ECRONICON OPEN ACCESS

EC DENTAL SCIENCE
Literature Review

# Newer Morphological Classification System - The Insight In Periodontics'

**Shivani Sachdeva[1]*, MB Phadnaik[2], Harish Saluja[1], Amit Mani[3] and Nilofar Attar[4]**

[1]*Associate Professor, Pravara Rural Dental College and Hospital, India*

[2]*Professor and Guide, Government Dental College and Hospital, Nagpur, India*

[3]*Professor, Pravara Rural Dental College and Hospital, India*

[4]*Assistant Professor, Government Dental College and Hospital, Mumbai, India*

***Corresponding Author:** Shivani Sachdeva, Associate Professor, Department of Periodontics, Pravara Rural Dental College and Hospital, India.

**Received:** March 05, 2019; **Published:** May 20, 2019

## Abstract

**Background:** The prevalence and distribution of different forms of bone defects not only provides clues to their pathogenesis but also helps in overcoming specific therapeutic problems during clinical practice. The present article has made an effort to form a classification system that not only follows the morphology of defects but also includes the location and number of osseous walls remaining around teeth.

**Method:** The study was carried out in Department of Periodontics at government dental college and hospital Aurangabad during 2011 to 2013 on forty-four patients including 21 males and 23 females within the age range of 30 to 70 years and having moderate to severe chronic periodontitis. The sample of 1041 teeth was explored surgically and in deciding the morphology of the periodontal bone defects the primary classification system has been followed as suprabony defects, infrabony defects, other bone defects and interradicular bone defects.

**Discussion:** The present article has followed a classification system which describes suprabony defects, infrabony defects, other bone defects and interradicular bone defects.

***Keywords:*** *Bone Architecture; Bone Defects; Prevalence; Infrabony Defects; Classification*

## Introduction

Periodontal osseous defects represent the anatomical sequel to the apical spread of periodontitis. Though, many attempts have been made to classify periodontal osseous defects but generally they are based upon specific morphological criteria [1]. Hereby, in the present article the classification system proposed is based not just on the morphological basis, but also focuses on the location, number of osseous walls remaining and on the furcation defects depending on the severity of the lesions.

## Materials and Methods

The study was carried out in Department of Periodontics at government dental college and hospital Aurangabad during 2009 to 2011 on forty-four patients including 21 males and 23 females within the age range of 30 to 70 years and having moderate to severe chronic periodontitis. The sample of 1041 teeth were explored surgically and in deciding the morphology of the periodontal bone defects the under mentioned classification system has been followed.

## Review of Literature

A first level of classification differentiates between suprabony defects, infrabony defects and interradicular defects [2]. The various classification systems have been discussed below.

Goldman., *et al.* (1958) [2,3] described the morphology of various bone defects and classified them according to the number of walls remaining as follows:

a. Four osseous walls:
   - Buccal, lingual, mesial and distal walls

b. Three osseous walls:
   - Proximal, buccal and lingual walls
   - Buccal, mesial and distal walls
   - Lingual, mesial and distal walls

c. Two osseous walls:
   - Buccal and lingual walls
   - Buccal and proximal walls
   - Lingual and proximal walls

d. One osseous wall:
   - Proximal wall
   - Buccal wall
   - Lingual wall

e. Combination:
   - Three walls plus two walls
   - Three walls plus two walls plus one wall
   - Three walls plus one wall
   - Two walls plus one wall

Glickman (1964) [1] again presented a specific description of bone deformities produced by periodontal disease as follows:

a. Osseous crater
b. Infrabony defects
c. Bulbous bone contours
d. Hemisepta
e. Inconsistent margins
f. Ledges

Prichard (1972) [4] classified the defects and gave the descriptive classification. According to him bone defects were present as follows:

a. Defects in Inter-alveolar bone
b. Defects in the Marginal bone

Defects in inter-alveolar bone usually can be classified by their morphology as:

- Intrabony defects
- Hemiseptum
- Craters

Destruction of marginal bone creates following defects:

1. Inconsistent margins which may be complicated by furcation invasion.
2. Anatomic aberrations such as:
3. Exostoses
4. Fenestration
5. Dehiscence
    - Intrabony defects can occur in cancellous bone between the vestibular and or lingual cortical plate and the tooth root where marginal bone is thick. They are also found in the apical region where the base of the arch is wider than the crest.

