

Prevalence of retromolar foramen in dry mandibles in Maputo

Prevalência do foramen retromolar em mandíbulas secas em Maputo

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Resumo

Introdução: O triângulo retromolar está envolvido em processos patológicos e a presença de variações anatômicas nesta região acarreta riscos anestésicos e cirúrgicos. **Objetivo:** O presente estudo tem como objetivo enfatizar a relevância clínica do foramen retromolar e determinar a sua prevalência em mandíbulas secas na Cidade de Maputo, em Moçambique. **Material e método:** Trata-se de um estudo descritivo observacional que foi conduzido na Osteoteca e Museu de Anatomia da Faculdade de Medicina da Universidade Eduardo Mondlane, na Cidade de Maputo (Moçambique), entre 24 a 28 de Julho de 2023. Todas as mandíbulas secas disponíveis foram analisadas. **Resultado:** Foram analisadas 228 hemimandíbulas (114 mandíbulas), onde foram identificadas 37 foramen retromolar. **Conclusão:** A prevalência do Foramen Retromolar em mandíbulas de indivíduos provenientes da Osteoteca e Museu de Anatomia da Faculdade de Medicina da Universidade Eduardo Mondlane na Cidade de Maputo foi de 23,68% (27/114), sendo que 56,76% (21/37) dos Foramen Retromolar analisados apresentavam predomínio esquerdo. Houve uma maior predominância de Foramen Retromolar Unilateral.

Descritores: Variação anatômica; odontologia; dentista; mandíbula.

Abstract

Introduction: The retromolar triangle is involved in pathological processes and the presence of anatomical variations in this region entails anesthetic and surgical risks. The present study aims to emphasize the clinical relevance of the retromolar foramen and determine its prevalence in dry jaws in Maputo City in Mozambique. **Material and method:** This is a descriptive observational study that was conducted at the Osteoteca and Anatomy Museum of the Faculty of Medicine of the Eduardo Mondlane University (UEM) in Maputo City (Mozambique) between the 24th and 28th of July 2023. All available dried mandibles were analysed. **Result:** 228 hemimandibles (114 mandibles) were analysed, where 37 retromolar foramina were identified. **Conclusion:** The prevalence of the Retromolar Foramen in the jaws of individuals from the Osteoteca and Anatomy Museum of the Faculty of Medicine of the Eduardo Mondlane University in the Maputo City of was 23.68% (27/114) with 56.76% (21/37) of the Retromolar Foramen analysed showing a predominance on the left side. There was a greater predominance of unilateral retromolar foramen.

Descriptors: Anatomic variation; dentistry; dentists; mandible.

INTRODUCTION

The retromolar triangle, sometimes called the retromolar fossa, is triangular area of mucosa covering anterior surface of the ramus of mandible, behind the lower third molar ^{1,2}, limited by



the buccinator crest laterally, the pterygomandibular raphe medially and the posterior part of the 3rd molar³, and occupied by a neurovascular bundle⁴, responsible for providing innervation to several areas, including the pulp of the third molar, the retromolar region and the fibers of the temporalis and buccinator muscles⁵.

This region is subject to anatomical variations such as the presence of the retromolar foramen (RMF) and the retromolar canal (RMC)⁶. The RMC is a collateral branch of the mandibular canal⁷.

The mandibular canal (lower dental canal) begins at the orifice of the lower dental canal, behind Lingula (Spix's spine), then runs downwards and forwards to the second premolar tooth, where it divides into two secondary canals, one external, constituting the mentonian canal, which opens into the mentonian foramen, and the other internal, the incisor canal, which ends below the incisor teeth⁸.

The retromolar canal was found in 72% of cases and in 27% of cases the canal was present bilaterally⁹.

The first characterization of the Retromolar Foramen (RMF) was made by Lofgren in 1957¹⁰ and the first detailed analysis of the Retromolar Canal was published by Schejtman in 1967⁹.

