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Description of Mandible Density in Patients with Type 2 Diabetes Mellitus using Panoramic Radiograph

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ABSTRACT

Introduction: Type 2 diabetes mellitus is the systemic disease that can cause the decrease of bone density. Bone density can be seen with the trabecular form which composed by bone and marow. Some equipment to assess is panoramic radiograph. The aim of this study was to describe the mandibular bone density in patients with type II Diabetes Mellitus using panoramic radiographs. Material and Method: The descriptive research design was done. The population of this study is all panoramic radiographs of patients with type 2 diabetes mellitus at Dental Hospital. The samples consisted of 20 women and 20 men, aged 25-55 years. The examination was conducted by calculating the percentage between bone and marrow in two areas, the head of condyles and the angulus of mandible. Result: The results showed that percentage of bone in the head of condyles both in man and women has same value is 23%, but in the angulus area, men has lower value at 22.82%, while women 23.2%. Conclusion: The density of the mandible in patients with type 2 Diabetes Mellitus in the head of condyle both men and women have the same value, while at the angle, the man lower than women.

Keyword: Density of mandible, Type II Diabetes Mellitus, Percentage of bone and marrow
INTRODUCTION

Diabetes mellitus is a metabolic disease which can cause metabolic disturbances and cause damage to body tissues.\(^1\) Diabetes mellitus type-2 or type-2 diabetes previously known as adult-onset diabetes in the form of a metabolic disorder characterized by high blood glucose in the context of their resistance to insulin and relative insulin deficiency. In the United States, it is found that 23.6 million people have diabetes mellitus and it turns out 17.9 million or approximately 7.8% of all diabetics are type 2. It also happened in Indonesia, since the beginning of this century, Indonesia has become the country with the number of patients with diabetes mellitus type 2. Based on WHO epidemiological study was conducted at 1999 in Indonesia, in the case of diabetes mellitus ranging from 1.5% - 2.3%, and 90% are type 2 diabetes mellitus.\(^4,5,6\)

Determination of the jaw bone density is very important, especially for the diagnosis, treatment planning, treatment progress as viewed on implant osseous integration, or the success of periodontal treatment. Assessment of the decline in the quality of bone can be affected by systemic conditions.\(^7,8,9,10,11\) There are number systemic diseases that lead to decreased bone density, as well as diabetes mellitus (DM). Diabetes mellitus can affect bone mineral formation due to obesity and hyperglycemia \(^12\). Albright and Reifenstein in 1948 first reported that, there has been a decrease in bone density in people with diabetes. The same thing has been said by other researchers, who expressed the same \(^13,14,15,16,17,18,19\). Value of bone mineral density (BMD) in patients with type 2 diabetes, according to a recent study showed a decrease in bone density in the radius bone and mandible earlier this does not occur in the spine and femur \(^20\). The relationship between bone mineral density (BMD) and type 2 diabetes mellitus has been controversial. In same study, The patients with type 2 diabetes no significant different from non-diabetic patient, while the other study said, at mellitus type 2 patient had lower density between non diabetic.\(^1,22,23,24\). Same study have been reports that the hyperglycaemic medications on diabetic patients can cause increasing the bone density and make the risk of fractures.\(^25,26,27\).

Bone density can be defined as a number of bone tissue in a unit volume and length. Volume jaw bone mostly composed of trabecular. The density of the trabecular density can be regarded as a whole and bone \(^28\). Panoramic radiograph is a radiograph of the most commonly use in the dentist’s. This is used by the researchers to determine the level of bone density, especially in the mandible. Many studies using panoramic radiographs especially to assessing same thing. This can be done to assess bone density and microstructure macrostructure. Macrostructure can be assessed by looking at the cortical bone and alveolar bone, while the microstructures that can be evaluated through the trabecular \(^29\). Research on trabecular pattern has been done on patients with a history of systemic disease, trabecular density seen by the presence and thickness of hard tissue such as bone nets which restrict the marrow cavity or often called trabecular nets \(^30\). Shimamoto in 2007, said that the trabecular bone have relatively higher metabolic rates up to 5-8 times compared with cortical bone, so the bone in case of a decrease in bone density, the bones become...
fragile and break easily. However, trabecular bone to support a minimum amount of material through 31. Each of systemic diseases have different characters, such as osteoporosis, diabetes mellitus, steroid users, people with tuberculosis and other diseases can be seen a decrease in bone quality when we review of trabecular pattern 32.

MATERIAL AND METHOD

The descriptive research design was done. 28,29. Population and sample in this research is all data panoramic radiographs of patients with Type 2 diabetes mellitus during 2016. The criteria are set are: 1) all radiographs should be of good quality with brightness, sharpness and density are well evidenced by the anatomical details were clearly visible 2) aged 25-55 years, 3) mandibular evident where there is no history of mandibular fractures. From the data, collected obtained a sample of 40 pieces of panoramic radiographs consisting of 20 women and 20 men. Assessment carried out by assessing bone density using Image-J software. The area chosen was the head of condyle and the angle of the mandible. Region of interest (ROI) used in this study was 5x5 mm. The final results are expected by looking at the value of bone density area ratio bone / particles and marrow.

RESULT

This research has shown that for the assessment in mandible bone in the head of condyle and angulus of mandible in male in female, with age group 25 to 55 year old. This study shows that based on the assessed area, the value of bone / particles at two areas there is no difference in value between the head of condyle bone and angle of the mandible both in men valued 76.78 at the head of condyle and a little higher on the angle of the mandible value of 77.18. While in women, seen similar density values ranged from 76.79 to 76.80 both on the head of condyle and the angle of the mandible. A similar trend can be seen in the value of marrow / hole in two areas both on IIF men and women have a value ranging 22.82 to 23.22.

