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Review article

ASSESSMENT OF THE INFLUENCE OF MANDIBULAR THIRD MOLARS ON THE OCCURRENCE OF INCISAL MANDIBULAR CROWDING

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Abstract

Mandibular incisal crowding is described as the discrepancy between the mesiodistal widths of the four permanent incisors and the available space in the alveolar process. The aim of this research is to assess the potential influence of mandibular third molars on the development of lower incisor crowding and to analyze the relationship between mandibular incisal crowding and retromolar eruption space, eruption level and angulation of third molars. For the realization of our objectives examinations are performed on study plaster orthodontic models (mandibular dental arches) and orthopantomographic images of 80 individuals, aged between 12 and 22 years. The whole sample is divided into two groups based on the Little's index of irregularity: group I- control group composed of patients with index 0 to 3 mm, and group II- study group composed of patients with index >3 mm. Calculations are made for the third molar eruption depth, eruption space, and angulation. The influence of the third molar on mandibular incisor crowding is evaluated in the dental literature and has been a challenging subject for many years. Further detailed studies are also required to assess correlation between lower anterior crowding and third molar eruption depth, angulation and space in different skeletal malocclusions, and also in different facial morphologies.

Keywords: Incisal mandibular crowding, third molars, Little's irregularity index, orthodontic study models, orthopantomographic images

Introduction

The influence of third molars on incisor crowding has long been discussed in the dental literature and has been a controversial topic for many years. Third molar is a tooth characterized by variability in the presence or absence in the oral cavity, time of its formation and calcification, its course of eruption and final position, and its crown and root morphology. Erupting third molars continually change their angular positions and show important preeruptive rotational movements (Almpani K, Kolokitha OE. 2015). Radiographic appearance of starts as early as the age of 5 years and up to the age of 16 years, commonly erupting in the oral cavity between the ages of 18 and 24, and they present the highest rate of impaction (Ambika Sood et al.2018). Because incisal mandibular crowding coincides with the chronological time of eruption of third molars and appears to be a cause-and-effect relationship, prophylactic extraction of mandibular third molars appears to be a logical preventive measure for tertiary mandibular crowding (A M Putri 2018)

Incisal mandibular crowding is described as the discrepancy between the mesiodistal widths of the four permanent incisors and the available space in the alveolar process. But incisor crowding is not only a discrepancy between the size of the teeth and the arch, but also a discrepancy between several variables (Mözgür Sayin 2004) such as: anterior component of occlusal force, physiological mesial drift of teeth, occlusal changes, mesial vectors of muscle contraction, development of third molars, amount and direction of late mandibular growth, skeletal morphology, and complex growth patterns (Danira Miloš 2021)

The main purpose of this study is to assess the potential influence of mandibular third molars on the development of lower incisor crowding and to find the relationship between these two entities.

Bibliography review

(Hasegawa et al. 2013) investigated the effect of third mandibular molars on incisal crowding and inclination of teeth in the posterior parts of the mandible in the Mongolian population using plaster study models of the teeth, panoramic and lateral cephalometric images. According to them, there was no significant correlation between Little's irregularity index and third molar angulation. (Niedzielska I. 2005) evaluated the length and width of the dental arches to reveal the effect of third molars on the crowding of mandibular incisors using panoramic radiographs and plaster study models and determining the Ganss ratio. Changes in the dimensions of the dental arch in 47 patients were noted three years after the removal of the third molar or the decision not to extract it. The results showed that measurements of the density, length and width of the arch changed in 12 lower and two upper dental arches. The relationship between these results and the Ganss ratio was statistically significant. (Gökçe et al. 2021) who analyzed the influence of the angulation of the third molars on incisal mandibular crowding claim that no statistical differences were found in all tested parameters (the angulation of the third mandibular molars in relation to the second mandibular molars, the occlusal plane and the horizontal reference plane) between the studied groups ($P > 0.005$). In the study by (Sidlauskas et al. 2006) the crowding of the lower incisors was compared in groups, with and without the presence of lower third molars. There were no significant statistical differences in lower anterior density in the two groups. (Okazaki K. 2010) found no data on interproximal dental pressure of the lower third molars on the lower anterior teeth. (Shigenobua et al. 2007) and (Stanaitytė et al. 2014) observed changes in the erupted dentition in the dental arches and concluded that the compressive force is not transmitted through the molars to the anterior teeth.

(Bjork A.et al.1972) in a study of mandibular third molars showed the association of third molar impaction with the lack of space in the alveolar arch between the second molar and the ramus. According to Bjork, there are three skeletal factors that contribute to this insufficient space for the third molar: 1) vertical direction of condylar growth resulting in little resorption of the anterior border of the ramus, 2) little growth of the mandible in length, 3) tendency to erupt the tooth pointing backwards. Delayed maturation of the third molar is also associated with its impaction.

Authors who analyzed the data obtained from the analyzes according to Bolton came to the conclusion that the impacts of the third molars are related to the delayed development of the facial skeleton (SograYassaei et al.2014)

Methodology

For the realization of the set goals clinical research is performed in the Polyclinic of Specialist Consultative Activity "Alba Ortodent" in Tetovo, under scientific supervision from the Department of Orthodontics at the Faculty of Dentistry at UKIM in Skopje. The material consists of orthodontic plaster studio models and orthopantomogram recordings of 80 male and female subjects aged 12 to 22 years with crowding of the mandibular incisors.

The selection of patients in the research sample was limited by certain criteria for patient selection, i.e. inclusion and exclusion from the study. Inclusion criteria of the study: patients aged 12-22 years, good health condition, full complement of teeth presents intraorally, irrespective of the third molars, have not had orthodontic treatment or are undergoing orthodontic treatment, presence of crowding in the mandibular incisors. Exclusion criteria of the study: absence of third molar, presence of retained deciduous teeth, supernumerary teeth, presence of mandible asymmetries, presence of large restorations, artificial teeth, presence of skeletal disorders and abnormalities, individuals who have had prior orthodontic treatment or orthognathic surgery.