Knowledge of the anatomy of the mandible, especially the retromolar trigone and its anatomical variations is very important for planning surgical interventions on the 3rd molar by dentists and maxillofacial surgeon's¹¹. The neurovascular bundle can be damaged during surgical extraction of impacted mandibular third molars or during sagittal osteotomies of the ramus of the mandible, with consequent haemorrhage and/or nerve injury⁴.

The repercussions on the clinical activity of the dental surgeon and maxillofacial surgeon range from atypical bleeding during surgery in this region to failures in anaesthetic techniques and neurosensory alterations after inadvertent incision. The management of these situations is challenging because, although the RMF is described in the literature, few professionals who work in this region are aware of this anatomical structure. Bleeding does not seem to be an important complication because it can be easily controlled, but hypothetically there could be perineural dissemination of the pathology¹².

The accessory innervation caused by the presence of retromolar foramen leads to failures in anaesthesia techniques by regional block of the inferior alveolar and buccal nerves⁹ and permanent paresthesia of the buccal mucosa following an injury to a branch of the buccal nerve during the extraction of a third molar. The affected area spanned from the retromolar region to the canine on the operated side. The injury occurred as the branch of the buccal nerve intersected the retromolar foramen during the extraction procedure¹³.

The present study aims to emphasize the clinical relevance of the retromolar foramen and determine its prevalence in dry jaws in Maputo City in Mozambique.

MATERIAL AND METHOD

This descriptive observational study was conducted at the Osteotheca and the Anatomy Museum of the Faculty of Medicine of the Eduardo Mondlane University (UEM), between the 24th and 28th of July 2023.

All dry mandibles of adults with teeth or the presence of a dental alveolus, regardless of sex and race, were macroscopically analysed, with emphasis on the retromolar trigone to detect the presence of a retromolar foramen, by two different authors, and the agreements between their observations were duly noted. The presence or absence of the RMF was recorded (Figure 1), documenting both unilateral and bilateral occurrences and noting any differences in incidence between the right and left sides of the mandible. All data were described as absolute and relative values. Exclusion criteria for this study were evidence of deformed, asymmetrical and fractured jaws, wear, damage or any pathological change and children's jaws. A total of 114 mandibles (228 hemimandibles) were evaluated and organized into groups, with or without a foramen in the

region of the retromolar triangle. One mandible was excluded from the study due to a fracture. The data collected were analysed using SPSS-27 (Statistical Package for the Social Sciences).



Figure 1. Superior view of a mandible with the presence of a RMF on the left side.

RESULT

In the study, 228 hemimandibles were analysed, revealing that 83.7% (191/228) did not present the RMF. Among the specimens, 37 RMFs were identified (16.2%), with 16 (7.02%) on the right side and 21 (9.21%) on the left side (Table 1).

Out of the 114 evaluated mandibles, only 8.77% (10/27) showed bilateral occurrence of the RMF.

Table 1. Distribution of RMF in the population of Maputo

Retromolar Foramen	N	%
Missing	191	83.7
Present	37	16.2
Unilateral	17	62.9
Bilateral	10	37.0
Right	17	62.9
Left	10	37.0

DISCUSSION

This study represents the first Mozambican effort to evaluate the prevalence of RMFs in dry mandibles, offering a crucial comparative dataset for future research. It provides healthcare professionals, including dentists, with valuable insights into the occurrence of this anatomical variation in the Mozambican population.

The RMF and CRM present challenging situations for dentists because they are overlooked and are not described in textbooks on human anatomy and dental practice¹⁴.

The retromolar trigone is an anatomical region implicated in pathological processes such as infections and malignant tumours. Dentists routinely utilize this area for anaesthetic blocks and surgical procedures. The presence of infrequent anatomical variations, like RMF and CRM, poses significant risks of complications such as anaesthesia failure, paraesthesia, bleeding, and nerve injury. Hence, these should not be overlooked by professionals. If suspected, appropriate imaging examinations are recommended¹⁵.

Due to the presence of blood vessels and nerves in this area, exercising extra care during anaesthetic interventions and surgical approaches in the retromolar region of the jaw is crucial⁴.

