Evaluation of impacted 3rd molars in Indian ethinicity on panoramic radiograph-a cross sectional study

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Abstract

Objective: The aim of present study is to know the association between types of impaction and jaws in males and females. This study also evaluates the prevalence of impaction according to age in maxilla and mandible.

Material and Methods: The orthopantomograms of 198 subjects were taken from Planmecca PM 2002 cc Proline Panoramic X-ray unit at Kvp (60-80), 10 mA at exposure time 18 second. The orthopantogram evaluated for type of impaction as per Winter's classification and related findings were recorded.

Results: The recorded data is analyzed by using Statistical Package for Social Sciences (SPSS) version 21.0. The maxillary right and left side is more predilected for vertical impaction in male and female population and it was statistically significant ($p<.05$). The mesioangular impaction is most common impaction in mandible and it was statistically non-significant ($p>.05$) in either gender. In all age groups, vertical impaction is most common type of impaction in maxilla however mesioangular impaction is most common type in mandible.

Conclusion: The vertical impaction is most common type of impaction in maxilla and mesioangular impaction is most common type in mandible in all age groups and gender.

Keywords: Panoramic Radiograph, Mandible, Impacted 3rd Molar.

Introduction

Tooth impaction is a common phenomenon.[1,2] The impacted teeth are those teeth which are unable to erupt or have delayed eruption. An impacted tooth is classified as erupted, partially erupted or unerupted and they do not have a normal arch relationship with the other teeth and tissues.[3] The common causes for third molar impaction is crowding, ectopic position of the tooth germ, supernumerary teeth and soft tissue or bony lesions.[3,4] Insufficient space is the commonest cause for the third molar impaction. An impacted tooth can result in caries, pericoronitis, pulp disease, periapical and periodontal disease, root resorption of the adjacent tooth and maxillofacialcysts and tumors.[5,6] Systemic factors such as genetic disorders, endocrine deficiencies and irradiation of the jaws are also causes for impaction.[7,8]

Winter's classification system is commonly considered for assessing the angle of impacted teeth which evaluates the angle formed between the intersected longitudinal axes of the second and third molars.[9] For explaining the prevalence and incidence of dental impaction, many theories have been put forward from time to time. Mendelian theory, phylogenic theory and orthodontic theory are among the most dominant and widely accepted theories among all. The concept of discrepancy between the size of the tooth and space available in the jaws due to size variation occurring in the jaws is the most frequently reason in all the major theories.[10]

Dietary habit has also influence on pre-velance of impacted molars which varies from one region to the other. Considerable variations has been reported in the prevalence and distribution of impacted teeth in different regions of the jaw.[11] The mandibular and maxillary third molar, maxillary canine, maxillary lateral incisor and mandibular premolars are the commonly impacted permanent teeth. Mandibular and maxillary third molars are the most frequently impacted teeth with slight predilection to the mandibular molars.[3,4] The third molars have a relatively high chance of becoming impacted.[12]

Many factors have been reported to be responsible for the high rate of impaction of mandibular third molars. These include insuficient space in the dental arch[13] unfavourable angulations and aberrant path of eruption, density of overlying soft and hard tissues and the late eruption sequence.[13] Mesiodistal diameter of the third molar may also play a role in the tendency for impactions. Svendsen and Maertens have reviewed in detail the etiology of third molar impactions. Two of the main causes for impaction was insufficient anterior-posterior dimension and late third molar mineralization and early physical maturation.[14] The impactions occurs in different angulations and positions and may occur in both jaws (maxilla and mandible). Identification of impactions can be done clinically and radiographically by orthopantomographs, lateral obliques and periapical radiographs. The radiograph of choice to assess third molar impactions is the orthopantomograph.[15] The

prevalence rates of mandibular third molar teeth varies from one population to another and many authors have reported prevalence rates ranging from 9.5% to 50% and higher in the western region.[16] The eruption timings of third molars are variable ranging from age 16 to 24 years.[17] The mean age for third molar eruption is 17years. The wide age range found with third molar eruption as well as positional changes that occur after eruption may be due to differences in race, nature of the diet, intensity of the use of the masticatory muscles and genetic factors.

Quek et al[18] concluded that mesio-angular impactions had the highest frequency followed by horizontal and vertical impactions. However in another study on Jordanian population, the mesioangular impaction was most common followed by vertical, distoangular and horizontal impactions.[19] Chu et al.[20] conducted a study on Hong Kong population and reported the classification according to angulation of the impacted wisdom teeth as: horizontal, mesioangular, vertical and distoangular impaction. They also concluded that horizontal type is most prevalent and distoangular type is least prevalent in Hong Kong population. Although removal of impacted teeth is the most common oral surgical procedure, many investigators have questioned the necessity of removal in patients who are free of symptoms or associated pathologies. Such comments are based on the view that long-term retention of impacted teeth has little risk of pathological change in the tooth itself or of adverse effects on adjacent structures.[11]

Materials and Methods

The orthopantomograms of 198 subjects were taken from Planmecca PM 2002 cc Proline Panoramic X-ray unit at Kvp (60-80), 10 mA at exposure time 18 second.