Manson., *et al.* (1976) [5,6] carried out study to record the location of bony defects associated with chronic periodontitis patients undergoing periodontal surgery for pocket. They followed descriptive classification as Prichard [4] did and studied the gross morphology of osseous defect as:

a. Thickened margin
b. Interdental crater
c. Hemiseptum
d. Infrabony defect with three osseous walls (other than a marginal gutter)
e. Infrabony defect with two osseous walls (other than an interdental crater)
f. Infrabony defect with one osseous wall (other than a hemiseptum)
g. Marginal gutter
h. Furcation involvement
i. Irregular bone margin
j. Dehiscence
k. Fenestration
l. Exostoses

Topographic classification of deformities of the alveolar process was given by Karn KW., *et al.* (1984) [2]. They used the terminology mentioned below:

a. Crater
b. Trench
c. Moat
d. Ramp
e. Plane

f. Cratered ramp

g. Ramp into a crater

They retained the terminology of horizontal bone loss when the original topography of bone was retained by uniform loss of bone.

Papapanou PN., *et al.* (2000) [7] classified osseous defects (Figure) into:

a. Suprabony defects

b. Infrabony defects

c. Interradicular defects

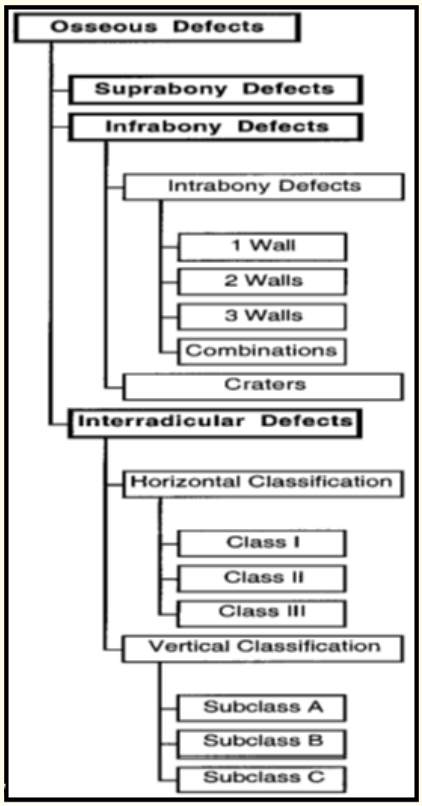


***Figure:*** *Depicts the classification of osseous defects.*

## Interradicular Defects

Conditions entailing pathological resorption of bone within the furcation of a multirooted tooth, defined as furcation involvements, were also included in the group of periodontal bony defects. These are classified as follows:

1) Glickman (1953) [1] graded furcation involvement into the following four classes as Grade I, Grade II, Grade III and Grade IV.

2) Hamp SE., *et al.* (1975) [8] in European literature classified furcation involvements as:

- Degree I: These furcation involvements are classified by horizontal bone loss of periodontal support not exceeding one third of the width of the tooth.

- Degree II: Horizontal loss of periodontal support exceeding one third of the width of the tooth, but not encompassing the total width of the furcation area.
- Degree III: Involvements requires a ''through and through'' destruction of the periodontal tissues in furcation area.

3) Tarnow D., *et al.* (1984) [9] added the vertical component to the diagnosis of furcation involvement. Subclass based on the vertical bone resorption from the furcation fornix was added.
   - Subclass A: Denotes furcation involvements with vertical bone loss of 3 mm or less.
   - Subclass B: 4 to 6 mm.
   - Subclass C: Presents with bone loss from the fornix of 7 mm or more.
4) The classification of Hamp SE., *et al.* (1975) [8] had been simplified by giving critical numerical values to the horizontal component of the attachment loss by Carnevale G., *et al.* (1997) [10]:
   - Class I Furcation: Less than 3 mm.
   - Class II Furcation: 3 mm or more but not through and through.
   - Class III Furcation: Definition was left unchanged; through and through.
5) American academy of Periodontology in 1993 (Chicago) [11] classified furcation defects as:
   - Class I: Indicating minimal but notable, loss of bone in a furcation.
   - Class II: Displaying a variable degree of bone destruction in a furcation but not exceeding completely through the furcation; and
   - Class III: In which bone resorption extends completely through the furcation.

