Prevalence of three-rooted mandibular permanent first and second molars in the Saudi population

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Abstract Introduction: This study aims to explore the frequency and factors affecting the prevalence of an extra root in the lower first and second permanent molars in the Saudi population.

Methods: Images of 379 Saudi patients who underwent CBCT for routine dental treatment were assessed. The CBCT images were evaluated on a 34-inch LED screen in a dark room and assessed by two examiners to count the prevalence of an additional root in the lower molars. Laterality and the gender factors were used to analyze that prevalence. Percentages represent categorical variables; Fisher’s exact test and Chi square test were also used for the categorical variables.

Results: In the lower first molars, the prevalence of extra root in female patients was 5.7%, 3% in male patients and the overall prevalence was 3.05%; in lower second molars, the prevalence was 1.81% in female patients and 3.04% in male patients with an overall prevalence of 1.48%. A statistically significant difference was found in the existence of an additional root with regard to laterality, to be more common on the right compared to the left side for both mandibular molars. The extra root prevalence was statistically significant in female patients at the first molar compared to male patients (p < 0.05).

Conclusion: The overall prevalence of extra roots in the lower first and second molars in the Saudi population are 3.05% and 1.48%, respectively. Consideration and identification of this variation is essential to ensure successful endodontic treatment.

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1. Introduction

For performing effective dental treatment, detailed knowledge of the anatomy and morphology of the root canal is important (Tu et al., 2009). In endodontic treatment, three-dimensional obturation is the main objective after performing thorough canal cleaning and shaping (Schilder, 1974). However,
anatomic variation in a root canal system presents clinical
traits in its influence on the final treatment out-
come (De Moor et al., 2004; Gulabivala et al., 2001;
Gulabivala et al., 2002; Siqueira et al., 2013; Tu et al., 2007;
Versiani et al., 2011; 2013). Failure of endodontic treatment
may occur in cases of missed canals or incomplete removal of
microorganisms and necrotic pulp remnants throughout
canal preparation, which result in persistent infection
(Berman et al., 2010).

Most first and second lower molars have two roots, with
one root located mesially and the other located distally
(Vertucci, 1984). However, anatomic variations in these teeth
have been described in the literature; the first report was of
an additional root in the lower molars (Carabelli, 1844). Racial
variations in dental anatomy have been recognized, one of
which is an extra root in the lower molar, which might be pre-

cent on the buccal side (radix paramolaris) or on the lingual
side (radix entomolaris). The cause of formation of a radix
entomolaris is as yet unclear. Formation of an additional root
can occur as a result of extrinsic factors during formation of
the tooth or due to inclusion of an atavistic gene in the genetic
makeup of the individual (Calberson et al., 2007; Carlsten and
Alexandersen, 1990). However, this is considered to be a major
anatomic variant in various populations, knowledge on the
prevalence is essential to insure better outcome of the
endodontic treatment.

Given that the frequency of an additional root in the lower
molars in the Saudi population has not yet been evaluated, a
study on the prevalence of this anatomic variation in this pop-
ulation is warranted to help endodontists and general dentists
improve treatment outcomes in these patients.

Conventional and digital radiographic techniques depict
three-dimensional objects in two-dimensional images, and
thus, they are limited for accurate assessment of the root mor-
phology or for detection of an extra root. Therefore, cone-
beam computed tomography (CBCT) would be a more reliable


3. Results

Three hundred and seventy-nine patients (204 male, 175
female) underwent scanning between January 1, 2014 and
January 31, 2018. In total, 655 first lower molars and 672 s
mandibular molars were evaluated, which comprised 320 left
first molars, 335 right first molars, 336 left second molars,
and 336 right second molars. Sixteen patients (6 male, 10
female) were found to have a lower first molar with a third
root (Table 1). Prevalence of additional roots in the lower first
molar was 3% in men, 5.7% in women, and an overall preva-
ience of 3.05%. Nine patients (6 male, 3 female) were found to
have a lower second molar with a third root with a prevalence
of 3.04% in men, 1.81% in women, and an overall prevalence
of 1.48%.

