



The comparison of Mental Index based on dental status in women using panoramic radiographs

Therine Arnecia¹, Intan Farizka^{2*} , Sariyani Pancasari Audry Arifin² 

ABSTRACT

Objectives: This research is aimed to determine the differences in Mental Index (MI) between dentate and edentulous regions in women through panoramic radiographs.

Materials and Methods: This research is using comparative analytic observational study with a cross-sectional approach, with 160 women panoramic radiograph samples available at the Dentistry Radiology Installation, RSGM-P, Trisakti University FKG, divided between 80 samples of the dentate region and 80 samples of the edentulous region. Calculations using MI with i-Dixel software version 2.2.0.3. (Morita, Japan) results in millimeters.

Results: There is a significant difference of MI between dentate and edentulous region ($p = 0.000$). The mean of dentate MI (right region 3.7443 ± 0.47927 mm and left region 3.7373 ± 0.41075 mm) was greater than edentulous MI (right region 2.4725 ± 0.48391 mm and left region 2.4421 ± 0.43962 mm).

Conclusion: Through panoramic radiographs, we can determine the differences in MI between dentate and edentulous regions in women. The loss of teeth in women may lead to any change in the Mental Index (MI).

Keywords: Mental index, dental status, women, bone density, panoramic radiographs

Cite this article: Arnecia T, Farizka I, Arifin SPA. *The comparison of Mental Index based on dental status in women using panoramic radiographs.* Jurnal Radiologi Dentomaksilofasial Indonesia 2023;7(2)59-62. <https://doi.org/10.32793/jrdi.v7i2.973>



This work is licensed under a [Creative Commons Attribution 4.0](https://creativecommons.org/licenses/by-nc-nd/4.0/) which permits use, distribution and reproduction, provided that the original work is properly cited, the use is non-commercial and no modifications or adaptations are made.

INTRODUCTION

Bones, one of which is the mandible, has a metabolic process consisting of remodeling and resorption processes.¹ This metabolic process can be disrupted due to an imbalance in the process and can cause abnormalities in bone density, one of which is osteoporosis. As we get older, the resorption process will run more dominantly than the remodeling process.² The influence of hormones is also one of the factors that affect the decrease in bone density, one of which is the hormone estrogen which is the most dominant in women.

Decreased estrogen hormone can result in an increase in the amount of osteoclast activity.³ Reduced bone density affects the supporting tissues of the teeth and eventually leads to tooth loss. Loss of teeth can affect the decrease in the thickness of the mandibular cortical bone. This may be related to masticatory muscle atrophy due to tooth loss. In areas where the teeth are still intact, the masticatory muscles play an important role and work normally in the chewing process. function *m. temporalis* and *m. masseter* will decrease in patients with partial or fully edentulous. As a result of masticatory muscle atrophy, it causes changes in the quality of the mandibular bone which can be

seen from the cortical bone. In addition, tooth loss is left too long without treatment, such as the use of dentures which will further worsen the quality and density of the mandibular cortical bone. According to Taguchi *et al.* and Dutra *et al.* women who have low mandibular cortical bone thickness have overall low bone density.^{4,5,6}

In order to detect a decrease in bone density, one of which can be done with a dual-energy X-ray absorptiometry (DXA) examination. DXA technology is considered the gold standard in assessing bone density, but it is relatively expensive, not widely available, and requires a trained operator.^{7,8} The existence of several shortcomings of DXA has prompted the field of dentistry to seek alternative examinations, namely by using panoramic radiography to assess abnormalities in bone density.

Panoramic radiography is a type of examination that is widely used in dental practice, besides being cheaper, its availability is also quite wide.⁴ Through the results of panoramic radiographs, it is then measured with a radiomorphometric index by measuring cortical thickness from predetermined anatomical points, one of which is the Mental Index (MI).

¹Faculty of Dentistry, Universitas Trisakti, Jakarta, Indonesia, 11440

²Department of Dentomaxillofacial Radiology, Faculty of Dentistry, Trisakti University, Jakarta, Indonesia, 11440

*Correspondence to:
Intan Farizka
✉ intanfarizka@trisakti.ac.id

Received on: July 2022
Revised on: August 2023
Accepted on: August 2023

MI is a measurement of the cortical thickness of the mandible by making a parallel line that follows the long axis of the mandible from the inferior border and another line that is tangent and made perpendicular between the inferior border of the mandible and the mental foramen.^{9,10} The advantages of MI as an examination of abnormalities in bone density because the distance of the foramen to the inferior edge of the mandible is relatively constant, even though there is resorption of the alveolar bone above the foramen, so it has a lower risk of error in assessment.³ Therefore, in this study MI was used as a measure used to see the difference in dental status between dentate and edentulous regions in women.

