

ORIGINAL ARTICLE

Comparative bone morphometric analysis of mandibles and iliac crests

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ABSTRACT:

Background: The examination of Bone Mineral Density Distribution (BMDD) in human bone biopsies has propelled the comprehension of how bone turnover relates with different known pathologies and medications meant to improve bone density. **Aim:** To comparatively evaluate the cortical bone mass and cortical width at a standard site of the mandible with that in the iliac crest. **Materials & methods:** The present study included assessment of 30 cadavers who have died in recent past and have been deposited to the department of human anatomy. Specimen materials were extracted from lower jaw two mm anterior to the mental foramen. Width of the measurement and the mean cortical width (MCW) were obtained. Another set of two specimens was obtained in a similar way, as done in case of mandibular specimen, from the iliac crest. All the results were analysed by SPSS software. **Results:** Mean bone mass observed in the subperiosteal and sub-endosteal layer of mandibular cortices was found to be 92.2 and 84.7 percent respectively. 88.2 percent was the mean bone mass observed in the entire cortical plate of mandibular cortices (Table 1). In the iliac crest cortices, the mean bone mass at sub-periosteal and sub-endosteal layer was found to be 86.6 and 82.6 respectively. The mean bone mass of the entire cortical plate in the iliac crest cortex was found to be 85.4 percent. Significant results were obtained while correlating the age and mean bone mass in the sub-periosteal and sub-endosteal cortex (P- value < 0.05). **Conclusion:** Iliac crest specimens cannot predict mandibular canal porosity.

Key words: Morphometric, Occipital, Skull.

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INTRODUCTION

The examination of Bone Mineral Density Distribution (BMDD) in human bone biopsies has propelled the comprehension of how bone turnover relates with different known pathologies and medications meant to improve bone density.¹⁻⁴ Although the utility of BMDD in human bone biopsies has profited from an advancement in methods, the examination of the same in a little creature display has been moderate being developed, particularly, in the craniofacial skeleton.⁵ A positive correlation has been observed in the past literature in between bone mass in ribs, vertebrae and iliac crest.⁶⁻⁸ Hence; we planned the present study to comparatively evaluate the cortical bone mass and cortical width at a standard site of the mandible with that in the iliac crest.

MATERIALS & METHODS

The present study was conducted in the department of human anatomy by involving 30 cadavers. Ethical approval was taken from institutional ethical committee. Complete detailed medical and clinical histories of all the cadavers were recorded and were divided on the basis of age and gender. Specimen materials were extracted from lower jaw two mm anterior to the mental foramen. These specimens consisted of buccal cortical plate and corresponded to cylindrical specimen with 5 mm diameter. All these specimens were obtained while performing autopsy.

Two straight one mm apart specimens were obtained from mandibular specimens. 100 micrometer thick ground sections were obtained from them. Bone mass was calculated which represented the percentage of area of cortical bone. Width of the measurement and the mean cortical width (MCW) were obtained and the dimensions were expressed in μm . measurement of the length of the cortical areas was also done. Estimation of bone mass in the remaining cortical area was also done. Another set of two specimens was obtained in a similar way, as done in case of mandibular specimen, from the iliac crest. Amount of trabecular bone was expressed in terms of percentage of area of the bone marrow in the iliac crest. All the results were analysed by SPSS software. Chi-square test and student t test were used for assessment of level of significance. P- Value of less than 0.05 was taken as significant.

RESULTS

All sections showed normal bone structure and almost linear periosteal surfaces at the levels examined in both the mandible and the iliac crest. Mean bone mass observed in the subperiosteal and sub-endosteal layer of mandibular cortices was found to be 92.2 and 84.7 percent respectively. 88.2 percent was the mean bone mass observed in the entire cortical plate of mandibular cortices (Table 1). In the iliac crest cortices, the mean bone mass at sub-periosteal and sub-endosteal layer was found to be 86.6 and 82.6

respectively. The mean bone mass of the entire cortical plate in the iliac crest cortex was found to be 85.4 percent. Significant results were obtained while

correlating the age and mean bone mass in the sub-periosteal and sub-endosteal cortex (**P- value < 0.05**) (**Table 2**).

