

A RADIOGRAPHIC ANALYSIS OF OSTEOSCLEROSIS OF THE JAWS

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顎骨에 發生된 骨硬化症에 對한 放射線學的 研究

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.....〈국문요약〉.....

Orthopantomograph 는 齒科診療에서 가장 一般的인 口外攝影方法으로 利用되고 있다.

著者は 1983年 서울大學校病院 齒科診療部 齒科放射線科에 來院한 患者中 Orthopantomogram을 촬영한 2,160명을 대상으로 骨硬化症의 性別, 年齡別 發生頻度와 發生部位, 硬化像의 크기,모양등을 分類하고 特發性 骨硬化症과 condensing osteitis에 關하여 관찰하였든 바 다음과 같은 結果를 얻었다.

1. Idiopathic osteosclerosis의 發現율은 16.0%, condensing osteitis의 發現율은 9.8%였고 男女間의 差異는 없었다.
2. 骨硬化症의 好發部位는 下顎小白齒, 大白齒部位였고, 上顎에서의 發生率은 적었다.
3. 骨硬化像의 크기는 idiopathic osteosclerosis는 10mm 이내였고, condensing osteitis는 10~20mm의 폭경을 가지고 있었다.
4. 骨硬化像의 形態, 健康骨과의 境界 및 發現되는 상태는 일정하지 않았다.

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INTRODUCTION

In the response of osseous tissue to various inflammatory or traumatic stimuli, imbalances in equilibrium between bone formation (osteoblastic activity) and bone destruction (osteoclastic activity) may occur, resulting in areas of increased or decreased bone density. Increased bone density include the idiopathic osteosclerosis and condensing osteitis, are composed of in these condition. Idiopathic osteosclerosis (bone whorl, bone eburnation, enostosis) develops during a healing process and is not caused by inflammation. It does not associated with infection. The most frequent example of this type of sclerosis is found in the apical area of a healthy vital mandibular premolar or molar region.

Condensing or sclerosing osteitis is used when an inflammation (either present of recently past) is likely the initiating factor for the sclerosing process. The most frequent examples of this condition is encountered in the apical area of a tooth with an infected root canal. There were many descriptions about the idiopathic osteosclerosis and condensing osteitis. And many literatures defined the idiopathic osteosclerosis and condensing osteitis as a separate entity. While there have been description of periapical radiopacities with limited statistical value.

In 1978, Farman et al reported focal osteosclerosis in the standardized orthopantomograms. They did not exactly differentiate the idiopathic osteosclerosis and condensing osteitis. Most cases of focal osteosclerosis were found in dentulous areas or associated with decayed or inadequately restored teeth, however, some were found to comparatively sound tooth root.

In 1980, Hasegawa et al reported roentgenographic evidences of condensing osteitis caused by periodontal disease. They could classified according to the possible etiologic factors and were observed for the condensing osteitis caused by periodontal disease and periapical pathosis. The incidences of these conditions in 25.7% of the examined subjects and it seemed to increased as the aging.

The author tried to observe more exactly the idiopathic osteosclerosis and condensing osteitis related to the periapical lesion in orthopantomograms which is one of the most common and useful extraoral radiographs and a simple and rapid method of recording dental condition.

MATERIALS AND METHODS

Standardized panoramic radiograms (by using Orthopantomograph 5; Siemens Co.) were obtained from 2,160 dental outpatients, attending for the treatment at the department of Oral Radiology, Seoul National University Hospital in 1983. The samples of this study comprised 1,166 males and 994 females from 3 to 83 years of age. The distribution of the samples by age and sex is shown in Table 1. The radiographs were examined by the author using same viewing condition with constant ambient lighting.

All idiopathic osteosclerosis and condensing osteitis related to periapical and periodontal lesions of the maxilla and mandible were recorded and the following parameters were considered;

Table 1. Age, sex distribution

Age	Sex		
	Males	Females	
0 – 9	158	123	
10 – 19	174	138	
20 – 29	275	207	
30 – 39	163	137	
40 – 49	153	124	
50 – 59	129	141	
60 – 69	83	79	
70 –	31	45	
	1166	994	2160

age, sex, incidences of the lesions, site, size, shape, margin, and mode of occurrence (solitary, multiple, and bilateral) of the osteosclerosis and condensing osteitis of the jaw bone.

