and 1mm) were set in the same model. Bending strains were compared among two PRRR levels and relining for 1mm PRRR. Kruskal–Wallis test and Bonferroni's correction for multiple comparison were conducted.

Bending strain with PRRR 1 mm was significantly larger than bending strain with PRRR 0mm and 1mm after relining. There was no significant difference of bending strain between PRRR 0mm and 1mm after relining.

[Conclusions]

The results of this study revealed that bending strain increased as peri-implant bone resorption increased. Attachment with low abutment height, large freedom of rotation, and small retention can minimize bending strain. Moreover, as posterior residual ridge resorption (PRRR) occurred, bending strain increased when relining was not performed. There was no significant difference of bending strain between PRRR 0mm and 1mm after relining.

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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

本研究は，下顎無歯顎のインプラントオーバーデンチャーにおけるインプラント周囲の骨吸収と欠損部顎堤吸収が，さらなるインプラント周囲の骨吸収に与える影響を明らかにすることを目的としたものである．

模型実験の結果，インプラント周囲の骨吸収と欠損部顎堤吸収は，インプラント周囲に生じる曲げひずみに影響することが明らかとなった．その結果，さらなるインプラント周囲の骨吸収を防ぐためには，アタッチメントの高さ，維持力，回転許容性を検討することと，義歯の適合性を維持することの重要性が明らかとなった．

本研究は，インプラントオーバーデンチャーの安定した長期予後に重要な示唆を与えるものと考えられる．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．