Relation Between Edentulism and Thickness of the Mandibular Cortex

Dişsizlik ile Mandibular Korteks Kalınlığı Arasındaki İlişki

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SUMMARY

Aim: The thickness of the mandibular angular cortex at gonion is a valuable parameter of metabolic bone loss. The aim of this study was to compare the thickness of the mandibular cortex at gonion and mental region in healthy dentulous and edentulous patients and also to evaluate the effect of edentulism on the thickness of the mandibular cortex.

Material and Methods: In the present study, subjects were divided in two groups. Healthy complete denture wearers were the first group which included 12 men and 18 women. Healthy fully dentate adults were the second group which included 22 women and 8 men. (All subjects ages ranged from 40 to 63 years in two groups). The thickness of the mandibular cortex at gonion and at mental foramina region were measured on both sides.

Results: There was no significant difference according to age between two groups.

Statistically there was no difference with regard to the thickness of the mandibular cortex neither at gonion nor in mental foramen region between two groups in both sides.

Conclusion: The difference of the mandibular thickness of cortical bone in mental foramina and gonion region in healthy adults were not affected from dentulism.

Key words: Thickness of mandibular cortex, edentulism

ÖZET


Bulgular: İki grup arasında yaşa bağlı olarak bir istatistiksel fark yoktu. İkinci grup tercihinde ikinci grup ise 22 kadın ve 8 erkekten oluşuyordu. (Örneklerin yaşları 40 ve 63 arasında değişiyordu). Görontında ve metal foramen bölgesindeki mandibular korteks kalınlığı her iki tarafta da ölçüldü.

Sonuç: Sağlıklı bireylerin dişli veya tam dişsiz olması durumu mandibulaın gonial ve mental foramen bölgesindeki kortikal kemik kalınlığını etkilediğini arastırdı.

Anahtar kelimeler: Mandibular korteks kalınlığı, dişsizlik

Introduction

Wide normal variations appear in the structure and density of the human mandible as well as of skeleton. The reproducibility and diagnostic validity of panoramic graphy is important in dentistry.

The thickness of the mandibular angular cortex at gonion is a diagnostic parameter of metabolic bone loss4-3.

The cortical layer at the angle of the mandible seems to be an interesting landmark because the area is independent of the teeth and can be easily measured and quantified even in edentulous patients4.

Previous studies have been focused on the thickness of inferior cortical bone on the mandible between healthy subjects and subjects with bone disease. Because of the lacking in the literature, the purpose of the study was to evaluate difference of the thickness of inferior cortical bone on the mandible between edentulous and fully dentate healthy subjects.

Materials and Methods

Sixty subjects were participated to the study. Samples
ages ranged between 40-63 years (mean 26.56 years). Subjects were divided into two groups. Healthy complete denture wearers were the first group which included 12 men and 18 women. Healthy fully dentate adults were the second group which included 22 women and 8 men. None of the subjects had any metabolic disease and or had taken estrogen, calcitonin, calcium, vitamin D, biphosphopates, anabolic steroids, vitamin K, fluoride, parathyroid and or thyroid hormone, none had a history of oophorectomy and or radiation therapy for ovarian cancer and none had a history of smoking that could have influenced tooth loss.

A dental panoramic radiograph was taken for each patient using the same X-ray machine (Siemens OP-2). Each radiograph was viewed using a standart light box (Kodak Ltd. London, UK) and measurements were made using a digital caliper (Mycal-Lite™ 6 Mitutoya) with 0.1 mm sensitivity under the same negatoscopy. All measurements were performed by an oral surgeon (N.Y.) and an oral radiologist (O.K.). Interobserver variation was calculated by the same author who compared the same sixty radiographs. The measurements of oral radiologist were evaluated.

The radiomorphometric indices of the mandible using panoramic radiography was evaluated similar method of Taguchi et al. The gonion was determined by bisecting the angle formed by lines drawn along the posterior and lower borders of the mandible. The thickness of the mandibular cortex at gonion were measured on both sides. The second measurements were made at mental foramina region which were located bilaterally and the cortical thicknesses at these two points were measured at right angles to a best-fit line drawn along the lower border of the mandible (Figure).

One Way Anova analysis and t-test were used for the statistical analyses.

![Figure](image_url) Figure. The evaluation method of the thickness of the mandibular cortex at gonion and mental region.

**Results**

The measurements of the two observer were in accordance with each other. In assessing interobserver performance, the Kappa indices of the observers were 0.72 and 0.71.

There was no significant difference according to age between two groups (t=1.700, P=0.095).

Statistically there was no difference with regard to the thickness of the mandibular cortex at gonion between two groups in right side (t=1.155, P=0.253) and left side (t=1.773, P=0.081) (Table).

Also the thickness of the mandibular cortex at mental foramen region was not statistically different between two groups in right side (t=0.979, P=0.332) and left side (t=1.416, P=0.162) (Table).

**Discussion**

Bone tissue influences by genetic factors, race, physical exertion, good nutrition, maintenance of body weight,
and sex hormone levels etc. Mandibular bone may be influenced by these factors. Tooth loss may begin related to bone disease.