FINDINGS

A. Idiopathic osteosclerosis

1. Incidences and age, sex distribution

Idiopathic osteosclerosis occurred in 345 cases (16.0%) from 2,160 subjects. The incidence of first decade (1.4%) was low and third (21.2%), fourth (22.7%) and fifth (20.2%) decades showed relatively high occurrence. Literatures reported that idiopathic osteosclerosis was a relatively common findings of dentulous patients over 12 years age. Boyne stated that a survey of 927 full mouth roentgenographs of male patients between the ages of 22 and 56 years revealed that 39 exhibited areas of localized osteosclerosis, and the areas of increased bone density which were smaller than 10 mm were not included in the study.

The idiopathic osteosclerosis were found in 189 males (16.2%) and 156 females (15.7%). And the distribution of individuals affected by idiopathic osteosclerosis was not significantly different between males and females (Table 2).

2. Site of the lesion

Idiopathic osteosclerosis occurred most commonly in the mandible (397 cases), on the other hand, it was very rare in the maxilla (1 case). Concerning the most common sites in the jaws affected by idiopathic osteosclerosis, the areas were the mandibular premolar, molar region (82.1%).

Farman et al stated that most periapical radiopacities were located in the apical area of the mandibular first premolar and canine (Table 2, 3).

Table 2. Age, sex distribution and incidences of the idiopathic osteosclerosis

Age	Sex		Incidences				Total	
	Males	Females	Males	Females	Males (%)	Females (%)	No	%
0 – 9	158	123	2(2)	2(2)	1.3	1.6	4(4)	1.4
10 – 19	174	138	30(34)	19(23)	17.2	13.8	49(57)	15.7
20 – 29	275	207	52(58)	50(62)	18.9	24.2	102(120)	21.2
30 – 39	163	137	38(46)	30(33)	23.3	21.9	68(79)	22.7
40 – 49	153	124	33(38)	23(26)	21.6	18.5	56(64)	20.2
50 – 59	129	141	18(21)	14(16)	14.0	10.0	32(37)	11.9
60 – 69	83	79	11(11)	15(18)	13.3	19.0	26(29)	16.0
70 –	31	45	5(5)	3(3)	16.1	6.7	8(8)	10.5
	1166	994	189(215)	156(183)	*** (16.2)	(15.7)	345(398)	(16.0)

*Number of affected individuals

** () Number of lesions

*** () Average incidence rate

3. Size of the lesions

The size of the sclerotic areas varied from 3 mm to 20 mm in length or width as measured from standardized orthopantomograms.

Idiopathic osteosclerosis sized 0 - 5 mm were found 170 cases (42.7%) and sized 6 - 10 mm were found in 177 cases (44.5%).

Therefore, idiopathic osteosclerosis less than 10 mm were common. Literature described that the size of sclerosis varied from a few millimeters to 2 or 3 centimeter in diameter (Table 4).

Table 3. Site of idiopathic osteosclerosis

Site	Maxilla	Mandible
Incisor		24(6.0%)
Canine		43(10.8%)
Premolar		214(53.7%)
Molar	1(0.3%)	113(28.4%)
Mandibular angle		4(1.0%)
	1	397

Table 4. Size of idiopathic osteosclerosis

Size(mm)	NO (%)
0 – 5	170(42.7)
6 – 10	177(44.5%)
11 – 15	41(10.3)
16 – 20	10(2.5)
Total	398(100)

4. Shape of the lesions

The shape of idiopathic osteosclerosis were formed from round to irregular types, the round shape appeared most common (299 cases, 75%), and the irregular shapes were 61 cases (15.3%), and the linear types were 48 cases (9.5%). The appearance of the lesions ranged generally from a slight to prominent accentuation of the normal trabecular pattern.

5. Margins of the lesions

Most of the margins of the lesions showed well-defined or smoothly contoured (258 cases, 64.8%), and the ragged margins were 138 cases (34.7%), and the diffuse margin were 2 cases (0.5%) with the adjacent normal bone, in that orders.

6. Modes of occurrences

Solitary lesions (290 cases, 84.0%) were most common and multiple (55 cases, 15.9%), and bilateral (23 cases, 6.7%) occurrences were also observed.