MATERIALS AND METHODS

The type of research used in this study is comparative analytic observational by comparing two or more groups of a particular variable, without any intervention to the subject during measurement. The approach method used in this study was cross-sectional, that is, it was only done one time and one time without any follow-up in the measurement.

This research was conducted from September 2022 to November 2022 and the data used in this study used secondary panoramic radiograph data obtained through the Dental Radiology Installation, Teaching Dental and Oral Hospital, Universitas Trisakti and used an unpaired comparative numerical analytical large sample formula. The number of samples used were 160 digital

panoramic radiograph samples of women over 30 years old, which were divided into 80 samples of the dentate region and 80 samples of the edentulous region. This research has also received approval for ethical clearance from KEPK-FKG Usakti with number 596/S1/KEPK/FKG/8/2022.

Inclusion criteria for the samples were digital panoramic radiographs of women over 30 years old. Edentulous is known as the posterior teeth that is completely missing or free end. The exclusion criteria were poor quality panoramic radiographs or having pathological lesions. The measurements were used on the both region right and left mandible.

MI values were measured using i-Dixel software version 2.2.0.3. (Morita, Japan) in units of millimeters (mm). MI is a parallel line following the long axis of the mandible from the inferior border and making another line that is tangent and perpendicular between the inferior border of the mandible and the mental foramen.¹¹

The results of the MI value data were analyzed using the software IBM SPSS version 25. Kolmogrov Smirnov normality tests were not normally distributed (p <0.05) then proceed with the non-parametric Mann Whitney test. Prior to data analysis, an interobserver test was also carried out using the Technical Error Measurement (TEM) method.¹² Interobserver measurements were carried out by 2 people, consisting of the main observer and a Dentomaxillofacial Radiologist. Interobserver measuring 20 random samples panoramic radiographs of dentate and edentulous regions.

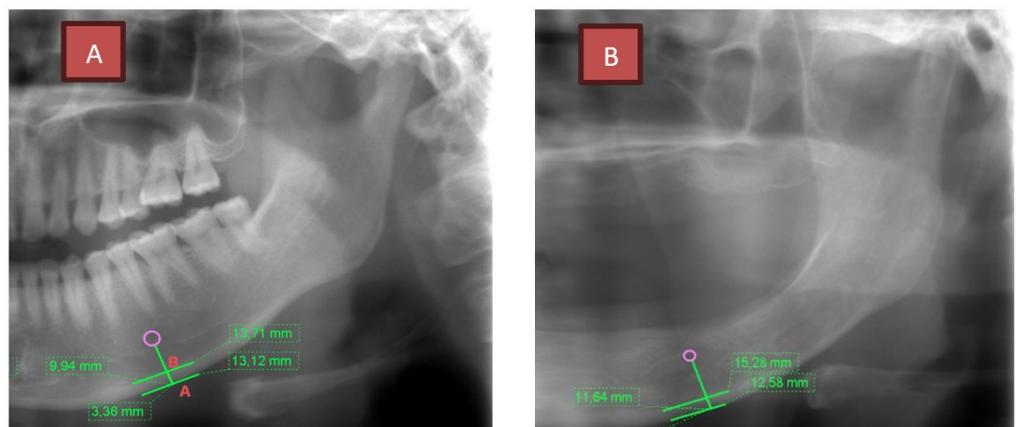


Figure 1. Mental index (MI) measurement on panoramic radiographs, (A) MI measurements in dentate region; (B) MI measurements in edentulous region

$$\text{Absolut TEM} : \sqrt{\frac{\sum D^2}{2N}}$$

$$\text{Relatif TEM} = \frac{\text{Absolut TEM}}{\bar{x}} \times 100\%$$

Formula description :

$\sum D^2$: The sum of the difference between two measurements squared

N : The sum of samples

\bar{x} : Average of the overall average between the two observers measurement

RESULTS

The results of the reliability test using the Technical Error Measurement (TEM) method in Table 1 yielded a value of 0.76% in the right dentate region; 1.01% in the left dentate region; 1.38% in the right edentulous region; and 1.39% in the edentulous left region. A TEM result of <2.0% indicates an agreement on reliability between the two observers, because the interobserver TEM relative value limit is acceptable if the result is <2.0%. Furthermore, the results of the data that have been obtained are carried out by the Kolmogorov-Smirnov normality test.