### Classification system: Revisited

The present classification system describes all kinds of osseous defects which are necessary not only for the academic purposes but also to serve as a rationale basis for the selection of a method of treatment i.e. whether these were amenable to either the new attachment procedure or osseous surgery for their eradication.

All the defects were recorded under good illumination and classified. In deciding, the morphology of the periodontal bone defects the following classification system by Glickman (1953), Goldman., *et al.* (1958), Karn KW., *et al.* (1984) and Papapanou PN., *et al.* (2000) [1-3,7] has been followed:

1) Suprabony defects
2) Infrabony defects
   a. Craters
   b. Intrabony defects (1-, 2-, 3-, 4-wall defect and combination)
3) Other bone defects
   a. Bulbous bone contour
   b. Ledge
   c. Reversed architecture
   d. Fenestration
   e. Dehiscence

f. Trench

g. Ramp (facial/ lingual or palatal)

4) Interradicular defects

a. Grade I

b. Grade II

c. Grade III

d. Grade IV

## Discussion

### Description of patterns of bone destruction

Destructive periodontitis caused by bacterial plaque involves resorption of alveolar bone supporting the teeth. The resorption of bone may occur to the same extent leading to horizontal bone loss around a number of adjacent teeth. However, in some cases the resorption occurs to a varying extent on neighboring teeth or tooth surfaces resulting in the formation of intrabony defect. The various patterns are mentioned below:

1) Horizontal bone loss

2) Vertical bone loss

3) Other bone defects

4) Furcation involvement

### Horizontal bone loss

Horizontal bone loss is the most common pattern of bone loss in periodontal disease. The bone is reduced in height, but the bone margin remains roughly perpendicular to the tooth surface. The interdental septa, facial and lingual plates are affected, but not necessarily to an equal degree around the same tooth (Figure 1).

***Figure 1:*** *Suprabony defect.*

### Vertical bone loss

Vertical or angular defects are those that occur in an oblique direction, leaving a hollowed- out trough in the bone alongside the root; the base of the defect is located apical to the surrounding bone. In most instances, angular defects have accompanying infrabony pocket; such pockets always have an underlying angular defect.

### Four wall defect

The four wall defects (buccal, lingual, mesial, and distal) usually involved circumferential pocket and involves the four surfaces of the tooth. The defect surrounds the root of the tooth [1,2,12] (Figure 2a).

### Three wall defect

Three wall defects are trough- like defect, commonly observed in interdental areas where one finds an intact proximal wall as well as buccal and lingual walls of the alveolar process. Some of these lesions may be shallow with a broad orifice to the osseous part of the pocket while others may be narrow and deep [1,2,13] (Figure 2b).

### Two wall defect

Two wall infrabony pockets may be seen in the interdental areas. If the buccal and lingual walls are intact, but the proximal wall has been destroyed. Because the base of the pocket is apical to either the buccal or lingual wall, this falls into the classification as an infrabony pocket. One may find that the two walls remaining are the buccal wall and the proximal wall or the lingual wall and the proximal wall [1,2,14] (Figure 2c).

### One wall defect

The infrabony pocket which has one osseous wall remaining is usually seen in the interdental area. Here it is most common to observe the presence of a proximal wall with the buccal and lingual walls destroyed. It is much less common to find the buccal wall intact with loss of the proximal and lingual walls or to have a lingual wall intact with the loss of the proximal and buccal [1,2] (Figure 2d).

### Combination defect

- Three walls plus two walls.
- Three walls plus two walls plus one wall.
- Three walls plus one wall.
- Two walls plus one wall.

### Interdental crater

The interproximal bony crater is the deformity most frequently caused by periodontal disease that affects the alveolar process. It is created when the crest of the interalveolar septum between the buccal and lingual cortical plates is resorbed.

The interdental crater is the predominant lesion of the lower posterior segment. An aggregate of factors would appear to be responsible for this phenomenon including the vulnerability of the col (Figure 2e).

