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**Research Article**

# SCLEROSING LESIONS OF THE JAW BONES: A PREVALENCE STUDY IN BHOPAL POPULATION

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**ABSTRACT**

Sclerosing lesions are typically detected as incidental findings during radiographic examinations. The aim of this study was to determine the prevalence of condensing osteitis (CO) and idiopathic osteosclerosis (IO) in Bhopal population sample. A retrospective study was performed using orthopantomograms of 1217 patients. Descriptive characteristics of radiopacities, including size, shape, localization, side of jaw, tooth status and dental relationship were recorded and $\chi 2$-test was used for statistical analysis. A total of 123 radiopacities were identified; 77 IO lesions and 46 CO lesions. Both lesions were found to be higher in number, among females. The frequency for both lesions was significantly higher in the age group 20-39 years. Results indicated a low prevalence of IO and CO in Bhopal population. The findings support the theory that IO lesions are developmental variants of normal bone architecture unrelated to local stimuli, whereas CO lesions could be considered reactive formations related to teeth with deep caries, large restoration, or treated root canal.



## INTRODUCTION

Panoramic radiograph is an imaging technique that helps to gain maximum amount of diagnostic information with a single tomographic image of the facial bones that includes both the dental arches and their supporting structures. Many a time this imaging modality is used to detect smaller pathologies, when the individual cannot tolerate intraoral radiograph.

The term 'bone sclerosis' means densest areas of trabecular bone, has passed normal morphologic limits & are encountered usually on radiographic examinations. (Consolaro A and Consolaro RB, 2012; Wood and Goaz, 1983) The word 'sclerosis' is interchangeably used with bone condensation.

Idiopathic osteosclerosis (IO) refers to localized non-expansible radiopacity of unknown etiology which cannot be accredited to any inflammatory, neoplastic, dysplastic or systemic disorder. (Marques-Silva *et al*, 2007; Jindal PG and Jindal V, 2012; Misirlioglu *et al*, 2013; Clinical Image, 2004; Miloglu *et al,* 2009; Kaka, 2011). IO is perpetually asymptomatic, not associated with cortical expansion and is typically detected during a routine radiographic examination. (Miloglu *et al,* 2009; Kaka, 2011; Verzak *et al*, 2012). Variety of names have been used to describe such lesions, including dense bone island, bone whorl, bone eburnation, bone scar, enostosis and focal periapical osteopetrosis. This entity is not limited to the jaws but can be found in many other bones, mostly the pelvis and long bones. (Jindal PG and Jindal V, 2012; Misirlioglu *et al*, 2013; Miloglu *et al,* 2009; Verzak *et al*, 2012; Williams and Brooks, 1998; Araki *et al* 2011; Park, 1983; Nakano *et al*, 2002; MacDonald Jankowski, 1999). These lesions might represent developmental intraosseous anatomic variation, similar to tori. (Clinical Image, 2004;

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Verzak *et al*, 2012) It is believed that enostosis is a counterpart of exostoses that occur in the inner surface of the cortical plates within the cancellous bone. It represents a focus of mature compact (cortical) bone within the cancellous bone (spongiosa). (Manish and Ravikiran, 2013; Stuart and Michael, 2011)

Radiopaque lesions in periapical area, associated with low grade inflammatory stimulus, are called focal chronic sclerosing osteomyelitis or condensing osteitis which are characterized by growth of the periodical bone. (Altun *et al*, 2014; Holly *et al* 2009) It develops as a result of inflamed pulp in chronic pulpitis or microorganisms from either necrotic pulp or from inappropriately treated root canals, in individuals with a high level of tissue resistance, inducing bone deposition. (Miloglu *et al,* 2009; Verzak *et al*, 2012; Williams and Brooks, 1998; Nakano *et al*, 2002) However, the accurate etiology is not identified and it is thought to be due to increase in osteoblastic activity. (Miloglu *et al,* 2009; Verzak *et al*, 2012; Williams and Brooks, 1998; Nakano *et al*, 2002)

These two entities may often be confused with each other and with other radiopacities like odontoma, foreign body, sialolith, hypercementosis, cementoblastoma etc. (Verzak *et al*, 2012; Misirlioglu *et al*, 2013) They may cause alarm to the patient till a definitive diagnosis is arrived at.

The aim of this study was to determine the prevalence and distribution of condensing osteitis (CO) and idiopathic osteosclerosis (IO) in Bhopal population. The objectives included establishing the age and gender distribution of these lesions and to determine jaw predilection and tooth and region with a greater propensity for their occurrence.