The subjects are divided into two groups depending on the irregularity index according to Little. The first group - control group consist of subjects with an index of irregularity from 0 to 3 mm, and the second group - examined group consist of subjects with an index of irregularity greater than 3 mm. Orthopantomogram scans are taken at the same time as the study models. Radiographs are performed with an orthopantomogram (OPG) device, Carestream CS 8100 2D.

1. *Assessment of the incisal mandibular density of mandibular studio models is performed based on the irregular index according to Little*

Little's Irregular Index - is a quantitative method for assessing mandibular incisal crowding, where the linear horizontal displacement of the anatomical contact points of each mandibular incisor with adjacent teeth, between the lower canines, is measured. Each of the five measurements represents the horizontal linear distance between the vertical projections of the anatomical contact points of the adjacent teeth. The sum of those 5 linear distances is the degree of the incisal irregularity. Each of the respondents is subjectively ranked on a scale of 0-10 mm, using the following criteria: 0 -ideally aligned mandibular incisors; 1,2,3 - minimum irregularity; 4,5,6 - moderate irregularity; 7,8,9 - severe irregularity; 10-20 - very severe irregularity. Based on the obtained values, the research sample is divided into two groups:

First group - a control group of 40 subjects with minimal incisal mandibular density, in which the irregular index according to Little is from 0 to 3 mm.

Second group - a study group of 40 subjects with pronounced incisal mandibular crowding, in which the irregular index according to Little is greater than 3mm

2. *Assessment of space, eruption level and angulation of mandibular third molars on orthopantomogram images*

We evaluate the impact of mandibular third molars on the occurrence of incisal mandibular crowding depending on three factors, determined on orthopantomogram images of each subject. Linear and angular measurements are performed, which refer to the assessment of: the space for the eruption of the third mandibular molars; the level of eruption (depth of eruption) of the third mandibular molars; the angulation of the third mandibular molars.

2.1. Assessment of the eruption space of the third mandibular molars is determined by:

• Measurement of the available space for eruption of the third molars (retromolar space) as a linear distance between the intersection of the occlusal plane with the anterior border of the ramus of the mandible and the intersection of the line perpendicular to the occlusal plane from the most distal point of the second permanent lower molar.
• Measurement of the mesiodistal width of the third molars as a linear measurement of the length of the line joining the most mesial and most distal border of the crown of the lower third molar.
• Determination of the Ganss ratio - as a ratio between the available space and the mesiodistal width of the third molars

Ganss ratio = A/B

A is the distance between the distal border of the crown of the second permanent mandibular molar and the anterior border of the ramus measured on the occlusal plane
B is the crown width of the lower third molar.

2.2. Evaluation of the eruption level (eruption depth) of the mandibular third molars is determined as the depth of the third molars in relation to the adjacent second molars, according to Pell and Gregory, and is determined in three levels:

- level A (fully erupted) – the third molar (M3) is at the same level or above the occlusal plane of the adjacent second molar. (M2)
- level B (partially erupted) - the third molar (M3) is below the occlusal plane, but above the cemento-enamel junction of the second molar. (M2)
- level C (unerupted) - the third molar (M3) is below the cemento-enamel junction of the second molar (M2).

2.3 Evaluation of the angulation of the third mandibular molars will be determined as:

- angulation of the third molars with the second molars, - as the angle formed by the longitudinal axis of the mandibular third molar and the longitudinal axis of the mandibular second molar
- angulation of the third molars with the occlusal plane – as an angle formed between the occlusal plane and the longitudinal axis of the third molar
- angulation of the third molars with the horizontal reference plane - as the angle formed between the horizontal reference plane and the longitudinal axis of the mandibular third molar.

Statistical Processing and Data Analysis

The data obtained during the research will be statistically processed using the SPSS software package, version 22.0 for Windows (SPSS, Chicago, IL, USA).

Expected Results

By correctly realizing the goals set in this paper and analyzes made, observing the entire work protocol in all patients equally, we expect to receive conclusions that will be valid and supported by evidence. Through this research, the role and influence of mandibular third molars on the occurrence of incisal mandibular crowding will be evaluated. The significance of this research is that it will provide correct guidelines and recommendations for justified extraction or monitoring of third molars in order to prevent tertiary mandibular crowding, as well as in the planning of retention procedures after the end of active orthodontic treatment, emphasizing the stability of the results.

Application of Research Results

As in all other fields, orthodontics aims at innovation and application of new scientific knowledge in everyday health practice. Studies on the mandibular third molar have always been of great interest in clinical practice. The development of the third molar space is influenced by various factors, including backward inclination of the anterior border of the mandibular ramus relative to the alveolar ridge, bone resorption from the anterior edge of the ramus, forward movement of the dentition, growth in the length of the mandible, the sagittal direction of mandibular growth and the sagittal direction of dentition eruption. Eruption of the third molar can be predicted at an early age during orthodontic treatment, and then later occurrences of severe impactions can be avoided. In that context, the research of methods related to the analysis of the incisal mandibular density and the correlation with the third lower molars represents a great contribution to the field of orthodontics and dentistry.

We anticipate that the knowledge that will emerge from this paper will be useful for the specific problem, and it will be clear which orthodontic method is used in the therapeutic approach. We hope that the benefit of the research will be significant, especially for orthodontists, so that they can determine if there is a need for early extraction of the third molars or their monitoring in the retention period, after successfully completing orthodontic treatment.

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