

# ROOT MORPHOLOGY OF THE PERMANENT DENTITION *CEBUS APELLA*: MORPHOMETRY AND GROSS ANATOMY

*Morfologia radicular da dentição permanente Cebus apella: morfometria e anatomia macroscópica*

Pablo Maranhão<sup>1</sup>

Ana Cassia Reis<sup>2</sup>

Suely Lamarão<sup>3</sup>

Kalena Melo Maranhão<sup>4</sup>

<sup>1</sup>Médico Residente da Universidade Federal do Pará – Belém – PA; Especialista em Saúde da Família e Comunidade pela UFCS – PA; Mestrando em Cirurgia experimental pela UEPA – PA, Belém, Pará, Brasil.

<sup>2</sup>Especialista em Endodontia pela São Leopoldo Mandic – Brasília-DF; Especialista em Gestão em Saúde Pública pela UFPA-PA; Mestre em Clínica Odontológica pela UFPA-PA; Professora da Escola Superior da Amazônia - ESAMAZ, Belém, Pará, Brasil.

<sup>3</sup>Especialista em Endodontia pela USP-SP; Doutora em Endodontia pela USP-SP; Professora da Universidade Federal do Pará – UFPA/PA, Belém, Pará, Brasil.

<sup>4</sup>Especialista em Endodontia pela UFPA-PA; Especialista em Ortodontia pela ESAMAZ – PA; Mestre em Clínica Odontológica pela UFPA-PA; Professora da Faculdade de Odontologia da Uninassau, Belém, Pará, Brasil.

Recebido em: 14/06/2018

Aceito em: 27/09/2018

MARANHÃO, Pablo *et al.* Root morphology of the permanent dentition *Cebus apella*: morphometry and gross anatomy. *SALUSVITA*, Bauru, v. 37, n. 3, p. 527-535, 2018

## ABSTRACT

**Introduction:** *the phylogenetic similarities between non-human primate and human being stimulate studies of its stomatognathic system, aiming its use on researches.* **Objective:** *an anatomic study of the external features of the permanent teeth of the Cebus apella was accomplished, comparing with the human features, in order to normalize as experimental model.* **Material and Method:** *two adult animals were used. After the removal of the organic tissue, the teeth were removed and photographed, being analyzed with the loupe.* **Result:** *the results showed that the teeth presented similar features to the human being, but with some peculiarities, such as: the presence of the third premolar; the roots present smaller length and volume; the apical third of the central,*

*lateral superiors and inferior incisors are mesiodistally flat; the superior premolars have two individualized roots; the 1st and 2nd superior molars have two roots and the 3rd superior and inferior molars have just one root. Conclusion: the authors conclude that the Cebus apella can be used as experimental model in substitution to the humans in dental researches.*

**Key Words:** *Anatomy. Cebus paella. Dental crown. Dental root.*

## RESUMO

**Introdução:** as semelhanças filogenéticas entre primatas não-humanos e humanos estimulam estudos de seu sistema estomatognático, visando seu uso em pesquisas. **Objetivo:** assim, um estudo anatômico das características externas dos dentes permanentes do *Cebus apella* foi realizado, comparando-as com as características humanas, a fim de se normalizar como modelo experimental. **Material e Método:** dois animais adultos foram utilizados. Após a retirada do tecido orgânico, os dentes foram removidos e fotografados, sendo analisados com a lupa. **Resultado:** os resultados mostraram que os dentes apresentavam características semelhantes ao ser humano, mas com algumas peculiaridades, como: a presença do terceiro pré-molar; as raízes apresentam menor comprimento e volume; o terço apical dos incisivos centrais, laterais superiores e inferiores é mesiodistalmente plano; os pré-molares superiores têm duas raízes individualizadas; o primeiro e segundo molares superiores têm duas raízes e os terceiros molares superiores e inferiores têm apenas uma raiz. **Conclusão:** os autores concluem que o *Cebus apella* pode ser usado como modelo experimental em substituição aos humanos em pesquisas odontológicas.