The values for the dentate and edentulous regions have a significance value of 0.000 ($p < 0.05$) indicating that the data was not normal. This shows that the Kolmogorov-Smirnov normality test is not normally distributed and then the data will be analyzed using the Mann Whitney non-parametric comparison test.

In Table 2 shows that, the mean value of dentate MI is greater (3.7373 ± 0.41075 mm) than edentulous ones (2.4421 ± 0.43962 mm). The minimum value in the dentate region is 2.68 mm and the edentulous region is 1.16 mm. Meanwhile, the maximum value in the dentate region was 4.75 mm and the edentulous region was 3.14 mm

Based on the results of the Mann Whitney test in, the results on both of the dentate and edentulous regions had a p-value of 0.000. It means that there was a significant difference between the MI values between the dentate and edentulous regions in women.

DISCUSSION

The results from this research are in line with the results of research similar to Reza *et al.* and Muhammed *et al.* In the results of research conducted by Reza *et al.* the results show MI had p value 0.001, so there was a significant difference. The study was used male and female subjects aged between 33-83 years, with the mean in the dentate region (3.29 ± 0.97 mm) was greater than edentulous region (2.80 ± 1.07 mm).¹³ In research

conducted by Muhamed *et al.* showed the results of the MI value had a significance $p \leq 0.001$ between the dentate and edentulous regions. The results of this study were used with subjects aged 20-60 years, with an average MI in the dentate region (4.9983 ± 0.76704 mm) also was greater than edentulous region (3.8510 ± 0.63508 m).¹⁴

In the present research, MI value on the dentate region had greater than edentulous region. The reason of that most likely related to the imbalance of remodeling and resorption processes causes changes in bone microstructure which causes a decrease in bone density. Furthermore, loss of teeth causes a gradual decrease in bone mass, thereby making the thickness of the mandibular cortical bone thinner.

The subjects used in the study were aged 30 years and over because at that age the bones are in the peak phase of bone mass or when the bones have reached maximum density.¹⁵ The reason for choosing the subjects in this study were women because of differences in hormones between men and women which could affect the results of MI values. Women have the hormone estrogen whose amount can decrease from the age of 35 years. A decrease in the hormone estrogen causes an increase in the number of osteoclasts. In research, Sylviana *et al.* showed a significant difference ($p < 0.05$) in cortical thickness between women and men aged 40-60. As a result, the cortical thickness of women is thinner than that of men.^{3,16}

Tooth status is one of the variables in this study, because the number of teeth can be related to bone density abnormalities. In a study conducted by Tanaka *et al.* showed that there was a significant difference between age and tooth loss in women ($p < 0.01$), whereas in men there was no significant difference between age and tooth loss in the value of mandibular cortical thickness.¹⁷

Dentists can be the first to detect abnormalities in bone density through the results of panoramic radiographs by observing a decrease in mandibular cortical thickness. However, the use of MI in women in detecting bone density abnormalities cannot be compared to its use based on tooth status between dentate and edentulous regions. A low MI value in the edentulous region cannot be

Table 1. Results on Technical Error Measurement

Region	Percentage (%)
Dentate	1.38
Edentulous	1.39

Table 2. The comparison test results and mean value of MI based on dental status

Region	N	p-value	Mean \pm SD (mm)	Min. Value	Max. Value
Dentate	80	0.000	3.7373 ± 0.41075	2.68	4.75
Edentulous	80		2.4421 ± 0.43962	1.16	3.14

directly described as a bone density abnormality. Several factors can affect the value of MI, such as age, menopause, or the absence of replacement teeth after long-term extraction.^{18,19,20}

CONCLUSION

According to the present research, it can be concluded that the loss of teeth in women may lead to any change in the Mental Index (MI). There is a significant difference between the dentate and edentulous regions in women using panoramic radiographs. A low value of Mental Index in the edentulous region in women can not be directly construed as a bone density abnormality.

ACKNOWLEDGMENTS

None.

FOOTNOTES

All authors have no potential conflict of interest to declare for this article. The study had approval from the Ethics Committee of KEPK-FKG Usakti with reference number 596/S1/KEPK/FKG/8/2022. All procedures conducted were in accordance with the ethical standards.

