



ORIGINAL ARTICLE

Nasal Septum Patterns Through Panoramic Radiographs: A Forensic Study

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Abstract

Introduction: To evaluate patterns occurring in the nasal septum in the digital orthopantogram samples. In disasters such as natural disasters, accidents like fire or road traffic accidents, where the human body becomes severely destroyed or damaged, human skull radiography becomes a useful tool for identification of the human remains. Here, the study is done using a digital radiograph, which can be used to identify the human skull by determining the pattern of nasal septum.

Materials and Methods: This study was conducted to investigate the uniqueness of various nasal patterns on Orthopantograms for determining the gender and personal identification. A total of 200 OPGs were selected and nasal septum patterns were evaluated. The radiographs were taken from Carestream CS8100 Orthopantogram-Xray machine and Carestream software. The OPGs were then traced was done through adobe acrobat software application to evaluate various patterns of the nasal septum.

Result: Straight nasal septum was observed in 160 subjects, Nasal septum pattern with left deviation was found in 18 subjects, right deviated Nasal septum pattern was showed with 13 subjects. The total distribution of gender was 101 males (50.5%) and 99 females (49.5%). Straight Nasal septum deviation was recorded maximum in both the genders followed by left Nasal septum deviation.

Conclusion: It was concluded that nasal septum deviations are an important consideration in forensic investigations.

Aim: To evaluate the patterns occurring in the nasal septum in the digital orthopantogram (OPG) samples.

Objectives

- To study and determine the various patterns of the nasal septum.
- To classify the various patterns and deviations of nasal septum through digital OPG.
- To investigate its role in forensics.

Keywords: Nasal Septum, Digital Radiograph, Forensic Identification, Forensic Study.

Introduction

During any disaster, criminal case or when human body is degraded and there is no access to genetic analysis, fingerprint etc, the identification of the remains can be done by forensic radiology as it plays a major role in personal identification as well as determination of the gender^[1]. Anatomy in human skull like nasal septum, frontal sinus, etc, can act benchmark

because of their idiosyncrasy in every single person. The nasal septum is a two millimetres thick cartilage that separates left and right nasal tracks. It is made up of cartilage, fibro-fatty tissue and bone. The divergence of the nasal septum from its midline is called as deviated nasal septum (DNS). It can be inherited as well as can also arise because of accidental trauma to nose, nasal injury in intra-uterine life or during parturition^[2]. There are no symptoms of DNS in major number of patients suffering with the same. Although some patients may exhibit symptoms like obstruction of nose, difficulty in breathing, sinusitis, nose bleeding, snoring, sleep disturbances, facial pain, postnasal drip, headache, and male infertility^[3,4]. In more than 80% of the general population, there is presence of DNS with variations in different types, ^[5]. DNS is diagnosed by following a routine examination of the patient's nose and considering the symptoms of the patient. The diagnosis of DNS can be done by various radiological

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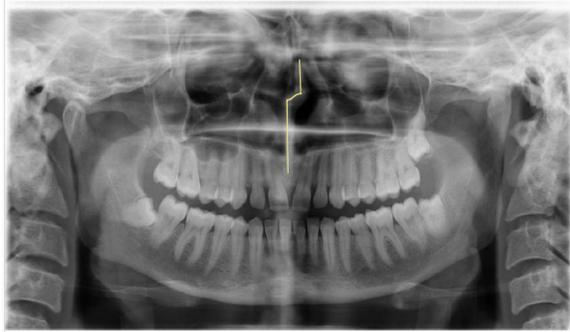


Figure 1: 19

aids such as paranasal sinus view (PNS), orthopantomogram (OPG), Computed Tomography (CT scan), and Cone-beam computed tomography (CBCT) [6-8].

Materials and Methods

This retrospective study involved a total of 200 OPG from the Carestream system (CS8100). Out of which 101 samples were of males and 99 were of females with the age group between 04-80 years included for this study. This study was evaluated under Adobe Acrobat software and marked with the nasal septum extending from the anterior nasal spine to nasal septum. The study uses an OPG as it shows an adequately sized normal nasal septum pattern with minimal irregularity on the radiograph. The dimension of nasal septum deviations as well as its patterns were recorded by tracing of radiographs for both the genders. The classification of deviation in nasal septum followed was: Right deviation (R'), Straight (S'), Left deviation (L'), Sigmoid (Si), Reverse sigmoid (Rsi) and others (O)^[9] (Figure 1). For both genders, the patterns were tabulated and characterised separately. The different patterns of nasal septum were evaluated. Images which were visibly clear and show all the anatomic landmarks were included for evaluation. Images that were all blurred, distorted, under exposed, over exposed were excluded from the sample.

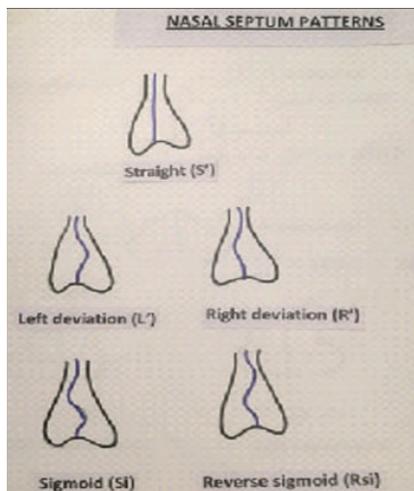


Figure 2: Traced OPG image

Table 1: Distribution of age and gender

Age (Mean ± SD)	(30.83 ± 17.498)
Gender n (%)	
Male	101 (50.5%)
Female	99 (49.5%)

Nasal septum evaluation

According to the deviation in the septa, the nasal septum pattern was traced from the radiographs as: Right deviation (R'), Straight (S'), Left deviation (L'), Sigmoid (Si), Reverse sigmoid (RSi) and Others (O). [Figure 2].

