Journal of Forensic and Legal Medicine 49 (2017) 54–58

Contents lists available at ScienceDirect

Journal of Forensic and Legal Medicine

journal homepage: www.elsevier.com/locate/jflm

Prevalence of the number of cusps and occlusal groove patterns of the mandibular molars in a Saudi Arabian population☆

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ARTICLE INFO

Article history:
Received 26 May 2016
Received in revised form
3 May 2017
Accepted 21 May 2017
Available online 24 May 2017

Keywords:
Occlusal morphology
Permanent mandibular molars
Forensic
Saudi population

ABSTRACT

A dental trait in humans can be a valuable diagnostic tool in anthropological studies for classifying and characterizing different ethnic groups. Many studies have attempted to relate the prevalence of dental morphologies with different factors. Several variations, such as variations in the size, number of cusps, and groove pattern, have been observed in the mandibular molars of diverse populations. The morphological features of the occlusal surfaces of the mandibular molars have been described by Gregory and Hellman. To date, no studies have been reported in the literature regarding the frequency and expression of different types of cusps and the occlusal groove patterns in a Saudi Arabian population. The present study aimed to determine the prevalence of different occlusal morphologies (number of cusps and occlusal groove patterns) of the permanent mandibular first and second molar in a Saudi population and to correlate its importance in forensics, if any. The results of this study showed that the most frequent occlusal configurations were the 5-cusp pattern seen in 85% (136 teeth) and the 4-cusp pattern seen in 11% (18 teeth) of the mandibular first molars, bilaterally. Regarding the mandibular second molars, the 4-cusp form was the most common occlusal configuration, seen in 82% (132 teeth), followed by the 5-cusps type, seen in approximately 16% (26 teeth), bilaterally. Statistically significant (P value = 0.001) differences were noted for the permanent mandibular first and second molars between male and female subjects in all cusp and groove patterns ("Y" and "+" patterns). Similarly, significant differences (P value = 0.001) were found between the unilateral and bilateral presence of different cusp and groove patterns, both in the mandibular first and second molars. The present study showed that the groove pattern in the mandibular first molars was very different when compared to other populations. The cusp and groove patterns of the mandibular second molars were similar to those of the East African and Iranian populations. The results of this study may be used in forensics. Thus, the outcomes of this study may be helpful in both anthropological and clinical dental research.

1. Introduction

Teeth serve as excellent sources of study material in anthropological, genetic, and forensic investigations, both in living and non-living populations.[1] Many authors have varied views regarding whether the ethnicity has a role in the morphology of a tooth. However, different degrees of expression and variations have been observed in the dentitions of different populations.[2,3]

Studies on the morphological characteristics or traits to describe the variations in the occlusal surfaces of the mandibular molars are based on the study by Gregory and Hellman.[4,5] Standard sizes of teeth are used in forensics for age and sex determination.[6] Studies on the dental morphological characteristics and odontometrics provide information on the phylogenetic relationships between various species, and the variations and diversities within a population. Additionally, these are significant in forensic and anthropological research.[7]

☆ We would like to show our gratitude and thanks to Dr. Roshan Noor Mohamed (assistant professors, department of pedo preventive dentistry department, faculty of dentistry, Taif University) and Dr. Sakeenabi Basha (assistant professors, preventive dentistry department, faculty of dentistry, Taif University) for sharing their help and assistance in statistical analysis for this research.

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http://dx.doi.org/10.1016/j.jflm.2017.05.013
1752-928X/

Furthermore, knowing common variations in the dental anatomy and morphology of each tooth can help in performing some dental treatments, such as restorative, endodontic, and orthodontic treatments.[8] To the best of our knowledge, to date, there are no studies on the frequency and expression of different types of occlusal grooves and patterns of the permanent mandibular molars in a Saudi or Middle East population. Hence, the present study was undertaken to assess and compare the number of cusps and occlusal groove patterns in the permanent mandibular first and second molars of a Saudi Arabian population in the Western region.

2. Materials and methods

This study was conducted in the dental clinics affiliated to the Government Hospitals of the Western Province (Makkah, Madina, and Jeddah cities) of the Kingdom of Saudi Arabia. A total of 160 out of 1660 patients who attended the outpatient department for orthodontic treatments were included in the study. The following patients alone were considered: those with completely erupted permanent mandibular first and second molars in both sides, free from occlusal/proximal caries, and have a clear occlusal outline with all the cusps and groove patterns. All participants were of Saudi origin alone. The participants were excluded from the study if their teeth were restored, worn, or heavily broken down (due to any pathology involving age-related changes) or had traumatic injuries, hypoplasia, and prosthesis. The ages of the patients ranged between 12 and 30 years, with 56 (35%) male and 104 (65%) female patients. The average age was 18.33 years and 17.13 years for male and female patients, respectively (Table 1).

