

## Original Article

# Forensic Odontology: Supernumerary Teeth, their Importance, and a Radiographic Study in Identifying Supernumerary Teeth

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## INTRODUCTION

Supernumerary teeth (ST) are defined as any teeth or odontogenic structure that is formed from a teeth germ in excess to the usual number in the dental arch.<sup>[1]</sup> ST may be single, multiple, unilateral, or bilateral in distribution.<sup>[2]</sup> The prevalence of ST varies between 0.1% and 3.8% and is more common in the permanent dentition.<sup>[3,4]</sup> Various theories have been put forward to describe the etiology of ST such as phylogenic theory, dichotomy theory, hyperactive theory, and genetic theory.<sup>[5,6]</sup> According to their morphology, ST are classified as dysmorphic or rudimentary (conical, tuberculate, molariform), eumorphic or supplementary.<sup>[7]</sup> Based on location, ST are classified as mesiodens, paramolar, parapremolar, and distomolar.<sup>[8]</sup> ST are associated with numerous problems such as failure of eruption, displacement of permanent teeth, crowding and cyst formation, and root resorption.<sup>[9-11]</sup> In many clinical situations, they remain asymptomatic and will be detected during routine radiographic examination.<sup>[12]</sup> Once an ST is detected, its presence is documented in the dental records. ST are a unique entity such that its position, in relation to surrounding structures, is unique to a particular individual and becomes an important identification point in forensic odontology as it is always documented and can be compared with previous radiographs. There are numerous case reports which state the importance of identification of an individual based on the dental records such as radiographs, case sheets, study models, and ST.<sup>[13]</sup> Detection and localization of ST

## ABSTRACT

**Aim:** The aim of this study was to evaluate the sensitivity and specificity of panoramic radiographs (PRs) in identifying supernumerary teeth (ST) which can be useful to identify the individual in case the ST are impacted which cannot be seen clinically.

**Materials and Methods:** The study analyzed the specificity and sensitivity of PR in identifying ST among the 180 dental undergraduate students in a University Dental College, India. The protocol was approved by the Institutional Review Board of Saveetha Dental College, India. Positive predictive values (PPVs) and negative predictive values (NPVs) were calculated and analyzed.

**Results and Conclusions:** The overall (all examiners) sensitivity and specificity figures for identifying patients with ST were 88.5% and 94.2%, respectively [Table 1]. The overall PPV for this study was 93.5% and the NPV was 89.6%. The sensitivity and specificity figures for students who have completed internship were 88.8% and 95%, respectively. The sensitivity and specificity for students who are currently doing internship were 87.9% and 93%, respectively.

**KEY WORDS:** Forensic odontology, identification, panoramic radiographs, supernumerary teeth

from radiograph are an important diagnostic adjunct to clinical assessment and identification of an individual.

The commonly taken radiographs for the detection of ST are intraoral periapical radiograph (IOPA), occlusal radiograph, panoramic radiograph (PR), lateral cephalogram, and the recently introduced cone beam computed tomography. Usually, an IOPA is taken when pathology is suspected, but it covers only a region of 3–4 teeth. In the same way, occlusal radiograph is taken only when a lesion is suspected and it covers only any one of the two dental arches. A PR provides the clinician with a comprehensive view of the entire maxilla-mandibular region, producing an image of both dental arches on a single film while limiting the amount of radiation exposure to the patient.<sup>[14]</sup> PRs provide an ideal platform in analyzing the stages of eruption of particular teeth, developing teeth germ, and other abnormalities in the maxilla and the mandible.<sup>[2]</sup>

PRs are the easiest radiographs that can be taken in case of handling the human or skull remains. Although the PR has many advantages such as increased coverage area and reduced radiation exposure, their major limitation is that the areas lying outside the machine's focal trough are blurred, magnified, or