Materials

1. For Panoramic Radiography

A. 6 inches x 12 inches TMG (T mat green sensitive) Kodak films (Eastman Kodak, Rochester, New York).
B. 6 inches x 12 inches cassette, Siemens, Germany) with Kodak Lanex intensifying screens.
C. Planmecca PM 2002 cc Proline Panoramic X-ray unit (Helsinki , Finland) with provision for automatic exposure parameters with variable Kvp 0f 60-80 V, variable current of 7-10 mA (constant) and 18 second of exposure time (constant).
D. Lead Apron, lead markers
E. Occlusal disposable envelope
F. Sterile gloves
G. Bite blocks

2. For Preparation of Developer and Fixer Solutions

1. Developer powder (Premier Allied Photographic India Ltd., 940 queers, 9 lts)
2. Fixer powder (Premier Allied Photographic, IndiaLtd., 2410 queers, 9 litres)
3. Stainless steel buckets (15 litres capacity, 2 nos.)
4. Warm water
5. Two stainless steel rods for stirring the solution

3. For Processing of the Exposed Films

A well equipped, light proof darkroom with 3 safe lights, one at the working table (4 feet above the surface, GBX-2 filter), one near the master tank and one near the drier. Adequate ventilation, running water supply and processing tank made of stainless steel consisting of

a. A tank containing 9 litres of developer solution
b. A tank containing 9 litres of fixer solution
c. A master tank provided with circulated water supply
d. Thermometer
e. A manual type timer
f. White adhesive plaster
g. Film-hanger
h. sterile gloves
i. Scissors

4. For Radiographic Interpretation

a. Room with subdued ambient illumination
b. Radiograph viewer box
c. Magnifying lens
d. Processed radiographs

Methodolgy

1. Panoramic Radiography Technique

Loading of the panoramic x-ray film was done in the dark room at a distance of 4 feet from safe light illumination by holding the film in the corner. After the loading procedure the cassette was placed into the cassette holder of Planmecca PM 2002 cc Proline Panoramic X-ray unit. The subject was positioned properly in the panoramic machine set up so that the jaws were within the focal trough as per the methodology described by Langland, Langlais and Morris (1982). The subject was made to stand erect with back straight. The height was adjusted by pressing the adjustable knob. The subjects were explained about the working of the machine. The operation of the panoramic machine was demonstrated to the subjects and the subjects were appraised of the need to be still during the procedure. Jacket, sweater and bulky dress materials were removed so that there could be sufficient space between the bottom of the cassette holder and patients shoulder. The subject was made to wear a lead apron and was positioned carefully in the focal through with the help of bite block covered with occlusal disposable envelope and head holder of the machine so that the lower border of mandible was equidistant on each side from the chin support and perpendicular to the Frankfurt horizontal plane. Frankfurt horizontal plane was maintained parallel to the floor of the clinic. The patient's midsagittal plane was positioned in the center of the

focal trough of the x-ray unit by asking the patient to bite with his central incisors (upper and lower). The patient was asked to close the lip and place the tongue against the palate. Automatic exposure parameters were selected. After all the adjustments were made, appropriate Kvp (60-80) and 10 mA were selected and exposures were made at 18 second of exposure time by depressing the control switch of the panoramic machine.

2. Processing of Exposed Panoramic Films

All the films were processed manually in a well equipped light proof dark room as described by Goaz and White (1996).The developing and fixing solutions were prepared according to the manufacturer's instructions. A processing tank filled with fresh developer solution and another filled with fresh fixing solution were kept in the master tank. A thermometer was fitted so that the bulb of the thermometer was in the developing solution. The temperature of the solution was maintained at 72°F±0.5°F throughout the procedure. Under a safelight provided with a 15 watt bulb and adequate filtration which was being 4 feet above the working area, the cassette containing the exposed film was opened and the film was held securely to a 6" x 12" film hanger. Then the hanger containing the film was kept in the developing solution and the time was noted. After 4 minutes, the films were rinsed in running water for 20 seconds. Then the film with the hanger was placed in the fixer solution for 15 minutes as recommended by Goaz and White (1996). The films were then placed in running water for 20 minutes to remove residual processing solutions. After washing the films excess water was removed by shaking the films and hanger. The films were then dried. Likewise all exposed films were processed.