**Palavras-chave:** Anatomia. *Cebus apella*. Coroa dentária. Raiz dentária.

## INTRODUCTION

*In South America, Cebus apella is considered as one of the primates which have the biggest size and weight (CORNE; RICHTSMEIER, 1991). This fact justifies studies related to dentistry, having the possibility of its use in applied research due to its phylogenetic proximity with human (HERSHKOVITZ, 1977;*

MARANHÃO, Pablo et al. Root morphology of the permanent dentition *Cebus apella*: morphometry and gross anatomy. *SALUSVITA*, Bauru, v. 37, n. 3, p. 527-535, 2018

MARANHÃO, Pablo et al. Root morphology of the permanent dentition *Cebus apella*: morphometry and gross anatomy. *SALUSVITA*, Bauru, v. 37, n. 3, p. 527-535, 2018

WHITTAKER, 1978; CORN; RICHTSMEIER, 1991). The aim of this study was to accomplish in *Cebus apella* an anatomic study of the permanent dentition including its external features such as: crown and root, comparing them to the features of human dentition.

## MATERIALS AND METHOD

Two skulls of adult animals were examined (one male and one female). Cadavers from the postmortem room of the Institute of Research Evandro Chagas (Pará, Belém, Brazil) were used in this study. The skulls were cleaned from most of the soft tissues, then immersed in a mixture of equal oxygenated water and borax proportions and put on a hot source for 15 min with the solution in ebullition to dissolve organic tissue. After, the pieces were kept in saline solution (9%) for bone hydration.

Next, all teeth were removed and photographed in sagittal and lateral planes. The photographs were taken using digital camera (Coolpix 995, Nikon, Japan). Each tooth was categorized according to location within the dental arch. The anatomic descriptions were based on visual exam, observed directly through the loupe.

## RESULTS

The *Cebus apella* genus has 36 permanent teeth on total, 18 in upper arch and 18 in lower arch, having the following dental formula:

$$\frac{3 \ 3 \ 1 \ 2 \ | \ 2 \ 1 \ 3 \ 3}{3 \ 3 \ 1 \ 2 \ | \ 2 \ 1 \ 3 \ 3} \text{ 2 incisors (i); 1 canine (c); 3 premolars (pm); 3 molars (m)}$$

### a) Characterization of upper teeth. (Fig.1)

They are very similar to human teeth; however, the size is about 1/3 smaller and there is a third premolar. The dental crown of central incisors present, in general, 0,6mm of length, having triangular shape, lateral incisors measure 0,5mm, canine crowns have 1,3mm of length and conic shaped; the premolar crowns have 2 cusps, the vestibular one has arrow shape and measure length of 0,4mm; the palatine cusp has 0,3mm and round shape; and finally, the molars crowns have four cusps with 0,3mm of length. (Collected data from Emilio Goeldi Museum; the register number is 26524, 23015, 21779, 21766). With regard to the roots, their shape and number are similar to human's and their characteristics are described on Table 1.