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even distorted at times.<sup>[2]</sup> Few studies have shown that PRs have missed ST and impacted teeth because of the narrow focal trough.<sup>[14-17]</sup> There are many studies on use of PR in identifying ST; however, in most of these studies, there are no reported values on the specificity and sensitivity for identifying ST. There are no studies done among dental graduates in India, regarding the reliability of PR in identifying the presence of ST. There is a need for a study which evaluated the usefulness of PR in identifying the individual based on the presence of ST. As a first stage of this research area, the objectives of this study is divided into two. First to evaluate the sensitivity and specificity of PR in identifying ST which can be useful to identify an individual, secondly the study is done among the undergraduates to find out how well they are trained to identify ST in OPG

## MATERIALS AND METHODS

### STUDY DESIGN AND ETHICAL APPROVAL

The study analyzed the specificity and sensitivity of PR in identifying ST among the dental undergraduate students in a University dental college, India. The protocol was approved by the Institutional Review Board of Saveetha Dental College, India.

### SAMPLING AND SAMPLE SIZE

All the undergraduate dental students who were present at the day of study were considered for the study. With the adjusted 80% power and 5% alpha error, the sample size was calculated to be 180 for identifying the sensitivity and specificity of PR to identify ST.

### SURVEY PROCEDURE

The PRs were taken with Sirona Orthophos XG 3G machines with kvp 60–90. The selection of PR was based on the inclusion criteria of students with full clinical and radiographic records having the presence or absence of ST. Qualified experts in oral and maxillofacial radiology carried out the selection process. Poor quality radiographs were excluded from the study. The radiology experts chose 40 PRs with the presence of ST and 40 with the absence of ST. The radiologists prepared the reference answer to confirm the presence or absence of ST, which was then used for evaluation. The digital copies of 80 PRs were made anonymous by obscuring the details of the patient and they were randomly arranged in a power point presentation (MS office 2004) in no specific order comprising the 80 slides. This power point was converted into a pdf document to be viewed on an iPad 3<sup>rd</sup> generation to standardize the viewing condition. The viewing conditions and lighting were standardized for each student. The students are not allowed to magnify or change the contrast to maintain a uniform viewing situation.

In this study, 180 examiners (85 recent undergraduate students who had completed their basic dental training and 95 students who were doing their internship in the same institution) were asked individually to examine each slide and were asked to assess the presence or absence of ST and record them in an evaluation sheet. After the evaluation of PRs by the examiners,

the evaluation sheets were collected and assessed. Sensitivity and specificity for identifying the presence or absence of the ST was then calculated.

## RESULTS

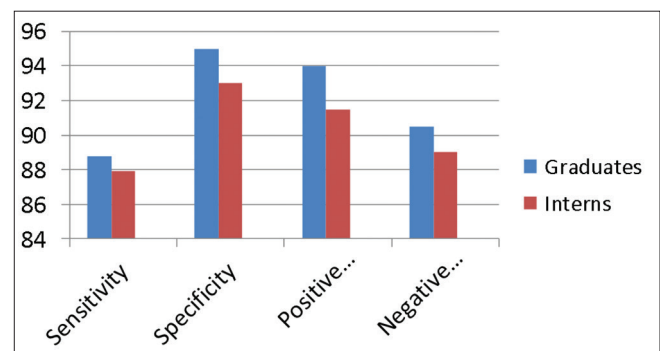
The overall (all examiners) sensitivity and specificity figures for identifying patients with ST were 88.5% and 94.2%, respectively [Table 1]. The overall positive predictive value (PPV) for this study was 93.5% and the negative predictive value (NPV) was 89.6% [Figure 1]. The sensitivity and specificity figures for students who have completed internship were 88.8% and 95%, respectively. The sensitivity and specificity for students who are currently doing internship were 87.9% and 93%, respectively [Table 2].

## DISCUSSION

Comprehensive radiographic examination is crucial in diagnosing impacted ST. PRs are non-invasive and cover the entire dentomaxillofacial region in a single film thereby making it an acceptable method for screening patients with suspected pathology.<sup>[2]</sup> A ST in case is impacted may not be seen in clinically but can be identified using a radiograph. Such a ST provided a unique identification point for the individual as the position, relation, orientation of a ST is unique to a particular individual.