3. Interpretation of Radiographs

Interpretation of radiographs was done in a quiet room with subdued lighting. The panoramic filmwas properly oriented on the flat radiograph viewer box emitting even light and using cardboard sheets extraneous light form the edges of the radiographs was masked out and impaction of maxillary and mandibular 3rd molar is classified as Winter's classifications-

a. Horizontal impaction
b. Vertical Impaction
c. Mesio-angular Impaction
d. Disto-angular Impaction

All data is recorded and analysis has been done.

Results

Statistical Analysis: Categorical variables will be presented in number and percentage (%). Qualitative variables will be compared using Chi-Square test /Fisher's exact test. A p value of <0.05 will be considered statistically significant. The data will be entered in MS EXCEL spreadsheet and analysis will be done using Statistical Package for Social Sciences (SPSS) version 21.0.

The study population consists of 198 subjects from age range between 18 to 60 years. The mean ± SD of age was 29.11±7.396 years (Table 1). The study population was divided in 3 age groups. Majority of the study subjects were between 18 to 35 years of age (83.8%) followed by 36 to 50 years (14.6%) and 51 to 60 years (1.5%)(Table 2). Males were predominant (59.1 %) than females (40.9%) in study population (Table 3).

$\chi 2$ test (Chi-square test) is used to evaluate the significance of association between age groups and gender of study population. It was found that majority of the study subjects were between 18 to 35 years of age i.e. 80.3% Males and 88.9% females. There was no significant association between age groups and gender ($p>0.05$)(Table 4).The impaction of maxillary and mandibular 3rd molar is divided in 4 types(Winter's Classification), Horizontal impaction, Mesioangular impaction, Vertical impaction and Distoangular impaction. The association of type of impaction and side of jaw is evaluated in males and females. In maxillary right side, vertical impaction is most common in males (60.6%) and females (51.9%) population. It is statistically significant i.e. maxillary right side is more predilected for vertical impaction in male and female population ($p=0.009$).(Table 5) However in maxillary left side, vertical impaction is most common in males (65.9%) and females (51.9%) population and It is statistically significant ($p=0.031$)(Table 6). So it can be concluded that vertical type of maxillary 3rd molar impaction is most common in Maxilla. In Mandibular right side, the Mesioangular impaction is most common in 56.7% male and 52.4% female. There was no significant association between impaction in mandibular right side with male/female ($p=0.266$) (Table 7). However in Mandibular left side, Mesioangular impaction is most common in 43.3% male and 54.3% female. There was no significant association between mandible left side with with male/female ($p=0.699$).

The type of impaction in different age groups has been calculated by using $\chi 2$ test for significance. In maxillary right side, Vertical impaction(56.7%) was most common in all age groups followed by mesioangular impaction(23.3%), Distoangular impaction(16.7%), Horizontal impaction and it was statistically non-significant(P value=0.682)(Table 9). However in maxillary left side, vertical impaction (53.4%) was the most common type of impaction followed by mesioangular impaction(23.3%), distoangular impaction(20.5%), horizontal impaction (2.7%) and it was statistically insignificant (P value=0.114) (Table-10). In mandibular right side, mesioangular impaction (54.9%) is most common type of impaction followed by vertical impaction (22.5%), Horizontal impaction (18.6%), distoangular impaction (3.9%) in all age groups. It was statistically significant (P value=0.037*) i.e. mesioangular impaction is more common in mandibular right side (Table-11). In mandibular left side, the mesioangular impaction is most

common (47.8%) followed by horizontal impaction (25.7%), vertical impaction (18.6%), Distoangular (8.0%) in all age groups.(Table 12) and it was statistically non-significant(P value=0.066).

Fig. 1: Panoramic radiograph showing vertical impaction of mandibular 3rd Molars (bilaterally)

Fig. 2: Panoramic radiograph showing horizontal impaction of mandibular 3rd molars and disto-angular impaction of maxillary 3rd molars

Fig. 3: Panoramic radiograph showing distoangular impaction of maxillary 3rd molars

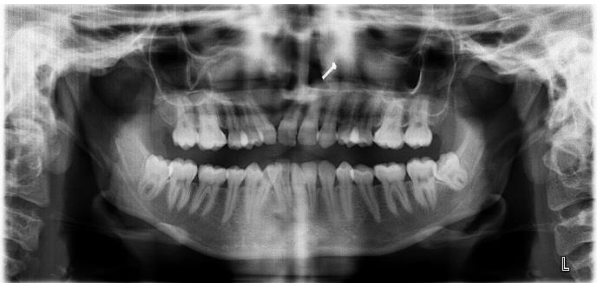

Fig. 4: Panoramic radiograph showing mesioangular impactions of mandibular 3rd molar bilaterally