B. Condensing osteitis related to periapical lesions

1. Incidences and age, sex distributions

Condensing osteitis occurred in 213 cases (9.8%) from 2,160 subjects. The incidences of first (2.8%) and second (7.4%) decades were relatively low, over the third decades showed high incidences of occurrences, and the sixth decades showed the highest occurrences. Hasegawa et al reported that condensing osteitis related to periapical lesions occurred 8.7 per cent from 408

Table 5. Age, sex distribution and incidences of the condensing osteitis

Age	Sex		Incidences				Total	
	Males	Females	Males	Females	Males(%)	Females(%)	No.	%
0 - 9	158	123	*** 4(5)	4(5)	2.5	3.3	8(10)	2.8
10 - 19	174	138	13(16)	10(13)	7.5	7.2	23(29)	7.4
20 - 29	275	207	21(27)	28(29)	7.6	13.5	49(56)	10.2
30 - 39	163	137	19(19)	15(18)	11.7	10.9	34(37)	11.3
40 - 49	153	124	16(17)	12(18)	10.5	9.7	28(35)	10.1
50 - 59	129	141	23(29)	23(24)	17.8	16.3	46(53)	17.0
69 - 09	83	79	9(9)	8(12)	10.8	10.1	17(21)	10.4
70 -	31	45	5(8)	3(4)	16.1	6.7	8(12)	10.5
	1166	994	110(130)	103(123)	*** (9.4)	(10.3)	213(253)	(9.8)

*Number of affected individuals

**Number of lesions

**Average incidence rate

subjects, and the condensing osteitis seemed to increase as the age became higher.

The condensing osteitis were found in 110 males (9.4%) and 103 females (10.3%), and the distribution of individuals affected by condensing osteitis related to periapical lesions was not significantly different between males and females in this study (Table 5).

2. Site of the lesions

The condensing osteitis occurred most commonly in the mandible (240 cases), while it was rare in the maxilla (15 cases).

Mandibular molar and premolar area showed high occurrences, and the areas were the maxillary molar, mandibular canine regions, in that order. Hasegawa et al stated that condensing osteitis was most frequently observed at the mandibular molar area regardless of their etiologic factors. Farman et al stated that the areas (focal osteosclerosis) were the mandibular first permanent molar (34.0%), the mandibular second permanent molar (17.9%), mandibular second premolar (10.3%), and mandibular third molar (8.2%) regions, in that order.

3. Size of the lesions

The size of the condensing osteitis varied from a few millimeters to 30 millimeters.

The lesions ranged from 6 mm to 20 mm in length or width as measured from standardized orthopantomograms. And the occurrences of the lesions especially ranged from 11 mm to 15 mm showed relatively high occurrences (37.3%) (Table 7).

Table 6. Site of the condensing osteitis

Site	Maxilla	Mandible
Incisor	1(0.4)	1(0.4)
Canine	1(0.4)	4(1.6)
Premolar	3(1.2)	25(9.8)
Molar	10(3.9)	210(82.4)
Mandibular angle		
Total	15	240

Table 7. Size of the condensing osteitis

Size (mm)	No (%)
0 – 5	8 (3.1)
6 – 10	69(27.1)
11 – 15	95(37.3)
16 – 20	67(26.3)
21 – 25	13(5.1)
26 – 30	3(1.2)
Total	255(100)

4. Shape of the lesions

The radiographic image of the condensing osteitis varied greatly, the shapes of the condensing osteitis related to periapical lesion were semilunar (187 cases, 73.9%), diffuse (52 cases, 20.6%), linear (9 cases, 3.6%) and round (5 cases, 1.9%), shapes in that order.

5. Margins of the lesions

Different areas of the condensing osteitis demonstrated variations in density, and margins

showed great variations.

Diffuse type (159 cases, 77.1%) and ragged (57 cases, 22.5%) margins occurred most common, and well-defined (1 case, 0.4%) margin was rare.

6. The modes of occurrences

Most of the lesions occurred solitary (181 cases, 85%), multiple (32 cases, 15.0%) and bilateral (21 cases, 9.9%) occurrences were also observed.

