

A study on the prevalence of the idiopathic osteosclerosis in Korean malocclusion patients

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ABSTRACT

Purpose : This retrospective study was performed to investigate the prevalence of the idiopathic osteosclerosis (IO) in Korean malocclusion patients according to age, sex, and the Angle's classification of malocclusion.

Materials and Methods : This study consisted of 2,001 randomly selected patients from the Department of Orthodontics at the Gangneung-Wonju National University Dental Hospital, Korea. The prevalence of IO in Korean malocclusion patients was recorded using their panoramic radiographs, and the following parameters were surveyed; age, sex, and the Angle's classification of malocclusion. The chi-square test was analyzed to determine the statistical significance of differences in the prevalence of IO between age, sex, and the Angle's classification of malocclusion.

Results : The prevalence of IO in the jaws was 6.7% in a total of 2,001 examined orthodontic patients. The majority of IO was found in the mandible (96.58%). The 30-39 age group showed the highest prevalence of IO (9.60%). There was a higher prevalence in females (6.89%) than in males (6.45%). The prevalence of IO in Angle Class I group (7.07%) was the most frequent, followed by Angle Class II group (6.72%), and Angle Class III group (6.40%). However, there was no statistical significance in sex and Angle's classification of malocclusion.

Conclusion : The prevalence of IO in malocclusion patients showed the differences between various age groups and most of them were found in the mandibular posterior area. However, sex and the type of malocclusion are not to be considered as a contributing factor of IO. (*Korean J Oral Maxillofac Radiol* 2010; 40 : 159-63)

KEY WORDS : Osteosclerosis; Radiography, Panoramic; Malocclusion

Introduction

Idiopathic osteosclerosis (IO) in the jaws is defined as a localized radiopacity of unknown origin.¹ Most of these lesions are asymptomatic and are detected on radiographs taken for some other purposes (Fig. 1).¹ On ordinary radiographic examinations, osteosclerotic areas frequently present as isolated radiopacities located at various positions in the jaws.²

Radiographs are routinely acquired in the diagnostic record for orthodontic treatment planning. In conventional orthodontic examination, lateral cephalometric and panoramic radiographs are taken. However, very few studies have analyzed the prevalence of IO on radiographs taken for orthodontic diagnosis and the Angle's classification of malocclusion. Therefore, the purpose of this study was to evaluate the prevalence of the idiopathic osteosclerosis (IO) in Korean malocclusion patients according to age, sex, and the Angle's classification of malocclusion.

Materials and Methods

The subjects of this study were 2,001 randomly selected patients, comprising 1,117 females and 884 males, with a mean age of 17.28 years (Table 1). The patients were selected from the Department of Orthodontics at Gangneung-Wonju National University Dental Hospital. No patients had known systemic disease, syndrome, or developmental defect. All panoramic radiographs were taken between 1998 and 2007 at the Department of Oral and Maxillofacial Radiology, Gangneung-Wonju National University Dental Hospital. Panoramic radiographs were taken with Cranex+Ceph (Soredex Orion Corp., Tuusula, Finland), and processed with FCR 5000R (Fuji Medical System, Tokyo, Japan). The images were printed out with Fuji medical laser imager (Fuji Medical System, Tokyo, Japan).

The radiographs were read in table mounted, suitably masked, and investigated under constant ambient lighting condition using a magnifier with a 23 magnification (5" regular glass lens, Osung Corp, Seoul, Korea). Radiographs were evaluated from not more than 50 patients at a time to minimize the risk of false assessments caused by fatigue. Two orthodontists investigated the radiographs independently and recorded the observed IO.

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Fig. 1. Idiopathic osteosclerosis, a round, localized radiopacity, is detected between lower left second premolar and first molar.



Fig. 2. Condensing osteitis, radiopacity around tooth with deep caries, is detected on right lower first molar. This lesion was excluded from this investigation, due to severe dental caries on right lower first molar.

Table 1. The distribution of 2,001 patients according to age and sex

| Age | Male | Female | Total |
|---------|------|--------|-------|
| Under 9 | 207 | 243 | 450 |
| 10-19 | 431 | 499 | 930 |
| 20-29 | 174 | 238 | 412 |
| 30-39 | 46 | 79 | 125 |
| Over 40 | 26 | 58 | 84 |

From a set of 200 radiographs, agreement percentages and kappa indices for inter- and intraexaminer variations were calculated. The intraexaminer agreement for the two observers for detecting IO was 98% (kappa 0.86) and 96.7% (kappa 0.82), respectively. The overall interexaminer agreement was 96%, corresponding to a kappa index of 0.83.

All radiographs were assessed for the presence of IO on the basis of the following criteria.¹

1. A well-cleared radiopacity in the jaws that is located adja-

cent to sound teeth, adjacent to teeth with small restorations, or at a distance from the teeth.