## MATERIALS & METHODS

A total of 1217 panoramic tomographs were analysed for 13 months in Department of Oral Medicine and Radiology and their related clinical & demographic data were extracted from the records. All the radiographs were captured using a digital orthopantomography device (Kodak 8000 C digital panoramic & cephalometric system, 73 kVp, 12 mA, 13.9 sec exposure time). Radiographic interpretation was jointly carried out by the two examiners, to reduce variability.

Dental status was assessed & recorded as intact, deep caries, large restoration, treated root canal, periodontal disease and crowns. The exclusion criteria were as follows (Miloglu *et al,* 2009; Kaka, 2011; Williams and Brooks, 1998; Altun *et al*, 2014):

- Incomplete records and Faulty radiographs.
- Mixed radiopaque-radiolucent lesions
- Teeth which showed marked malposition or those serving as abutment for fixed or removable prosthesis.
- Fragments of deciduous or permanent teeth.
- Radiographs showing tori or exostoses or soft tissue calcifications.
- Solitary radiopacities seen in edentulous regions.
- Patients with Gardner's syndrome, familial polyposis of the colon, and bone metabolic disturbance.

Well defined radiopacities with distinct boundaries, not in proximity to any tooth was considered as IO lesion.

Radioopaque lesions with well or ill-defined borders surrounding the apex of teeth with deep caries or endodontically treated teeth or large restorations or had bone loss as seen in periodontitis, were considered to be CO.

In patients identified as IO or CO, the shape, localization, and dental relationships of the lesions were also recorded.

The size of the lesion was determined by measuring the largest diameter on the digital panoramic radiograph by a using KODAK dental imaging software. According to their size, lesions were classified as 1 - 5 mm, 6 - 10 mm, 11 - 20 mm. The location of the lesion was specified firstly as mandibular or maxillary, then further region wise in the jaw: incisive, canine, premolar, molar region. The shape of the lesions was described as round, elliptical or irregular. The side of the jaw as right or left was recorded. The relationship to teeth was defined:

1. Apical if the masses were predominately located around the root apices.
2. Separate if the radiopacities were apical to and clearly separated from the teeth and lamina dura.
3. Interradicular if the sclerotic tissue was limited to the area between the roots and
4. Apical and interradicular if the radiopacities were located at the apices and exhibited significant extension between the roots;

The above criteria was specified by Geist and Katz. (Geist and Katz, 1990; Sisman *et al,* 2011; Langlais *et al*, 1995)

The data were analysed using the SPSS 11.5; Chicago, IL, USA Program. The $\chi 2$-test was used to determine the potential differences in the distribution of radiopaque lesions. A " p" value of $<0.05$ was considered statistically significant.

**Table 1** Patients with idiopathic osteosclerosis lesion and selected covariates: sample size and frequency.

| | | n | Patients with IO lesions | % | $X^2$ | P value |
|---|---|---|---|---|---|---|
| Age groups | 5-19 years | 487 | 7 | 1.43 | 57.02 | 0.000 |
| | 20-39 years | 391 | 52 | 13.2 | | |
| | 40-69 years | 339 | 14 | 4.12 | | |
| Gender | Female | 558 | 48 | 8.60 | 11.47 | 0.0007 |
| | Male | 659 | 26 | 3.94 | | |

**Table 2** Patients with condensing osteitis lesions and selected covariates: sample size and frequency.

| | | n | Patients with CO lesions | % | $X^2$ | P value |
|---|---|---|---|---|---|---|
| Age groups | 5-19 years | 487 | 2 | 0.41 | 27.069 | 0.000 |
| | 20-39 years | 391 | 27 | 6.90 | | |
| | 40-69 years | 339 | 16 | 4.71 | | |
| Gender | Female | 558 | 25 | 4.48 | 2.211 | 0.136 |
| | Male | 659 | 19 | 2.88 | | |