Table 1: Mean value of bone mass (percentage) in sub-periosteal layer, sub-endosteal layer and entire cortical plate in mandibular, iliac crest and in trabecular bone of iliac crest (A and B)

Bone	Measure area	Mean bone mass (%)
Cortices of mandible	Sub-periosteal layer	92.2
	Sub- endosteal layer	84.6
	Entire cortical plate	88.2
Cortices of iliac crest	Sub-periosteal layer	86.6
	Sub- endosteal layer	82.6
	Entire cortical plate	85.4
Trabecular bone of iliac crest	A	13.6
	B	14.6

Table 2: Comparison of age and the mandibular and iliac variables

Bone	Measure area	Correlation	p- value
Mandible	Sub-periosteal layer	Age/ bone mass	0.01*
	Sub- endosteal layer	Age/ bone mass	0.02*
	Entire cortical plate	Age/ MCW	0.56
Iliac crests	Sub-periosteal layer	Age/ bone mass	0.26
	Both cortical areas Trabecular bone area	Age/ bone mass Age/ MCW	0.01* 0.02*

*: Significant

DISCUSSION

No previous histomorphometric studies concerning correlation between bone mass in the mandible and another locality in the skeleton seem to be available. However, a comparison of bone mass in edentulous mandibles and radial bones has been carried out by Henrikson et al. In the present study, we observed that iliac crestal biopsy tissue does not predict the mean bone mass and cortical width in the mandibular bone (**Table 1, Table 2**). TahaSönmez T et al assessed the morphological characteristics and dimensions of the ilium and fibula to evaluate the suitability of particular areas of bone for use as donor sites for dental reconstructions that carry implants. They measured the dimensions of 130 bilaterally harvested ilium and fibula bones from 65 adult cadavers using osteometric methods, and analysed the effects of age, sex, and side. Dimensions at measuring points, overall suitability for implantation, and relations among age, sex, and side, were evaluated statistically. They report observations of bone morphology involving cross-sections, and clinical relevance. Although the mean dimensions of the fibula and iliac crest were adequate, some segments would not support an implant 10 mm long and 3.5 mm wide. The overall suitability of parts of the iliac block fell to 30%. Fibular morphology is characterised by constant height and width, and relation of cortical and cancellous bone. Bony dimensions on the iliac fossa and fibula were

significantly greater in men than in women. Age had a negative impact in one area of the iliac fossa, but nowhere on the iliac crest. Side was not significant. They found differences in dimensions and morphology between measuring points on the same bone. Precise knowledge about which areas of the donor sites can reliably provide sufficient bone to carry implants after reconstructions will allow greater flexibility and safety when reconstructions are designed.⁹ Wower NV et al conducted a comparative analysis of bone mass in the mandible and the iliac crest in autopsy specimens from 30 subjects aged 23–84 years. Microradiograms of standardized 100- μ m-thick sections of the undemineralized plastic embedded material from the two locations were used for quantitation. The following measurements were carried out by electronic point-counting: 1) the percentage of cortical bone mass in the subperiosteal and subendosteal layers, 2) mean cortical width, and 3) the percentage of trabecular bone mass in the iliac crest. Positive correlations were found in the expressions of bone mass within the mandible; the values were significantly higher in the 200- μ m-thick subperiosteal layer than in the remaining part of the mandibular cortex. Only a poor or no correlation was found in the expressions of bone mass from the two sites. The investigation, therefore, shows that bone mass and cortical width in the mandible cannot be predicted from a biopsy from the iliac crest. This

finding may partly be due to different age-dependent functional changes of the two bones.¹⁰ Wowern NV et al examined the precision in vitro and in vivo and the accuracy in vivo for assessment of Bone mineral content (BMC) in the maxilla. The precision was determined by repeated measurements in vitro on a cranium and in vivo on two test persons with and without a bone specimen fixed to a palatal plate. The accuracy in vivo was determined from the BMC measurements of the two test persons and of nine edentulous persons, scanned before and after augmentation of the maxillary alveolar ridge with hydroxyapatite. The analyses indicated that the precision for maxillary BMC assessments was high (0.9% in vitro and 2.0% in vivo) and the accuracy in vivo was 6.6%, corresponding to the accuracy in vitro for skeletal BMC measurements by dual-photon absorptiometry. The present method therefore seems to be well-suited for follow-up analyses of the BMC changes in the jaws after augmentation of the alveolar ridges with bone or hydroxyapatite.¹¹ Lumetti S et al compared the outcome of fresh-frozen versus autologous bone block grafts for horizontal ridge augmentation in patients with Cawood and Howell class IV atrophies. Seventeen patients received autologous grafts and 21 patients received fresh-frozen bone grafts. Patients underwent CT scans 1 week and 6 months after surgery for graft volume and density analysis. Two autologous and 3 fresh-frozen grafts failed. Autologous and fresh-frozen grafts lost, respectively, 28% and 46% of their initial volume ($P = 0.028$). It is noteworthy that less dense fresh-frozen blocks lost more volume than denser grafts (61% versus 16%). According to these 6-month results, only denser fresh-frozen bone graft may be an acceptable alternative to autologous bone for horizontal ridge augmentation.¹²

CONCLUSION

From present investigation it was concluded that bone mass and cortical width in the mandible cannot be predicted from a biopsy from the iliac crest.

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