2. Round or oval in shape and more than 3 mm in size.
3. No surrounding radiolucent boundary.

The following criteria³ were excluded from this investigation:

1. Isolated radiopacities in edentulous regions because these could be residual condensing osteitis.
2. Radiopacities around teeth with deep caries, large restorations, or canal fillings (Fig. 2).
3. Radiopacities in patients with Gardner's syndrome, familial adenomatosis of the colon, and other systemic disease of bone.

The prevalence of IO was recorded and the following parameters were surveyed; age, sex, location of IO in the jaws, and the Angle's classification of malocclusion. The location of IO was classified as the following 4 areas; maxillary anterior and

Table 2. The distribution and prevalence of 134 cases of idiopathic osteosclerosis according to age

| Age | No. of case examined | No. of IO* | Prevalence (%) |
|---------|----------------------|------------|----------------|
| Under 9 | 450 | 14 | 3.11 |
| 10-19 | 930 | 72 | 7.74 |
| 20-29 | 412 | 32 | 7.77 |
| 30-39 | 125 | 12 | 9.60 |
| Over 40 | 84 | 4 | 4.76 |

*IO: idiopathic osteosclerosis, $\chi^2=13.771$, $df=4$, $p=0.008$

posterior teeth area, and mandibular anterior and posterior teeth area.

The Angle's classification of malocclusion for the patients was confirmed using the diagnostic dental models by 2 observers. From a set of 200 pretreatment diagnostic dental models, the agreement percentages and kappa indices for inter- and intraexaminer variations were also calculated. The intraexaminer agreement for the two observers to confirm the Angle's classification of malocclusion was 100% (kappa 1.0) and 100% (kappa 1.0), respectively. The overall interexaminer agreement was 97%, corresponding to a kappa index of 0.86. Out of 2,001 patients, 509 patients showed Angle's Class I malocclusion (25.3%), and 804 patients were Class II (39.9%), and 688 patients were Class III malocclusion (34.8%).

The chi-square test was analyzed to determine the statistical significance of differences in the prevalence of IO between age, sex, location of IO in the jaws, and the Angle's classification of malocclusion.

Results

Total of 146 IO were found in 134 patients (6.7%). Out of 134 patients, 10 patients had two IO, and one patient had three IO. There were no patients with 4 or more IO. Table 2 shows the prevalence of IO according to age. The 30-39 age group showed the highest prevalence of IO (9.60%), and children under 9 years showed the lowest prevalence of IO (3.11%). There was significant difference in the prevalence of IO among age groups ($p < 0.01$). Table 3 shows the prevalence of IO according to sex. The prevalence in females (6.89%) was higher than in males (6.45%), however there was no statistically significant difference ($p=0.692$).

Of the 146 lesions, 141 (96.6%) lesions were present in the mandible with only 5 (3.4%) lesions in the maxilla (Table 4). And 112 (76.6%) lesions of the mandible were present at the posterior teeth area and 29 (20.0%) at the anterior area (Table 4). There was significant difference in the prevalence of IO

Table 3. The distribution and prevalence of 134 cases of idiopathic osteosclerosis according to sex

| Sex | No. of case examined | No. of IO* | Prevalence (%) |
|--------|----------------------|------------|----------------|
| Male | 884 | 57 | 6.45 |
| Female | 1117 | 77 | 6.89 |

*IO: idiopathic osteosclerosis, $\chi^2=0.157$, $df=1$, $p=0.692$

Table 4. The distribution and prevalence of 146 lesions of idiopathic osteosclerosis according to quartet site

| Distribution of IO* | | No. of IO* | Prevalence (%) |
|---------------------|----------------------|------------|----------------|
| Maxilla | Anterior teeth area | 4 | 2.74 |
| | Posterior teeth area | 1 | 0.68 |
| Mandible | Anterior teeth area | 29 | 19.86 |
| | Posterior teeth area | 112 | 76.71 |

*IO: idiopathic osteosclerosis, $\chi^2=133.0$, $df=1$, $p=0.000$

Table 5. The distribution and prevalence of 134 cases of idiopathic osteosclerosis according to the Angle's classification of malocclusion

| Classification of malocclusion | No. of case examined | No. of IO* | Prevalence (%) |
|--------------------------------|----------------------|------------|----------------|
| Class I | 509 | 36 | 7.07 |
| Class II | 804 | 54 | 6.72 |
| Class III | 688 | 44 | 6.40 |

*IO: idiopathic osteosclerosis, $\chi^2=0.216$, $df=2$, $p=0.898$

between the maxilla and mandible ($p=0.000$). Also, there was higher prevalence at the mandibular posterior area than the maxillary anterior, maxillary posterior, and mandibular anterior area.

The prevalence of IO in Angle Class I group (7.07%) was the most frequent, followed by Angle Class II group (6.72%), and Angle Class III group (6.40%) (Table 5). However, there was no statistical significance among the Angle's classification of malocclusion ($p=0.898$).