The position of the ST can be in any region of the dental arch, there are also case reports in literature where supernumerary tooth is diagnosed in maxillary sinus, nasal cavities, orbit, incisive sutures, soft palate, ophthalmic shell, maxillary tuberosity, sphenomaxillary suture, and between the orbit and brain.<sup>[18]</sup> Most of the time, a patient who has ST would approach a dentist for their treatment and thus creating a dental record. In diagnosing these complex locations, the PRs seem to be a suitable radiographic method in accurately identifying ST. Once a radiograph for the ST is taken, it is always documented in the dental records of the patient.

A radiographic test is considered superior if it displays high specificity and sensitivity values. Sensitivity is the ability of the test to correctly identify a person as having the particular disease, i.e., the measure of true positives. As an ST is a unique identification characteristic in an individual and a PR is a radiograph that can be easily taken while handling



**Figure 1:** Sensitivity, specificity, positive predictive value, and negative predictive value for graduates and interns

**Table 1: Overall (all examiners) sensitivity, specificity, positive predictive value and negative predictive values**

	Sensitivity (%)	Specificity (%)	Positive predictive value (%)	Negative predictive value (%)
Over all values	88.5	94.2	93.5	89.6

**Table 2: Comparison of sensitivity, specificity, positive predictive value and negative predictive value among graduates and interns**

	Sensitivity (%)	Specificity (%)	Positive predictive value (%)	Negative predictive value (%)
Graduates	88.8	95	94	90.5
Interns	87.9	93	91.5	89

the remains/skull in forensic odontology, studies are needed to find out if PR can be used effectively for identifying a person based on ST. In the present study, sensitivity refers to the ability of the PR to correctly classify patients as having ST and this value was found to be 88.5%. Specificity is the ability of the test to correctly identify the person as being disease-free, i.e. a measure of true negatives. In our study, specificity refers to the ability of the PR to correctly classify patients as not having ST and this value was found to be 94.2%. These values of sensitivity and specificity suggest that PRs have an acceptable efficiency in identifying ST. Sensitivity and specificity are values that are taken into account when choosing a test. Once the results of the tests are available, the reliability of the results is determined by the predictive value.<sup>[19]</sup> A PPV is the probability of the disease being present in a patient with a positive test, i.e., the probability of the patient having ST when ST are identified on the PR. In our study, an overall PPV of 93.5% was obtained. A NPV, on the other hand, is the probability of not having the disease in a patient with a negative test, i.e., the probability of the patient not having ST when the results of PR show no evidence of ST.

In our study, the overall NPV of the test was found to be 89.6%. A similar study by Anthonappa *et al.* showed varied results with regard to sensitivity (50%) but similar results with regard to specificity (97.2%) and predictive values (PPV = 90.6% and NPV = 83.6%). The low sensitivity values in their study were attributed to the level of dental training and the fact that junior staff tends to perform the initial screening of PRs in large hospitals which increase the chances of missing ST.<sup>[2]</sup> The accurate identification of ST, therefore, involves not only a reliable diagnostic test but also an experienced clinician who is able to interpret the diagnostic test accurately. In our study, we also compared the values obtained by recent graduates and interns of the same institution. Recent graduates were found to have a slightly higher (88.8%) sensitivity value when compared to interns (87.9%) and the specificity values obtained were also higher (95%) for the graduate group when compared to interns (93%). These high values indicate that proper level of dental training and experience helps in the more accurate identification of ST by PRs. The reason for higher sensitivity may be that the students are prompted to identify the presence of ST.

## CONCLUSION

PRs are an acceptable radiographic method of identifying ST. Interpreting PRs need adequate clinical experience and thus more importance should be given to understanding and interpreting PRs in the undergraduate dental curriculum. Further studies are needed which evaluate the identification of an individual with ST so that a protocol can be made to examine all forensic odontology case with PR.

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## CONFLICTS OF INTEREST

There are no conflicts of interest.

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