

# Prevalence of alveolar bone defect pattern in periodontitis patients with diabetes mellitus using bitewing radiography



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## Abstract

**Objective:** The purpose of this study is to know the prevalence of horizontal pattern bone defect compare to vertical pattern that found in periodontal disease.

**Material and Methods:** In this study, sample selected by purposive sampling according to inclusion criteria, samples with periodontitis that diagnosed clinically approved by periodontist, and the sample also have diabetic diseases that having measure their sugar level blood test 3 months before the study, and then measure it again before taking the radiograph.

**Results:** The horizontal pattern that found in periodontitis in patient that sustain diabetes mellitus in this study might occur due to bone damage that developed in long period and without treatment.

**Conclusion:** This study shows the prevalence of bone damage pattern was the pattern of horizontal obtained 76.3%, vertical pattern is found at 23.7%. The horizontal pattern that found mostly in periodontitis in patient that sustain diabetes mellitus in this study might occur due to bone damage that developed in long period and without treatment.

**Keywords:** Periodontitis, Diabetes mellitus, Horizontal bone defect, Vertical bone defect

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## Introduction

Periodontal diseases can caused by accumulation of bacteria attached to the tooth surface, that expand until sub ginggiva and reduce the alveolar bone. Subgingival bacteria colonized produced periodontal pockets and caused further inflammation of gingival tissue and reduce periodontitis diseases resulting a progressive alveolar bone loss which left untreated, will result tooth mobility or tooth loss. Periodontitis can alter systemic physiology in diabetic patient. Diabetes mellitus can have adverse effects on periodontal disease and periodontal disease can lead in parallel with glycemic control. Diabetes mellitus causes production of higher levels of pro-inflammatory cytokines, such as IL-1 and TNF- $\alpha$ , leading to greater bone loss. Plaque bacteria play an indirect role in generating inflammatory mediators, such as prostaglandins, or cytokines IL-1 and TNF- $\alpha$ , which trigger acute bone loss.<sup>1</sup> Periodontitis characteristic of gingival tissue attachment destruction, alveolar bone loss, epithelial apex migration and the formation of periodontal pocket. The alveolar bone is part of the cortical bone that forms and supports the tooth socket. The picture of normal alveolar bone in radiography is a thin layer of radiopaque cortical bone around the teeth.<sup>2</sup> Bone loss that occurs in periodontitis disease has a pattern of horizontal and vertical. Horizontal bone damage involves a

decrease in alveolar peak height with bone margins that remain perpendicular to the tooth surface. In a vertical pattern, the bone damage process occurs not symmetrically.<sup>2</sup>

Patients with diabetes mellitus have a greater chance of developing destructive periodontal disease as well as a greater chance of experiencing progressive alveolar bone loss.<sup>3</sup> Clinically, radiographs have been frequently used to evaluate periodontal disease. The tool commonly used for the diagnosis of periodontal disease are periodontal probe and intra oral radiography. Gedik et al.<sup>4</sup> stated in his research that bitewing radiography is more accurate in detecting bone loss.<sup>4</sup>

Negrato et al.<sup>5</sup> study suggests that diabetes has adverse effects on periodontal health and periodontitis has adverse effects on glycemic control. The inflamed periodontal tissue may serve as a chronic source of bacteria, bacterial products and many inflammatory mediators such as TNF- $\alpha$ , IL6 AND IL1 that have been show to have important effect on lipid and glucose metabolism.<sup>5,6</sup>

The results of Fukuda et al.<sup>7</sup> suggest losing alveolar bone is more common in the maxillary bone. This because the molar in maxilla contain a larger number of roots and the possibility of furcation involvement, favoring increase periodontal diseases higher.

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## Material and Methods

In this study, sample selected by purposive sampling according to inclusion criteria, samples with periodontitis that diagnosed clinically approved by periodontist, and the sample also have diabetic diseases that having measure their sugar level blood test 3 months before the study, and then measure it again before taking the radiograph. The research was conducted at Radiology Dental Clinic Faculty of Dentistry University of Sumatera Utara.

After having Ethical clearance, the sample taken bitewing radiograph to examine the prevalence patterns of horizontal and vertical bone defect in patients with diabetes mellitus. Sample radiographs were measured in bone height and observed the bone resorption pattern either horizontally or vertically that found more often.