**Table 3** Distribution of condensing osteitis and idiopathic osteosclerosis lesions according to tooth status.

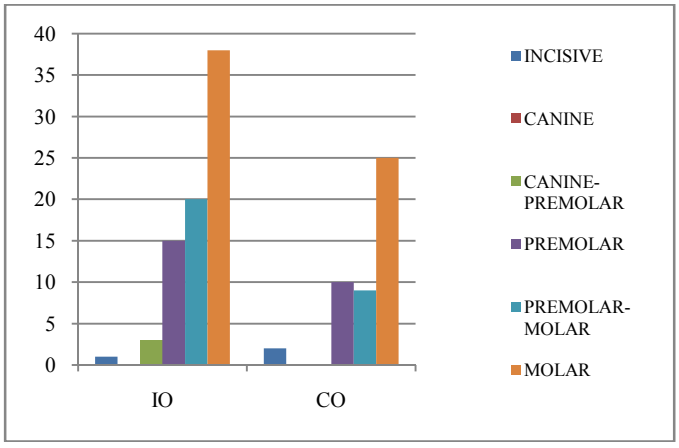
| Dental status | IO lesions | % | CO lesions | % | $X^2$ | P value |
|---|---|---|---|---|---|---|
| Intact | 77 | 100 | 0 | 0 | | |
| Deep caries | 0 | 0 | 19 | 41.3 | | |
| Large restorations | 0 | 0 | 9 | 19.6 | | |
| Treated root canal | 0 | 0 | 16 | 34.7 | | |
| Crowned | 0 | 0 | 0 | 0 | 123 | 0.000 |
| Periodontal disease | 0 | 0 | 2 | 4.34 | | |

**Table 4** The distributions of idiopathic osteosclerosis and condensing osteitis lesions with respect to shape, localization, and dental relationship.

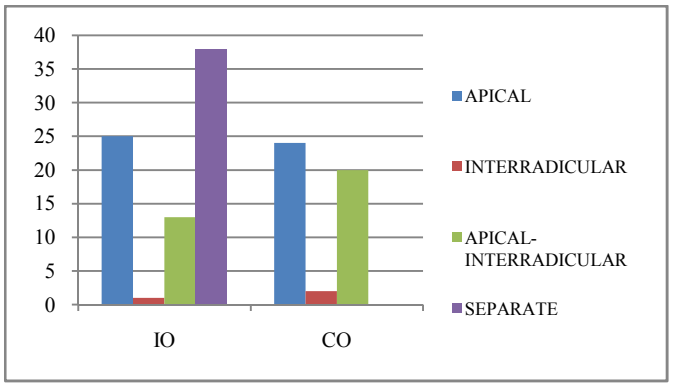
| | | IO lesions | % | CO lesions | % | $X^2$ | P value |
|---|---|---|---|---|---|---|---|
| Localization of lesions | Maxilla | 2 | 2.6 | 5 | 10.9 | 3.671 | .055 |
| | Mandible | 75 | 97.4 | 41 | 89.1 | | |
| Side of Jaw | Right | 48 | 62.3 | 26 | 56.5 | 0.406 | 0.524 |
| | Left | 29 | 37.7 | 20 | 43.5 | | |
| Regional localization of lesions | Incisive | 1 | 1.3 | 2 | 4.7 | 3.604 | .462 |
| | Canine | 18 | 23.4 | 10 | 21.7 | | |
| | Premolar | 20 | 26 | 9 | 19.6 | | |
| | Molar | 38 | 49.4 | 25 | 54.3 | | |
| The relationship of teeth to lesions | Apical | 25 | 32.4 | 24 | 52.2 | 27.151 | 0.000 |
| | Interradicular | 1 | 1.3 | 2 | 4.3 | | |
| | Apical-Interradicular | 13 | 39.4 | 20 | 60.6 | | |
| | Separate | 38 | 49.3 | 0 | 0 | | |
| Shape of lesions | Round | 29 | 37.7 | 3 | 6.5 | 18.029 | 0.000 |
| | Elliptical | 6 | 7.8 | 1 | 2.2 | | |
| | Irregular | 42 | 54.5 | 42 | 91.3 | | |
| Size of lesions | 1-5 mm | 12 | 15.6 | 14 | 30.4 | 4.04 | 0.13 |
| | 6-10 mm | 31 | 40.3 | 17 | 37 | | |
| | 11-20 mm | 34 | 44.1 | 15 | 31.3 | | |

## RESULTS

### *Regional Localization of the Lesions*




**Graph 1** Regional Localization of The Lesions




**Graph 2** The Relationship Of Teeth To Lesions

This study was performed on panoramic radiographs of 1217 patients (558 female, 659 male), aged 5 - 69 years (mean: 33.4). There were 123 radiopacities identified; 77 IO lesions in 74 subjects (6.08 %) and 46 CO lesions in 44 subjects (3.61 %).

Of the subjects with multiple lesions, 3 radiographs had 2 lesions of IO, 2 radiographs had 2 CO lesions. None of the radiographs had both IO and CO lesions concurrently. Both these lesions were found to be higher in females. However, this difference was statistically significant only for IO lesions ($p<0.001$). The number of IO & CO were found to be significantly higher between the age group of 20-39 years old patients. ($p<0.01$) (Table 1 and 2).