When tooth loss begins the system function may destroy. Teeth and masticatory muscles attribute to stomatognathic system function. Although the cortical layer at the angle of the mandible seems to be an interesting landmark because the area is independent of the teeth and can be easily measured and quantified even in edentulous patients. Benson et al have also recently described a panoramic mandibular index to measure the cortical thickness in the region of the mental foramen.

The alveolar process and the basal portion of the mandible behave differently over the years. The age related increase in cortical porosity and thinning occurs mainly in the alveolar process, that part of the jaws where the roots were previously situated, while the basal portion remains more intact.

The thickness of the mandibular angular cortex at gonion as a valuable parameter of metabolic bone loss has been discussed by Brass et al. It may be considered that the tooth loss should affect the cortical thickness of the bone.

During the first fifteen years of life postnatal mandibular growth and development occurs and is completed before the twentieth year.

Calcium and phosphorus metabolism alterations affect the bone structure. Both serum calcium and serum phosphorus levels controlled by the action of several hormones. Loss of bone structure may affected by hormone mineral metabolism alterations. Examples of metabolic bone loss are hyperparathyroidism, postmenopausal osteoporosis and hypercortisonism. Some authors suggested that drugs which reverse a low bone mineral density (BMD) status and or osteoporosis may reduce tooth loss. Payne et al. reported that while oestrogen therapy raised alveolar BMD, it did not influence bone height. Also Bras et al. reported that the cortex of the angle of the mandible was distinctly thinner on panoramic radiographs of postmenopausal women and patients with chronic renal failure.

Horner and Devlin stated that mandibular cortical thickness had significantly better diagnostic validity than panoramic density. Since the high accuracy of the OPG, it was used in all measurements in the present study. Also according to Matilla et all and Ceylan et al cephalometric measurements on OPGs were slightly more accurate. Modern radiological equipment for measuring BMD and bone mass in the jaws is expensive and is beyond the means and expertise of general dental practitioners.

Authors found a relatively constant thickness of the cortical layer at gonion (average 1.56 mm and a range of 1.0 to 2.5 mm, standard deviation 0.26) on OPGs of normal dental patients. The cortical thickness decreased in postmenopausal women of 60 years and older, but remained constant in elderly men. Based on the above-mentioned studies and if measured under identical circumstances, a cortical thickness at gonion less than 1 mm (average normal cortical thickness minus twice the standard deviation) is indicative of metabolic bone loss.

In the present study the mean of the thickness of the cortical layer at gonion was similar with measurements of Bras et al. There was no difference with regard to the thickness of the mandibular cortex at gonion and mental foramen region between two groups in right side and left side in subjects without bone disease. This was an expected result and were in accordance with the study of Bras et al. There was one subject (3.3%) had the thickness of the mandibular cortex at gonion under 1 mm in healthy complete denture wearers in both sides.

Significant differences have been found in normal and osteoporotic populations in cortical thickness at the gonion.

According to Brass et al no differences in cortical thickness were found between dentate, partially dentate and edentate jaws in subjects without bone disease. In the present study the thickness of the mandibular angular cortex at gonion was not statistically significant in all subjects and was also in accordance with literature.

According to the results of Horner and Devlin, using panoramic radiographic measurements might be useful as a method for determining cortical bone thickness in mandibular gonial region. Further research on a larger patient sample is currently in progress that will both compare the diagnostic validity of radiographic measurements with other referral criteria (family history, clinical risk factors) and also determine whether combinations of positive clinical and radiographic criteria add to validity.

The thickness of mandibular inferior cortical bone in women increases rapidly in the second decade, remains constant thereafter until the sixth decade, followed by a rapid decrease in the seventh decade. Since in the present study patients ages were ranged from 40-63 which was in accordance with the statement of Taguchi et al according to the thickness of mandibular inferior cortical bone. Therefore the patients thickness of the mandibular inferior cortical bone remained constant.

Devlin and Horner stated that sensitivity and specificity of
the OPG was insufficient in determining the measurements of the thickness of mandibular inferior cortical bone in osteoporosis and osteopenia. When determining the risk group of osteoporosis and osteopenia one must pay attention to not only the measurements of the thickness of mandibular inferior cortical bone but also the family history and clinical risk factors.

According to Drozdzowska et al\textsuperscript{23}, the efficacy of the panoramic-based mandibular indices in diagnosing osteopenia-osteoporosis is low to moderate. Since in the present study the groups were healthy adults we could not find any statistically significant difference in mandibular cortex thickness.

In a study some linear radiomorphometric measurements on dental panoramic radiograph were correlated with different categories of body mass index\textsuperscript{24}. In the present study body mass index was not used. More lengthy

training and experience in using mandibular cortex indices would be needed for it to be effective as a diagnostic tool in dental practice.

The cortical thickness can be calculated in conventional radiographs. This usually involves direct measurement of the inner and outer diameters of the cortex the limitation of this method in the present study is the failure to show the inner and outer parts clearly in conventional radiographs. In a study\textsuperscript{25} CT has been used to distinguish the inner and outer cortex. According to study the cortical thickness of the mandible has been related to the decreasing number of teeth.

It must be taken into consideration that thickness of inferior cortical bone in the region of mandibular foramen and gonion at routine control of OPG in relation to bone disease is important.

References


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