Direct intraoral examination was performed carefully, and the morphological details of the crown, namely, the number of cusps and groove patterns of the teeth, and the sex of the subjects were recorded on prepared forms. Photographs of the teeth showing clear occlusal outlines with all cusps and groove patterns of the permanent mandibular first and second molars were obtained using a 14-megapixel digital camera.

A total of 160 patients (12–30 years old) were considered, based on the inclusion and exclusion criteria, as mentioned earlier. The number of cusps and groove patterns of the mandibular first and second molars were examined, and the number of occlusal cusps and fissure patterns were recorded. The data collected were analysed statistically using Statistical Package for Social Science version 17 (SPSS Inc., Chicago).

2.1. Statistical analysis

Descriptive summary statistics were obtained for all the independent and outcome variables. Differences in the proportions were tested using the chi-square test. The Yates correction was applied if the values were less than 5. All statistical tests were two-sided and the significance level was set at a P value < 0.05.

3. Results

The results showed that the 5-cusp pattern was the most frequent occlusal configuration for mandibular first molars, seen in 85% (136 teeth) of cases (Fig. 1), followed by the 4-cusp pattern, seen in 11% (18 teeth) of cases bilaterally (Fig. 2). Regarding mandibular second molars, the 4-cusp form was the most common occlusal configuration, seen in 82% (132 teeth) of cases (Fig. 1), followed by the 5-cusp type, seen in approximately 16% (26 teeth) of cases bilaterally (Fig. 3). Regarding the mandibular first molars, in 4% (6 teeth) of cases alone, there were both 4 and 5 cusps (mixed number of cusps) unilaterally (Fig. 4). Similarly, regarding the mandibular second molars, in 1% of cases alone, there were 4 and 5 cusps (mixed number of cusps) unilaterally (Table 2). In the present study, no teeth showed the "X" groove pattern or a 6- or 7-cusp pattern in both molars.

The major occlusal groove pattern seen in the mandibular first molars was the "Y" groove pattern, seen in 80% (128 teeth) of cases, followed by the "+" pattern, seen in 16% (26 teeth) of cases, and both types of patterns ("+ and Y"), seen in 4% of cases (Table 2). Hence, the most frequent occlusal surface configuration in the first mandibular molars was the "Y5" form, where "Y" represents the groove pattern and "5" the number of cusps (Fig. 1). Among the mandibular second molars, the most prominent occlusal groove pattern seen was the "+" pattern, seen in 88% (140 teeth) of cases, followed by the "Y" pattern, seen in 11% (18 teeth) of cases, and the mixed type pattern (both "+ and Y") in 1% of cases (Table 2). Hence, the most common occlusal surface configuration of the mandibular second molars was the "+4" form, where the "+" is the occlusal groove pattern and "4" represents the number of cusps (Fig. 1).

Statistical comparisons between the mandibular first and second molars at for all parameters (for both the number of cusps and groove patterns) were highly significant (P value = 0.001) and is shown in Table 2.

Table 3 shows the sex-wise distribution of cusps and groove patterns of the permanent mandibular first and second molars. Statistically significant (P value = 0.001) differences were noted for the permanent mandibular first and second molars between male and female patients for all cusps (5 cusps and 4 cusps) and groove patterns ("Y" and "+"). Table 4 shows the significant differences (P value = 0.001) between the unilateral and bilateral presence of different cusps and groove patterns in both mandibular first and second molars.

Table 1
Age and Sex distribution of patients.

	No. of patients	Age range (years)	Average Age (years)
Male	56	14–26	18.33
Female	104	12–30	17.13
Total	160		

4. Discussion

The final tooth form represents the sum total of its genetic endowment and long-term environmental influences.[3] The fissure pattern is independent of the number of cusps and is assumed to be polygenic, determined by combinations of alleles at two or more loci.[9] Therefore, the number of cusps and the groove patterns were considered separately because their evolutionary changes are not well correlated phenotypically.[10]

Dental anthropology is concerned with the study of the origin and variations of human dentition and is a valuable tool to identify the geographic origin.[11] The role of ethnicity on dental morphology is not clear. It must be kept in mind that it is impractical to exclusively attribute any distinct anatomic characteristic to a specific race. However, a collective data from careful examination of the physical, skeletal, and dental structures may help identity the racial features of an individual. Nonetheless, there is a vast range of expression and frequency in the variation of teeth in different populations. However, few studies in dental anthropology have shown an association between the dental morphological features and crown traits.[12] Traditional textbook literature on tooth morphology is mostly based on the classification of Gregory and Hellman.[4,5] Such studies have used various methods, such as extracted teeth,[3,13] intraoral examination,[3,13,14] and dental study casts.[13,15,16] Intraoral examination has the advantages of accurate