The dental status of the IO lesions was intact for all the cases. In the CO lesions, 19 were associated with deep caries, 16 in treated root canal, 9 lesions in large restorations, 2 lesions in periodontal disease; no lesion in crowned tooth. (Table 3).

With regard to the shape of the lesions, the irregular shape appeared to be most common in IO (54.5 %) & CO (91.3 %) as compared to elliptical in IO (7.8 %) & CO (2.2 %) while round (37.7 %) in IO, (6.5 %) in CO. Here, ($p<0.05$) was highly significant for both.

The size of lesions varied from 1 to 20 mm. For IO lesions, the size was 1 - 5 mm in 15.6 %, 6 - 10 mm in 40.3 % and 11 - 20 mm in 44.1 %, whereas for CO lesions, the size ranged between 1 - 5 mm in 30.4 %, 6 - 10 mm in 37 % and 11-20 mm in 31.3 %. The results were statistically non-significant.

About 89.4% of the CO lesions and 98.9% of the IO lesions were located in the mandible ($p<0.05$) & only 10.9% and 2.6% respectively were found in the maxilla. Both entities showed higher rate of involvement in the molar region.

With regard to relationship to teeth, it was found that the CO lesions were greater in apical region (52.2 %) and IO lesions were more frequent as a separate (49.3 %) lesion. Both of the lesions were more common on the right side of the jaw. (Table 4).


**Figure 1** Condensing Osteitis with respect to 46. Deep occlusal caries noted.


**Figure 2** Idiopathic Osteosclerosis with respect to 35 noted.

## DISCUSSION

Disorders may vary in their presentations in different populations primarily due to ethnic variations, anthropometrics and environmental factors. The various types of radiopacities in jaws, too, may show variations in their presentations in people groups.

In our study, which comprised of 118 radiographs, 9.69 % revealed radiopacities conforming to the diagnosis of either CO or IO. Verzak *et al* reported 8.17% prevalence in his study, while Avramidou *et al* stated 1.96% in his report.

The frequency of IO in this study was 6.08 % which is comparable to Sisman *et al* & Yonetsu *et al* at 6.1 % while Halse A and Molven O reported a frequency of 7.6% and MacDonald-Jankowski DS reported the prevalence varying from 2.7 - 6.7 %.

In our study, multiple radiopacities were found in 3 individuals, with 2 lesions of IO, 2 individuals with 2 CO lesions each; no patient had both IO and CO lesions concurrently. Williams and Brooks reported multiple lesions in subjects where they found 9 individuals had 2 lesions of IO, 13 had 2 of CO, 1 had 3 of CO, and 6 had both a CO and an IO.

The present study found IO to be more prevalent among women (8.6 %) than men (3.9 %) which is similar to some reports. (Miloglu *et al,* 2009; MacDonald-Jankowski, 1999; Manish and Ravikiran, 2013; Avramidou *et al*, 2008). This differed from other studies (William and Brook, 1998; Yonetsu *et al*, 1997; Austin and Moule, 1984; Norman *et al*, 2013; Farman *et al*, 1978) where no gender predilection was seen.

Age-wise distribution showed maximum in 20-39 years age group which was similar to Miloglu *et al,* 2009; Kaka *et al, 2011*. A possible explanation for higher incidence of IO lesions in this age might be because of maximum bone mass acquisition. Some studies showed no significant difference in prevalence of IO among age groups. (Sisman *et al* 2011, Avramidou *et al* 2008; Farman *et al,* 1978)

All studies including ours, unanimously agreed that the prevalence of IO and CO lesions were higher in mandible than maxilla. (Miloglu *et al,* 2009; Kaka, 2011; Avramidou *et al* 2008) Hypothesis like superimposition of anatomic structures in the maxilla in Panoramic radiographs, increased blood supply near the foramen leading to formation of masses and mandibular premolar region experiencing inner distortion have been put forth to try to explain the preponderance of these in the mandible.

The results of this study support the previous findings, which indicated the most common location of IO in the molar region of the mandible (Verzak *et al*, 2012; Macdonald-Jankowski, 1999; Sisman *et al* 2011; Avramidou *et al*, 2008; Yonetsu *et al*, 1997; Kawai *et al*, 1992; Eversole *et al*, 1984), albeit some studies (Miloglu *et al,* 2009; Kaka, 2011; Wood and Goaz, 1983) reported the highest occurrence in the premolar region. Disharmony in occlusion may precipitate this hard tissue formation; increased vascularity in the mental foramen region probably precipitate increase bone formation.