## Results

Table 1 shows the prevalence of overall bone damage pattern for the horizontal pattern obtained 76.3% vertical pattern was found to be 23.7%.

Table 2 shows that the prevalence of alveolar bone damage on the mesial portion was 7.3% for horizontal pattern, 26.3% for vertical pattern. Whereas, table 3 shows the prevalence of bone damage pattern on the distal was found 78.8% for the horizontal pattern, 21.2% for the vertical pattern.

Bone loss in the study table 4 with mild bone loss criteria occurring 1-2 mm, moderate 3-4 mm, and weight greater than 5 mm, found that mild category was 14.1%, moderate 52.0 %, weight 33.8%.

## Discussion

This study result was the prevalence of bone damage pattern mostly was the horizontal pattern, obtained 76.3%. That most prevalence of periodontal disease and severity is higher among diabetics when compared with non diabetic patients.<sup>6</sup> This is due to changes in blood vessels, impaired neutrophil function, collagen synthesis, micro-biotic factors, and genetic predisposition.<sup>7</sup> That diabetes mellitus and periodontal disease are very common worldwide, and the prevalence is higher in the elderly population.<sup>8</sup> Diabetes can increase the severity of gingivitis and periodontitis and have a significant impact on overall health, controlling blood sugar and periodontal treatment is necessary.<sup>9</sup>

The prevalence of alveolar bone damage on the mesial portion was 7.3% for horizontal pattern, 26.3% for vertical pattern. As for the prevalence of bone damage pattern on the distal portion found 78.8% for the horizontal pattern, 21.2% for the vertical pattern. This is in line with research conducted by Fukuda et al.<sup>7</sup> which states that the largest average bone loss is seen in the distal portion of the mesial. The prevalence of alveolar bone loss in patients with periodontitis was obtained prevalence of bone damage pattern on the mesial section of 75.67% for horizontal pattern, 16.22% for vertical pattern. As for the prevalence of bone damage patterns on the distal portion was found 71.62% for the horizontal pattern, 20.27% for the vertical pattern.<sup>10</sup> The distal portion of higher bone loss is likely due to the distal surface of the lower canine deeper and wide concave roots. Bone loss in the canines corresponds to a condition of concavity with a mandibular root anatomy wherein the deeper incisors of the mandibular canine and the mandible premolars.<sup>8</sup>

Bone loss in this study with mild bone loss criteria occurring 1-2 mm, moderate 3-4 mm, and weight greater than 5 mm, found that mild category of 14.1%, moderate 52.0 %, weight 33.8%. This is probably caused by periodontitis with diabetes mellitus, a disease occurring due to metabolic abnormalities in which the characteristic of this disease is less in insulin production, due to the occurrence of alveolar bone resorption. Insulin and diabetic regulation have an effect on bone metabolism and insulin can increase the uptake of amino acids and collagen synthesis in bone cells. People with diabetes mellitus have high levels of

**Table 1** Prevalence of overall bone damage pattern

Category	Total	%
Horizontal	151	76.3
Vertical	47	23.7

**Table 2** Prevalence of bone damage pattern occurring on the mesial part

Category	Amount	%
Horizontal	73	73.7
Vertical	26	26.3

**Table 3** Prevalence of bone damage patterns that occur in the distal

Category	Amount	%
Horizontal	78	78.8
Vertical	21	21.2

**Table 4** Percentage of bone loss ratio

Category	Amount	%
Horizontal	78	78.8
Vertical	21	21.2

inflammation, this is due to high blood glucose levels that causes the growth of bacteria becomes difficult to control. Bone loss is also due to reduced bone calcium levels due to insulin deficiency. Both of these conditions cause alveolar bone resorption to occur faster than the condition of patients with periodontitis without diabetes mellitus.<sup>11-15</sup>

### Conclusion

This study shows the prevalence of bone damage pattern was the pattern of horizontal obtained 76.3%, vertical pattern is found at 23.7%. The horizontal pattern that found mostly in periodontitis in patient that sustain diabetes mellitus in this study might occur due to bone damage that developed in long period and without treatment.

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### Conflict of Interest

The authors report no conflict of interest.

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