Discussion

Impacted third molars are developmental pathologic medical deformities characteristic of a modern civilization. They account for 98% of all impacted teeth.[21] Removal of an impacted third molar is one of the most frequently performed dental surgeries in young adults. Because of the increasing incidence of impacted third molars and the association of numerous complications with these unerupted teeth, assessment of the third molar and prognosis of its eruption is necessary for better patient management. For the cause of impaction of one or more teeth, several mechanisms have been suggested: physical disruption of dental lamina, insufficient space and an inherent defect of the dental lamina or failure of induction of underlying mesenchyme. As racial variation, type of diet and degree of use of masticatory apparatus affect the jaw size and tooth size, the prevalence and incidence of impacted third molars have been studied on different population groups by various authors.[22] The third molar is the most frequently unerupted tooth with a frequency of occurrence generally reported to be from 18% to 32%.[23] It is considered impacted when its eruption into normal functional occlusion has been interfered with by other teeth, overlying bone, or soft tissue and it is not fully erupted by its expected age of approximately 20years.[24] The third molar was considered impacted when it was not fully erupted to the assumed normal functional position in the occlusal plane within the normal range of eruption time.

In many studies, the criteria used for eruption was the emergence of any portion of the crown through the oral mucosa. This may give misleading results because many of the mandibular third molars do not continue to erupt but remain impacted in a partially erupted position.[25] It is generally accepted that patterns of facial growth and jaw and tooth size are inherited and are likely to differ among different populations and races. Till date, very little information is available on the status of mandibular third molars in the Indian population.

Impacted third molars (average eruption age 17 to 21 years) rank first in the frequency of impacted teeth.[26] The published data till date have shown that impacted teeth can be associated with so many pathologic conditions such as pericoronitis, swelling, cheek ulceration,[27-29] caries lesions,[27,29-32] bone loss,[27,29,30] odontogenic cysts or tumors,[27,29,31] and resorption of the adjacent teeth.[27,29-31,33-38] External root resorption (ERR) of adjacent permanent teeth is believed to result from mechanical or inflammatory factors such as the force pressure of orthodontic appliances, dental trauma, cysts or tumors, chronic apical periodontitis, and poor regeneration of the periodontium in reimplanted or transplanted teeth.[39,40] Another factor frequently associated with external root resorption of adjacent second molars is the presence of a unerupted third molar in close proximity to the root of the second molar.[29,31,33,41] This type of root resorption has been

found at the site of contact with the impacted tooth which show that the pressure exerted by the impacted tooth participates in the resorption process.[34,38] Although this mechanism of resorption is not yet entirely clear, some investigators consider it similar to the mechanism involved in the resorption of deciduous teeth.[34,41] An inflammatory process (e.g., periodontal loss) can complicate the condition or even stimulate the reduced dental epithelium of the impacted tooth to secrete the inflammatory mediators involved in osteoclast recruitment and mineralized tissue resorption.[38,41] Experimental animal studies[42,43] and finite element analysis[44] have shown that the dental follicle is involved in bone resorption and formation of an eruption pathway. However the underlying mechanism of root resorption has not been clearly defined.[45]

According to Elsey and Rock[46] impaction of the third molar is occurring in up to 73% of young adults in Europe. Generally third molars have been found to erupt between the ages of 17 and 21 years[47,48] Furthermore third molar eruption time have been reported to vary within different population and races.[47,48,49] The mandibular third molars may erupt as early as 14 years of age in Nigerians[49] and up to the age of 26 years in Europeans.[50] The average age of the eruption of mandibular third molars in male is approximately 3 to 6 months ahead of females.[51] Many authors claim that the incidence of mandibular third molar impaction is higher in females.[50,52] Third molar eruption and continuous positional changes after eruption can be related not only with race but also with nature of the diet, the intensity of the use of the masticatory apparatus and possibly due to different genetic background.[53] Impaction of mandibular third molars is a common condition related with different difficulty degree of extraction operation and risk of different complications including iatrogenic trigeminal nerve injury.

The classification of impacted teeth allows dental surgeons to communicate better with one another and aids in anticipating the difficulties of surgical removal and the associated surgical complications. The classification of the impacted mandibular third molar by Pell and Gregory[54] which includes a portion of the Winter classification[55] has served its purpose well. To date no single system of classification is accepted unanimously for impacted maxillary third molar however few have classified it. Archer[56] categorized the anatomic position of the maxillary third molar using the following criteria: the relative depth of the impacted maxillary third molar, the position of the impacted maxillary third molar in relation to the adjacent second molar and the position of the impacted maxillary third molar in relation to the maxillary sinus. There are limited prevalence data in the literature on the types of impaction of the maxillary third molar.

Conclusion

In the present study the impacted teeth are more prevalent in males compared to females. The vertical type of maxillary 3rd molar impaction is most common in Maxilla. However the Mesioangular impaction is most common in mandible. The age group 18 years to 35 years have more predilection for impacted teeth than other age groups.

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