REFERENCES

- Cooper C, Ferrari SL; IOF Board and Executive Committee. IOF Compendium of Osteoporosis. 2nd Ed. Nyon: International Osteoporosis Foundation; 2019. p.1–76.
- Kristianti S, Kiswanjaya B, Priaminiarti M, Iskandar HHB. Mandibular Cortical width and Age in Elderly. *Journal of International Dental and Medical Research*. 2021;14(2):680–5.
- Sarianoferni, Wahjuningsih E. Perbandingan osteoporosis berdasarkan radiomorfometri panoramik antara mandibular cortical index dengan panoramic mandibular index pada pasien di Rumah Sakit Gigi Mulut Universitas Hang Tuah. *Makassar Dent J*. 2015;4(2):60–6.
- Tounta TS. Diagnosis of osteoporosis in dental patients. *J Frailty, Sarcopenia Falls*. 2017;02(02):21–7.
- Gulsahi A. Osteoporosis and jawbones in women. *J Int Soc Prev Community Dent*. 2015;5(4):263.
- Bozdog G, Sener S. The evaluation of MCI, MI, PMI and GT on both genders with different age and dental status. *Dentomaxillofacial Radiol*. 2015;44(9):20140435.
- Taguchi A. Triage screening for osteoporosis in dental clinics using panoramic radiographs. *Oral Dis*. 2010;16(4):316–27.
- Vlasiadis KZ, Skouteris CA, Velegarakis GA, Fragouli I, Neratzoulakis JM, Damilakis J, et al. Mandibular radiomorphometric measurements as indicators of possible osteoporosis in postmenopausal women. *Maturitas*. 2007;58(3):226–35.
- Shah DS, Desai AR, Gohil N. The Asian Audit Epidemiology Costs and Burden of Osteoporosis di Indonesia. *Innov J Med Heal Sci [Internet]*. 2012;2(5):81–5.
- Bajoria AA, ML A, Kamath G, Babshet M, Patil P, Sukhija P. Evaluation of Radiomorphometric Indices in Panoramic Radiograph – A Screening Tool. *Open Dent J*. 2015;9(1):303–10.
- Kathirvelu D, Anburajan M. Prediction of low bone mass using a combinational approach of cortical and trabecular bone measures from dental panoramic radiographs. *Proc Inst Mech Eng Part H J Eng Med*. 2014;228(9):890–8.
- Taguchi A, Sueti Y, Sanada M, Ohtsuka M, Nakamoto T, Sumida H, et al. Validation of dental panoramic radiography measures for identifying postmenopausal women with spinal osteoporosis. *Am J Roentgenol*. 2004;183(6):1755–60.
- Rajaah M, Jamaiyah H, Geeta A, Safiza MN, Khor GL, Wong NF, et al. Reliability, technical error of measurements and validity of length and weight measurements for children under two years old in Malaysia. *Med J Malaysia*. 2010;65:131–7.
- Derafshi R, Ghapanchi J, Farzin M, Haghnegahdar A, Zahed M, Tavakoli M. Evaluation of mandibular inferior cortical bone thickness using panoramic radiographs in edentulous and dentate cases. *Research Square*. 2019;1–14.
- Ajanović M, Kamber-Česir A, Tosum S, Džonlagić A. Influence of Dental Status, Age and Gender on the Cortical Width of the Lower Border of the Mandible and Mandibular Cortical Index. *Acta Stomatologica Croatica*. 2013;47(1):31–8.
- National Institutes of Health. Osteoporosis : Peak Bone Mass in Women. *Natl Inst Heal [Internet]*. 2015;(Juni):1–2.
- Azhari, Fahmi O, Fariska I. Normal value of cortical and mandibular trabecular bone density using cone beam computed tomography (CBCT). *J Int Dent Med Res*. 2019;12(1):160–4.
- Tanaka R, Tanaka T, Yeung AWK, Taguchi A, Katsumata A, Bornstein MM. Mandibular Radiomorphometric Indices and Tooth Loss as Predictors for the Risk of Osteoporosis using Panoramic Radiographs. *Oral Health Prev Dent [Internet]*. 2020;18(1):773–82.
- Hardanti S, Azhari FO. Description of mandibular bone quality based on measurements of cortical thickness using Mental Index of male and female patients between 40-60 years old. *Imaging Sci Dent*. 2011;41(4):151–3.
- Ramadhanty A, Farizka I. Prevalensi tipe hubungan akar gigi posterior terhadap sinus maksilaris ditinjau dari radiografi panoramik. *Jurnal Kedokteran Gigi Terpadu*. 2022;4(1):41–5.