Figure 1. Panoramic radiograph, seen areal of ROI 5x5 mm, in the head of condyle and angle of the mandibular condyle (Research property)
### Tabel 1. Density of Head Candyle

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<th>Average</th>
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<tbody>
<tr>
<td></td>
<td>Bone</td>
<td>Marrow</td>
<td>Bone</td>
</tr>
<tr>
<td>Women</td>
<td>23,53</td>
<td>72,47</td>
<td>22,88</td>
</tr>
<tr>
<td>Man</td>
<td>23,13</td>
<td>71,88</td>
<td>23,32</td>
</tr>
</tbody>
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Diagram 1. Shown the value between man and women there's no difference, the score average in 76,79-76

### Tabel 2. Density of Mandible Angle

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<th>Average</th>
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<tbody>
<tr>
<td></td>
<td>Bone</td>
<td>Marrow</td>
<td>Bone</td>
</tr>
<tr>
<td>Women</td>
<td>23,24</td>
<td>71,76</td>
<td>23,16</td>
</tr>
<tr>
<td>Man</td>
<td>23,01</td>
<td>71,99</td>
<td>22,62</td>
</tr>
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Diagram 2. Shown that the less differences above man and women density in angulus of mandible
The results also showed that the bone /particles in patients with diabetes mellitus type 2 is lower than the value of marrow/hole. It gives meaning of that, in the description of the bones in the head area of the angle of the mandible condyle and dominated by the hole/marrow as compared with the number of particles/bone either in man or women.

DISCUSSION

Diabetes mellitus is a metabolic disorder that is caused by many factors, of which the primary symptom are visible in the form of chronic hyperglycemia as well as several disturbances in the metabolism of carbohydrates, fats and proteins. This condition is caused by a deficiency of the hormone insulin secretion, disorders of insulin activity, or it can occur both\(^{30,31}\) Diabetes mellitus can cause many complications caused by high blood glucose levels (hyperglycemia). Some of the proteins in the body, in these conditions will be become glycolysis and its cause of growing number of IgG.\(^{32}\)

The World Health Organization (WHO) classifies diabetes mellitus in multiple categories based on the treatment and symptoms are: \(^{33}\) Diabetes mellitus type 1, include ketoacidosis syndrome until the destruction of beta cells in the pancreas, which caused or cause autoimmunity are idiopathic; Diabetes militus type2, caused by a deficiency of insulin secretion, is often accompanied by insulin resistance syndrome Gestational diabetes mellitus, including gestational impaired glucose tolerance (IGT) and gestational diabetes mellitus (GDM); Diabetes mellitus type 2 (adult-onset diabetes, obesity-related diabetes, non-insulin-dependent diabetes mellitus, NIDDM) is a type of diabetes mellitus was not due mindless levels of insulin in the blood circulation is low, but because of metabolic disorders, which caused by mutations in many genes in the pancreas.\(^{34,35}\) There are several theories about the cause for certain states and mechanisms of this resistance, but obesity is a predisposing factor most suspected occurrence of resistance to insulin, this is related to how many of adipokinase hormone is give the tolerance in the body. Obesity is with diabetes mellitus type 2, found in about 90% of patients the world.\(^{34,35}\)

Diabetic mellitus condition can cause the decrease od the bone density. Things to keep in mind that the insulin and mecanism of diabetic mellitus can efect bone metabolim.\(^{36}\) This is because the function of insulin in increasing the uptake of amino acids and collagen synthesis in bone cells, which is crucial to bone formation by osteoblasts. Bad body condition cause hypo calcemia resulting in provokes an increase of parathyroid hormone, which can improve the process of bone resorption. Bad body condition also interfere with the metabolism of vitamin D, resulting in decreased absorption of calcium in the intestines and stimulates macrophages to synthesize cytokine hormone functioning bone resorption.\(^{34,35}\)

This condition causes a decrease in bone density in the condition of diabetes mellitus. A decrease in bone density can occur in almost all parts of the skeleton including the mandible bone. A decrease in density in this study can be represented by the number of particles /bone was lower when compared to the number of holes / marrow on an area of research and more than 50%. Seen from the research, that the values of the particle / bone 75% lower.
than the number of holes / marrow in this area. Another suggestion said that the reduction in bone density caused by interference with the process of the formation of calcium on bone formation so that the rate of resorption greater than reposisi.\textsuperscript{34} bone mass in patients with type 2 diabetes mellitus controlled by consuming oral insulin regularly recorded fewer fractures than those who did not consume insulin. Resorption may caused the increase of bone quality, the resorption process actually must be stop in normal remodeling processes, but in people with diabetes mellitus, resorption process faster than with the healing process (apopsis). According to several literature, the condition of diabetes mellitus with high blood glucose levels (hyperglycemia) will cause the body to become glycosylation, caused by rising amount of IgG glication.\textsuperscript{34} On the glycosylation state of hyperglycemia and affinity IgG antibody to an antigen, so that people with diabetes mellitus vulnerable to infection, thereby reducing the ability of fibroblast multiplication which resulted in delays and regeneration ability granulizes.\textsuperscript{32,33}
CONCLUSION

The density of the mandible in patients with type 2 Diabetes Mellitus in the head of condyle both men and women have the same value, while at the angle, the man lower than women.

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