Discussion

The prevalence of IO has been reported from 2.4% to 16.0% in previous studies (Table 6).¹⁻⁹ In this study the prevalence of IO was 6.7%. The reason for these various results was probably due to the difference in the ethnic group, type of radiographs, and definition of IO. Ahn et al.² used periapical radiographs reporting lower prevalence than our result. The prevalence in a Caucasians by Geist and Katz¹ and Farman et al.¹⁰ was also lower than ours.

Table 6. Prevalence of IO^a in the previous studies

| | Prevalence of IO ^a | Number of subjects | Type of radiographs | Excluding the condensing osteitis | Age | Most frequently detected location | Sex |
|-------------------------------------|-------------------------------|--------------------|-----------------------------------|-----------------------------------|-----|-----------------------------------|-----|
| Geist and Katz ¹ (1990) | 5% | 1921 | Full mouth periapical radiographs | No | – | Mandibular premolar region | * |
| Ahn et al. ² (1994) | 2.43% | 6220 | Full mouth periapical radiographs | No | NS | Mandibular premolar region | * |
| Yonetsu et al. ³ (1997) | 6.1% | 1047 | Panorama | Yes | – | Mandibular first molar region | NS |
| Choi ⁴ (1995) | 9.76% | 7837 | Panorama | No | NS | Mandibular molar region | NS |
| Park ⁵ (1984) | 16.0% | 2160 | Panorama | No | * | Mandibular premolar region | NS |
| MacDonald et al. ⁶ | | | | | | | |
| Hong Kong in 1981 | 6.7% | | | | | | |
| Hong Kong in 1990 | 5.5% | | Panorama | Yes | – | Mandibular premolar region | * |
| London in 1990 | 2.7% | | | | | | |
| Edinburgh in 1993 | 4.1% | | | | | | |
| | | | | | | | |
| Garau et al. ⁷ (2002) | 8.3% | 697 | Panorama | No | NS | Mandibular first molar region | NS |
| Williams et al. ⁸ (1998) | 5.7% | 1585 | Full mouth periapical radiographs | No | NS | – | – |
| Kawai et al. ⁹ (1992) | 9.7% | 1203 | Panorama | No | NS | Mandibular first molar region | NS |

^aidiopathic osteosclerosis

*significant; NS, not significant

The present study found no difference of the incidence according to sex. This finding agrees with Park,⁵ Garau et al.,⁷ Kawai et al.⁹ and Yonetsu et al.³ whereas Geist and Katz¹ and McDonnell¹¹ reported a female to male ratio of 1.5 : 1 and 2 : 1, respectively. Ahn et al.² showed that there was a higher prevalence in women (3.12%) than in men (1.68%).

This study was also focused on the relation between the prevalence of IO and age. Our result showed that there was a statistical difference in the prevalence of IO among the age groups. Some studies²⁻¹⁰ reported that there was no statistical difference among age groups. On the other hand, Park⁵ reported that relatively high occurrence of IO with aging. He reported that the prevalence of IO was 1.4% (10's), 15.7% (20's), 21.2% (30's), 22.7% (40's), and 20.2% (50's), respectively. Eversole et al.¹² also reported that there were higher prevalence in older age group. It was suggested that once IO was established in the early stage of life, it does not tend to regress.^{1,11,13} In our study, the prevalence of IO was higher in older age group than in younger age group. However, in the age group over 40 years, the prevalence tended to decrease, and this might be originated from the insufficient samples.

Many previous studies reported higher prevalence of IO in the mandible than in the maxilla (Table 6). Our results showed

that 96.6% of IO was found in mandible, whereas only 3.4% was found in the maxilla. And 76.6% of IO in the mandible was found in posterior area. Our result was in accordance with the previous reports.^{1-9,12,14} The reason for high prevalence in the mandible has not been fully explained, however the difference in the density between the mandible and the maxilla, and bending phenomenon of the mandible during mastication might be related with the occurrence of IO.

There were many previous studies on IO using radiographs, however no study about the Angle's classification of malocclusion with findings of IO is cited in the literature. In the etiology of IO, Eversole et al.¹² reported that excessive occlusal forces could be a cause. Because the occlusal forces could be different between the types of malocclusion, we investigated the prevalence of IO in three types of malocclusion patients. However, there was no significant difference in prevalence of IO among the Angle's classification of malocclusion groups.

In conclusion, the prevalence of IO in the jaws was 6.7% in a total of 2,001 examined orthodontic patients. The majority of IO was found in the mandible (96.58%). The 30-39 age group showed the highest prevalence of IO (9.60%). And, there was a higher prevalence in females (6.89%) than in males (6.45%). The prevalence of IO in Angle Class I group (7.07%)

was the most frequent, followed by Angle Class II group (6.72%), and Angle Class III group (6.40%). However, there was no statistical significance in sex and Angle's classification of malocclusion. The prevalence of IO in malocclusion patients showed the difference between the age groups, and most of them were found at the mandibular posterior area. However, sex and the type of malocclusion are not to be considered as a contributing factor of IO.

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