At least two methods for identifying the RMF are described in the literature: Direct Inspection of Skeletal Samples and Radiographic analysis using the patient's Cone Beam Computed Tomography (CBCT)¹⁶. However, it's important to note that the current study depended on Direct Inspection of Skeletal Samples from the Osteotheca and Anatomy Museum of the Faculty of Medicine at UEM. In Mozambique, CBCT is not yet available, rendering it impossible to conduct the study using this imaging technology.

According to Park et al.¹⁷ Northeast Asians, including the Korean population, show the highest incidence rate of the retromolar foramen compared to other races.

Several studies have been conducted over time in various locations, aiming to characterize the RMF in populations. The worldwide prevalence of retromolar foramen ranges from 7.9% to 72% (Table 2). Our study had 23,68% of cases.

Table 2. Distribution of the prevalence of retromolar foramen in dry mandibles found in various studies

Reference	Country	Number of mandibles studied	Prevalence	Type of Sample
This Study	Mozambique	114	23.68% (27/114)	Dry mandible
9	Argentina	18	72% (13/18)	Cadaveric
18	Brazil	61	29.5% (18/61)	Dry mandible
6	Brazil	35	17% (6/35)	Dry mandible
19	Brazil	294	12.9% (38/294)	Dry mandible
20	China	123	31.7% (39/123)	Dry mandible
21	Egypt	11	23% (3/11)	Dry mandible
22	India	94	11.7% (11/94)	Dry mandible
23	India	120	12.5% (15/120)	Dry mandible
24	India	40	20% (8/40)	Dry mandible
25	India	224	14.7(33/224)	Dry mandible
26	Italy	233	14.6% (34/233)	CBCT
17	Korea	154	46.8% (144/308)	Dry mandible
16	South Africa	885	7.9% (70/885)	Dry mandible
27	Spain	600	31% (184/600)	Dry mandible
4	Turkey	40	25% (10/40)	Dry mandible

In this study, a left-sided predominance of the RMF was evident, mirroring results from studies in Turkey⁴ and South Africa¹⁶. Research conducted in Brazil^{6,18,19}, China²⁰ and reported India²²⁻²⁴ a more prominent occurrence on the right side. An Indian study²⁵ noted a higher prevalence of bilateral RMF.

Studies conducted in Brazil¹⁸, India²³ and Spain²⁷ indicated a higher prevalence of the RMF among male individuals. Contrarily, in the Indian study²⁵, a greater occurrence of the RMF was noted among females.

Some authors report that there is no correlation between RMF, sex, and age¹⁶.

He et al.²⁸ performed the first description of a triple RMF located on the right side of the mandible in a cadaver. It should be noted that all the mandibles analysed did not present supernumerary RMF.

The present study is limited by the lack of differentiation by sex. It was conducted only at one university, despite it being the largest in the country. Since it was carried out solely in the city of Maputo, it is not possible to extrapolate the results to the Mozambican population. Due to the lack of imaging equipment in the anatomy labs, it was not possible to study the CRM in this research.

CONCLUSION

This study demonstrated that the Retromolar Foramen in the jaws of individuals from the Osteoteca and Anatomy Museum of the Faculty of Medicine of the Eduardo Mondlane University in the city of Maputo was 23.68%, with 56.76% of the analysed RMFs showing a predominance

on the left side and should be considered in the planning and execution of anaesthetic and surgical procedures in order to avoid complications. The accessory innervation caused by the presence of retromolar foramen leads to failures in anesthesia techniques by regional block of the inferior alveolar and buccal nerves.

AUTHOR'S CONTRIBUTION

Abdul Habib Mahomed Dadá: Conceptualization, data curation, data analysis, research, methodology, design of data presentation, writing of the original manuscript, proofreading and editing.

Mahomed Sidique Abdul Cadar Dadá: Conceptualization, data curation, data analysis, research, methodology, design of data presentation, Supervision, writing of the original manuscript, proofreading and editing.

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CONFLICTS OF INTERESTS

The authors have no conflicts of interest to declare.

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