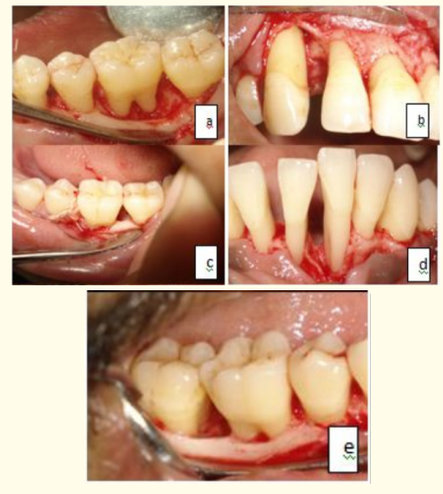


***Figure 2:*** *Infrabony defects. a) 4-wall, b) 3-wall, c) 2-wall, d) 1-wall, e) Interdental center.*

## Other bone defects

### Buccal bone contours

They are the bony enlargements caused by exostoses, adaptation to function or buttressing bone formation. They are found more frequently in the maxilla than in mandible.

*Exostoses* were defined as definite convex outgrowths of buccal (or lingual) bone, which could be delineated from the surrounding cortical plate. These are benign, slow growing bony protuberances on the buccal alveolar bone [4] (Figure 3a).

### Reversed architecture

Reversed architecture defects are morphological relationship in which the radicular bone on the labial or lingual aspects of the tooth is in a more coronal position than the adjacent interdental bone. It is produced by loss of interdental bone, including the facial, lingual plates or both, without concomitant loss of radicular bone, thereby reversing the normal architecture. Such defects are more common in maxilla [5] (Figure 3b).

### Ledges

Plateau like bone margins caused by resorption of thickened bony plates (Figure 3c).

### Dehiscence and fenestration

Two commonly encountered alveolar bone defects are dehiscence and fenestration. An alveolar dehiscence denotes a lack of the facial or lingual alveolar cortical plate resulting in a denuded root surface, while an alveolar fenestration is a circumscribed defect of the cortical plate which exposes the underlying root surface but does not involve the alveolar margin of bone [4] (Figure 3d).

### Trench

This term is applied when such bone loss affects two or three confluent surfaces of the same tooth. Trenches can be similarly identified by tooth surfaces involved (e.g. mesio-facial, mesio-lingual- distal, etc.), since trenches involve either two or three surfaces of the same tooth there are eight possible types (MF, ML, DF, DL, MFD, MLD, FML, FDL) (Figure 3e).

### Moat

When the previously described deformity involves all the four surfaces of a tooth, it is described as a moat. Since the term "moat" is applied to a deformity totally encircling a tooth, only the tooth number is necessary to identify it.

### Ramp

It describes a deformity that results when both alveolar bone and its supporting bone are lost to the same degree in such a manner that the margins of the deformity are at different levels (Figure 3f).

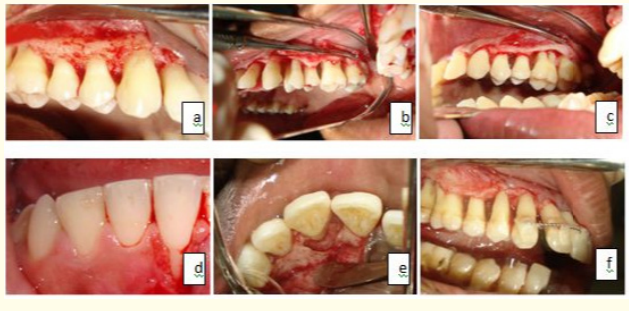


***Figure 3:*** *a) Bulbous bone contour, b) Reversed architecture, c) Ledge, d) Fenestration, e) Trench, f) Ramp.*

### Furcation involvement

Conditions entailing pathological resorption of bone within the furcation of multirooted teeth are defined as furcation invasions, and these were included under periodontal osseous defects by Papapanou., *et al.* (2000), but according to Prichard furcations involvement, represents a stage in the progress of tissue destruction rather than a form of bone lesion.

Glickman (1953) [1] classification system was followed for furcation defects:

- **Grade I**: It is incipient or early stage of furcation involvement. The pocket is suprabony and primarily affects the soft tissues (Figure 4a).
- **Grade II**: It is essentially a cul- de- sac with a definite horizontal component. If multiple defects are present, they do not communicate with each other, since a portion of the alveolar bone remains attached to the tooth (Figure 4b).
- **Grade III**: The bone is not attached to the dome of the furcation. In early grade III furcations involvement the opening may be filled with the soft tissue and may not be visible. Indeed one may not be able to pass the probe completely through the furcations because of interference with bifurcational ridges or facial/lingual bony margins (Figure 4c).
- **Grade IV**: In this the interdental bone is destroyed and soft tissues have receded apically so that the furcation opening is clinically visible. The periodontal probe therefore passes readily from one aspect of tooth to another (Figure 4d).