Furthermore, there was a statistically significant sex-related
difference in the frequency of an extra root: the extra root was
more in female patients at the first molar.

Table 2 shows a significant difference in laterality
(p < 0.05), with a predilection for the right side in both the
first and second molars (first molar, p = 0.003; second molar,
p = 0.035).

4. Discussion

Different population studies reported variable prevalence of
the extra root in lower molars. In a study conducted in a
Malaysian subpopulation, (Pan et al., 2019) radix entomolaris
prevalence in the first molar was 21.4%. Another study in
North India found the prevalence of radix entomolaris to be
8.3% in all teeth examined. (Gupta et al., 2017) According
to another study in an Indian population, the prevalence of
lower first molars with three roots was 4.55% (Garg et al.,
A different study (Souza-Flamini et al., 2014) showed that the extra root occurred more frequently in the distolingual location.

There is lack of anatomical studies in Saudi population in regards to the radix root of lower permanent molars. In this study, using three-dimensional CBCT, the prevalence of extra root in the lower permanent first and second molars was determined to be 3.05% and 1.48%, respectively. An extra root in the lower first and second molars was present more often on the right side. This finding is consistent with that of Jayasinghe and Li (2007), who reported that an extra root was observed more frequently on the right side of the lower first molars. Other studies found that there was no significant difference in the sides or in the sex distribution (Chandra et al., 2011; Schafer et al., 2009).

The prevalence of first lower molars with an extra root was 3.05% in this study, which is higher than the prevalence of 0.7% reported in a study by Schäfer et al. in the German population (Schafer et al., 2009) and lower than the prevalence of 27.06% reported in a study by Yang et al. in the Chinese population of Shanghai (Yang et al., 2010). A recent study in Brazilian population (Rodrigues et al., 2016) showed that the prevalence of the first lower molar with three roots was 2.58%, which is slightly lower than the prevalence reported this study. Table 3 shows the prevalence of radix entomolaris or paramolaris in the lower first molar in different ethnic groups.

We found an extra root on the right side in 2.0% of male patients and 4.02% of female patients; these percentages are lower than the respective figures reported in the Chinese population of Shanghai representing 6.59% and 5.56% (Yang et al., 2010). Further, the current study found that the prevalence of an extra-root was 3.05% in the first lower molar and 1.48% in the second lower molar; these figures were lower than the corresponding values (24.5% and 0.7%, respectively) reported in a study performed in the Korean population by Song et al. (2010). This variation in prevalence varies according to the type of population and possibly there genetic predisposition.

This study was performed in the city of Riyadh; future multicenter studies with a larger sample size would provide a better estimation of the frequency of such anomaly in the Saudi population.

5. Conclusion

The overall prevalence of the extra roots is 3.05 and 1.48% in the mandibular first and second molars in the Saudi population, respectively. Consideration and identification of this

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| Reference         | Year | Population     | Teeth, n | Three-rooted teeth n | %   |
|-------------------|------|----------------|----------|----------------------|-----|
| Chandra et al. (2011) | 2011 | South Indian   | 1000     | 133                  | 13.3 |
| Schafer et al. (2009)  | 2009 | German         | 1024     | 7                    | 0.7  |
| Yang et al. (2010)    | 2010 | Shanghai Chinese | 1020 | 276                  | 27.06 |
| Gupta et al. (2017)   | 2017 | North Indian   | 1000     | 83                   | 8.3  |
| Garg et al. (2010)    | 2010 | Indian         | 1054     | 48                   | 4.55 |
variation is essential to ensure successful endodontic treatment. Careful study of radiographs obtained at different angles is needed before initiating endodontic treatment to increase the chance of detection of such anatomical variations and reduce the risk of missing a canal; further, CBCT is recommended in patients suspected to have an additional root. If an extra root is found, the patient should be referred to an endodontist to avoid possible complications.

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Conflict of Interest

The authors deny any conflicts of interest related to this study.

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