Statistical Analysis

The NSD pattern data, collected from all patients and both the genders, were exposed to statistical analysis in SPSS software.

Results

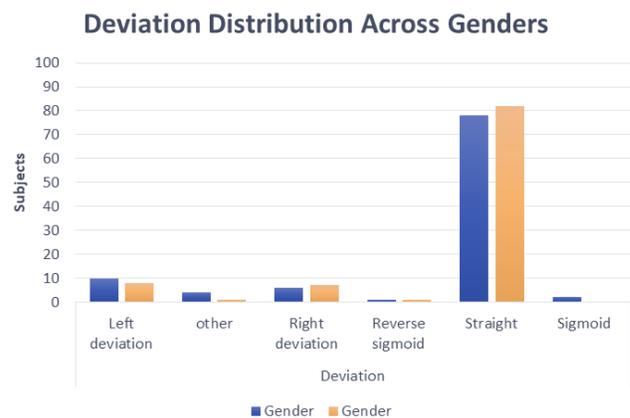
Out of 200 individuals, the gender distribution was 101 males (50.5%) and 99 females (49.5%). The mean age of the population is 30 years (Table 1).

Graph 1 indicates straight nasal septum is most common among females and males followed by left deviation then right deviation in population (graph 1).

Graph 2 shows the percentage distribution of nasal septum deviation patterns (graph 2).

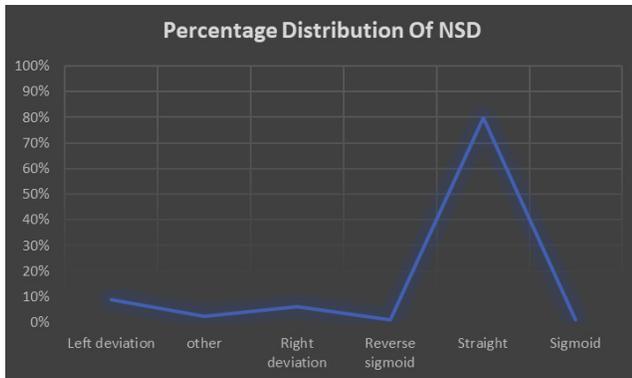
Discussion

Fingerprints, autopsies, and DNA typing have long been reliable methods for forensic identification. But due to degradation of soft tissues with time this has its own limitations^[1]. For forensic investigation hard tissues or body parts are normally resistant to putrefaction for years, they can serve as good alternate material. For identification either in human remains or in living person, radiographic evaluation of various skeletal structures including skull is a potentially useful procedure^[10]. The current study demonstrated that, from 200 samples of population, 160 had straight nasal



Graph 1: Deviation distribution across genders





Graph 2: Percentage distribution of NSD

septum, 18 had left deviated, 13 had right deviated, 02 had sigmoid and 02 had reverse sigmoid pattern of nasal septum. Other 5 sample were included traumatic nasal septum.

Nasal septum deviation is condition where the nasal septum, the wall between the two nostrils, is displaced to one side. In forensics, understanding and identifying nasal septum deviation can be crucial for several reasons. There are different kinds of radiographic aids which can be used to evaluate the DNS like CT, CBCT, PNS (paranasal sinus view), OPG (orthopantogram)^[6]. Verma K. et al (2017), performed a almost identical study but employing postero-anterior view radiographs and showed that the straight nasal pattern in females is more than males⁹. Taniguchi et al. 2003, reported observing asymmetry in the frontal sinus in 56.6% of cases and symmetry in 43.1%. This contrasts with our study, which found a higher prevalence of symmetry (77.5%) compared to asymmetry (22.5%)^[11].

Since nasal septum deviation can be a distinctive anatomical feature, it may help in matching remains to medical records or identifying a person through their unique physical characteristics. Secondly, nasal septum deviation can provide insights into past traumas or injuries. Deviations are often caused by trauma to the nose, which can occur from accidents, physical altercations, or other incidents. In forensic examinations, determining the cause and age of such a deviation can contribute to reconstructing the events leading to an individual's death or injury. This can be particularly significant in criminal investigations where establishing a timeline of injuries is necessary. In addition to trauma, nasal septum deviation can also result from congenital conditions. Identifying whether a deviation is congenital or acquired can provide information about the individual's medical history, which can be relevant in both criminal and civil forensic cases. Severe deviations can lead to chronic nasal congestion, sleep apnea, and other respiratory issues which can be relevant in cases where respiratory issues might have contributed to the individual's condition or circumstances leading to their death. Moreover, nasal septum deviation can affect the

accuracy of certain forensic techniques. For instance, in forensic odontology, where bite marks and dental records are used for identification, the alignment of teeth can be influenced by nasal structure. A deviated septum might lead to asymmetrical facial features, which could affect the interpretation of dental records and facial reconstructions.

Conclusion

- Nasal septum deviation is an important consideration in forensic investigations. It can assist in identifying individuals, understanding their medical history and trauma, and interpreting other forensic evidence accurately. Straight nasal septum pattern is most common type of nasal septum noted.
- Its relevance spans across various aspects of forensic science, from establishing identity to reconstructing events and understanding medical conditions that may have impacted the individual's life or death.
- OPG can be used to identify the nasal septum pattern in an individual. Forensic experts also consider the implications of nasal septum deviation on breathing and overall health. It can serve as a point of identification in cases where the identity of a body is in question.

Conflict of Interest

There is no conflict of interest.

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