Condensing osteitis was identified in 3.61 % of cases in our study while other studies reported the prevalence of CO lesions ranging from 0.81 % to 8 %. (Wood and Goaz, 1983; Miloglu *et al,* 2009; Verzak *et al*, 2012; William and Brooks, 1998; Altun *et al*, 2014; Marmary and Y.G., 1986; Eliasson S *et al*, 1984)

There was no significant gender difference in the incidence of CO; this finding agreed with some studies. (Miloglu *et al,* 2009; Verzak *et al*, 2012; William and Brooks, 1998; Altun *et al*, 2014) However, some studies (Kaka, 2011; Avramidou *et al* 2008; Marmary and Y.G., 1986) detected CO lesions in female more than males.

Age-wise distribution of CO lesions showed maximum in 20-39 years age group which was similar to (Miloglu *et al*, 2009; Kaka *et al*, 2011) may be because of increased risk of caries and pulpal infection with increasing age.

CO lesions were associated with pulpally involved carious teeth (41.3 %), treated root canal (34.7 %), large restorations (19.6 %) & periodontal disease (4.3 %) which was similar to some studies. (Avramidou *et al* 2008; Altun *et al*, 2014; Verzak *et al*, 2012) reported treated root canal involved teeth to be most commonly involved.

IO lesions were completely intact, which suggests that they may be developmental variations of normal bone architecture not related to a local stimulant. (Misirlioglu *et al,* 2013; Verzak et al, 2012; William and Brooks, 1998; Yonetsu *et al*, 1997; Halse and Molven, 2002)

Molar region is the site of predominance for CO lesions according to our study and some others. (Wood and Goaz, 1983; Kaka *et al*, 2011; Park, 1983; Altun *et al*, 2014; Geist and Katz, 1990; Langlais *et al*, 1995; Eliasson *et al*, 1984). Avramidou *et al*[22], William & brook[10] however reported premolar region as the predominant site. Occlusal stress, high incidence of caries and infection of the pulp are usually in the molars; this probably accounts for the presence of this reactive lesion

While the present study showed a predominance of irregular shape in the IO lesions which was similar to the findings in certain studies. (Misirlioglu *et al,* 2013; Williams and Brooks; 1998) others showed a predominance of round pattern. (Miloglu *et al*, 2009; Park T, 1983; Langlais *et al,* 1995)

The present study showed a predominance of the size range between 11-20 mm which is similar is in agreement with some authors. (Wood and Goaz, 1983; Altun *et al*, 2014; Geist and Katz, 1990; Langlais *et al,* 1995; Eliasson *et al*, 1984) Most authors reported variation in size from 1-20 mm including our study; some reported less than 10 mm in theirs. (Misirlioglu *et al,* 2013; Verzak *et al*, 2012; Park T, 1983; Kawai *et al*, 1992)

In this study, IO lesions were more prevalent as separate lesions i.e. located in the bone which was comparable to some studies. (Miloglu *et al*, 2009; Kaka *et al*, 2011) Others reported that IO lesions were more prevalent in periapical region. (Misirlioglu *et al,* 2013; Araki *et al*, 2011; Park TW, 1983) while William and Brook, 1998 reported preponderance in interradicular regions.

While, Miloglu *et al*, 2009 reported round shape in CO lesions to be more prevalent, other studies (William and Brook, 1998; Altun *et al*, 2014; Holly *et al*, 2009) inclusive of ours showed irregular shape to be predominant.

The current study reported majority of CO lesions in between 6-10 mm size range which was similar to the study by Verzak et al, 2012; Park TW, 1983 reported variation in size between 11-20 mm.

Most studies (Miloglu *et al*, 2009; Kaka *et al*, 2011; Altun *et al*, 2014) showed CO located in apical region including the present study while William & Brook, 1998 observed 42 % in interradicular region.

## CONCLUSION

Radiopacities in the jaws have varied causes; some require intervention while some need only periodic follow up. Sound knowledge of these aid in taking the right steps towards suitable management. Ethnic variations have been recorded in these lesions as have been seen with other pathologies; maintaining such data bases may prove helpful in systematic reviews. The world of imaging has been revolutionized with advancing modalities like CBCT. While panoramic radiography are instrumental and an economical modality to detect such lesions CBCT supercedes the former in producing a 3-D image. Similar prevalence studies of the jaw lesions can be more effectively undertaken which could be more sensitive and specific.

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