DISCUSSION

The term sclerosis or osteosclerosis is applied to radiopacities which are resulted from a density brought about by an intrinsic change in the bone. An idiopathic osteosclerosis (bone whorl, bone eburnation, enostosis) develops during a healing process and is not caused by inflammation. It does not associated with infections.

Panoramic radiographs is a simple and rapid method of recording dental conditions, but it is not designed to delineate area of extreme detail. Firstly, we must have a knowledge of the normal appearance of anatomic structures for interpreting the orthopantomograms. Superimposition, distortion, and artifacts that are known to occur with panagraphy must be recognized. The existence of lingual foramen and superimposition of vertebra should be considered in the anterior region of the jaw in orthopantomogram.

Magnification of objects with the basic image layer (focal trough) of the orthopantomograph will be approximately 29 to 35 percent in the vertical dimension (elongation and foreshortening), varying with the size and shape of the jaw. Width distortion of an anatomic structure, caused by distance and motion factors, can vary from 39 to 46 percent.

Therefore, one must recognize these facts in considering the results of size, shape, margin of the idiopathic osteosclerosis and condensing osteitis. Additional intraoral radiographs will be helpful for diagnosis and evaluation of the treatment results.

Identifying the specific types of sclerosis (idiopathic osteosclerosis and condensing osteitis) may not always be possible because the sclerotic area may have been induced by a previous disturbance that is no longer present. In such instances the clinician will be unable to relate the lesion to any disorder currently apparent; and he will then diagnosis the lesion as an idiopathic osteosclerosis.

Bone, sclerosis, or condensing osteitis, or sclerosing osteitis is believed to develop as a results of stress, trauma, or inflammation of teeth and surrounding bone. It is generally characterized radiographically by reduction in the size of both trabecular spaces and trabeculae, an increase in their number, and increase in the opacity of the involved bone. The extent of the area involved varies greatly.

The highly concentrated products of infection are thought to act as irritants and to produce bone resorption where as the diluted irritants may induce bone proliferation such as that seen in condensing osteitis. These concepts are illustrated occasionally when a periapical area of rare-

fying osteitis is surrounded by a radiopaque halo of condensing osteitis.

Condensing or sclerosing osteitis must be differentiated from all the other periapical radiopacities; periapical idiopathic osteosclerosis, periapical cementoma, an unerupted tooth, a foreign body introduced during root canal therapy, hypercementosis, and the rare lesions. In addition, the clinician must rule out the false periapical radiopacities by using Clark's tube shift technique when exposing the additional intraoral films.

In 1971, Mans reported follow-up study of periradicular bone condensation (the fate of a radiographically diagnosed periradicular bone condensation), the results of their study, radiopaque areas were recorded in altogether 7% of the 540 teeth. Thirty-three (87%) of the teeth were mandibular and five (13%) in maxillary area. At the time of the follow-up the radiopaque areas persisted in 22 teeth (55%) and had disappeared in 16 (45%). Of the persistent radiopaque areas 8 had decreased in size, 12 were unchanged, and 2 had become larger.

The majority of the condensing osteitis occurred in the mandibular premolar (9.8%) and molar (82.4%) region in this study. The results were similar to the previous reports.

Microscopical characteristics of osteosclerosis was the obliteration of the normal marrow spaces by thickened trabecular patterns in most instances, in some areas reveals individual trabeculae is fibrous and shows proliferating fibroblasts with small capillaries and no evidence of inflammatory elements.

CONCLUSION

The author surveyed 2,160 standardized panoramic radiograms which were taken from dental outpatients, attending for the treatment at the Department of Oral Radiology, Seoul National University Hospital in 1983. The results of this study about idiopathic osteosclerosis and condensing osteitis related to the periapical lesions are:

1. The incidence of idiopathic osteosclerosis was 16.0%, and the distribution of individuals affected by the idiopathic osteosclerosis was not significantly different between males and females.
2. Idiopathic osteosclerosis occurred most commonly in the mandible, and the premolar-molar region showed high occurrences (82.1%).
3. The incidence of condensing osteitis was 9.8%, and the distribution of individuals affected by condensing osteitis was not significantly different between males and females.
4. Mandibular premolar-molar area showed high occurrence of condensing osteitis.
5. The size, shape, margin, and mode of occurrence of the both conditions showed great variations.

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