***Figure 4:*** *Interradicular defects. a) Grade I, b) Grade II, c) Grade III, d) Grade IV.*

## Conclusion

In the present study, 1041 teeth were explored surgically and out of those 1010 absolute defects (Suprabony, Infrabony and Other Bone defects) were found. Hence, the prevalence of defects was 97%, while prevalence of teeth with defects was 94%. Out of 404 multirooted teeth, 254 interradicular defects were explored. The prevalence of Interradicular defects was 62.8%, while prevalence of multirooted teeth with interradicular defects was 38.1%.

The principal conclusions under the limitations of the present study have been mentioned below:

1) The prevalence and distribution of Suprabony defects was 63.7% in moderate to severe chronic periodontitis patients.
2) The prevalence and distribution of Infrabony defects was 31.1% in moderate to severe chronic periodontitis patients.
3) Among the Infrabony defects, crater comprised of 46.8% of defects. It was interpreted that intrabony defects and crater were almost equal.
4) Among the Infrabony defects, intrabony defects comprised of 53.2% of defects. It was interpreted that 2-wall > 3-wall > 1-wall > 4-wall > combination defect.

5) The prevalence and distribution of Other bone defects was 5.2% in moderate to severe chronic periodontitis patients. It was interpreted that Ledge > Bulbuous Bone contour > Trench > Dehiscence = Ramp > Reversed architecture, while fenestration was absent.

6) The prevalence and distribution of Grade I, II and III IR relative defects were 54.7%, 37% and 8.3%, respectively, while Grade IV Interradicular defect was absent. It was interpreted that Grade I > II > III.

For today's periodontists, and patients, regeneration of the periodontium lost by periodontitis is ultimate goal. The high prevalence as well as great variation and complexity of bone defects support the view that treatment procedures with predictable success rates are of great significance in periodontal therapy.

## Bibliography


1. Glickman I. "Bone loss and patterns of bone destruction in periodontal disease". Clinical Periodontology (1972): 218-232.
2. Goldman Henry M and D Walter Cohen. "The infrabony pocket: classification and treatment". *The Journal of Periodontology* 29.4 (1958): 272-291.
3. Rosenberg MM., *et al*. "Management of Osseous Defects". Clinical Dentistry: Periodontal and Oral Surgery (1977): 11.
4. Prichard JF. "Periodontal osseous surgery". Advanced periodontal disease: Surgical and prosthetic management (1972): 437-511.
5. Manson JD and K Nicholson. "The distribution of bone defects in chronic periodontitis". *Journal of Periodontology* 45.2 (1974): 88-92.
6. Manson JD. "Bone morphology and bone loss in periodontal disease". *Journal of Clinical Periodontology* 3.1 (1976): 14-22.
7. Papapanou Panos N and Maurizio S Tonetti. "Diagnosis and epidemiology of periodontal osseous lesions". *Periodontology 2000* 22.1 (2000): 8-21.
8. Hamp Sven-Erik., *et al*. "Periodontal treatment of multi rooted teeth. Results after 5 years". *Journal of Clinical Periodontology* 2.3 (1975): 126-135.
9. Tarnow Dennis and Paul Fletcher. "Classification of the vertical component of furcation involvement". *Journal of Periodontology* 55.5 (1984): 283-284.
10. Carnevale G., *et al*. "Treatment of furcation involved teeth". Clinical Periodontology and Implant Dentistry (1997): 682-710.
11. "Glossary of periodontal terms". Chicago: American academy of periodontology (1993).
12. Bui Dinh X. "Intrabony Defects: Diagnosis and Treatment". (2010).
13. Carranza FA., *et al*. "Bone loss and patterns of bone destruction". Carranza's Clinical Periodontology (2006): 452-466.
14. Nielsen IM., *et al*. "Interproximal periodontal intrabony defects: Prevalence, localization and etiological factors". *Journal of Clinical Periodontology* 7.3 (1980): 187-198.


**Volume 18 Issue 6 June 2019**