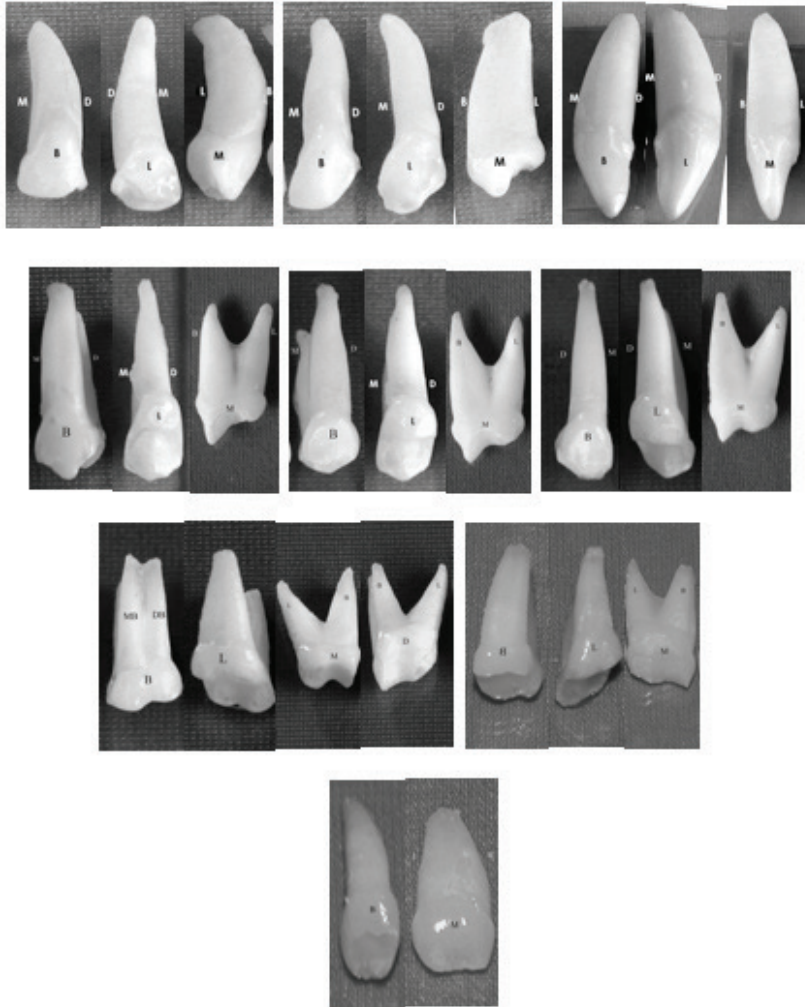


Figure 1 - Upper permanent teeth: (A) Central incisor; (B) Lateral incisor; (C) Canine; (D) First Pre molar; (E) Second Pre molar; (F) Third Pre molar; (G) First molar; (H) Second molar; (I) Third molar.

MARANHÃO, Pablo *et al.* Root morphology of the permanent dentition *Cebus apella*: morphometry and gross anatomy. *SALUSVITA*, Bauru, v. 37, n. 3, p. 527-535, 2018

MARANHÃO, Pablo et al. Root morphology of the permanent dentition *Cebus apella*: morphometry and gross anatomy. *SALUSVITA*, Bauru, v. 37, n. 3, p. 527-535, 2018

Table 1 - Upper teeth

Upper		Root		
Arch	Mean length mm	Number	Shape	Direction
Central Incisor	0,9	01	Mesio-Distal flat, Voluminous	Straight, apical curvature for palatine side
Lateral Incisor	0,8	01	Mesio-Distal flat, Voluminous	Straight, apical curvature for distal side
Canine	1,4	01	Conic, voluminous	Straight
Premolars 1° and 2°	V-0,7/ P-0,6	All of them 02	All of them Vestibular and Palatine- flat	All of them Vestibular-Straight or with apical curvature Palatine root-Straight
3°	V-0,6/ P-0,5			
Molars 1° and 2°	MV/DV-0,5 P-0,4 MV/DV-0,4 P-0,4	Both 02	Both MV e DV joined, Mesio-distal flat. MV- wider Palatine-Conic, voluminous	All of them MV/ DV e P - Straight
3°	0,3			

Font: authorship

## b) Characterization of lower teeth. (Fig.2)

*They are similar to the humans; however, they have half size and there is a third premolar. The dental crowns of central incisors have mean length of 0,5mm and triangular shape; lateral incisors have 0,5mm of length; canines measure 1,4mm and they have conic shape; the premolars crowns have two cusps; the vestibular one has arrow shape and the lingual one has 0,5mm of length; and finally, the crowns of molars have four cusps with 0,3mm each. (Collected data from Emilio Goeldi Museum; the register number is 26524,23015,21779,21766). The roots shape and number are similar to humans and their characteristics are described on Table 2.*

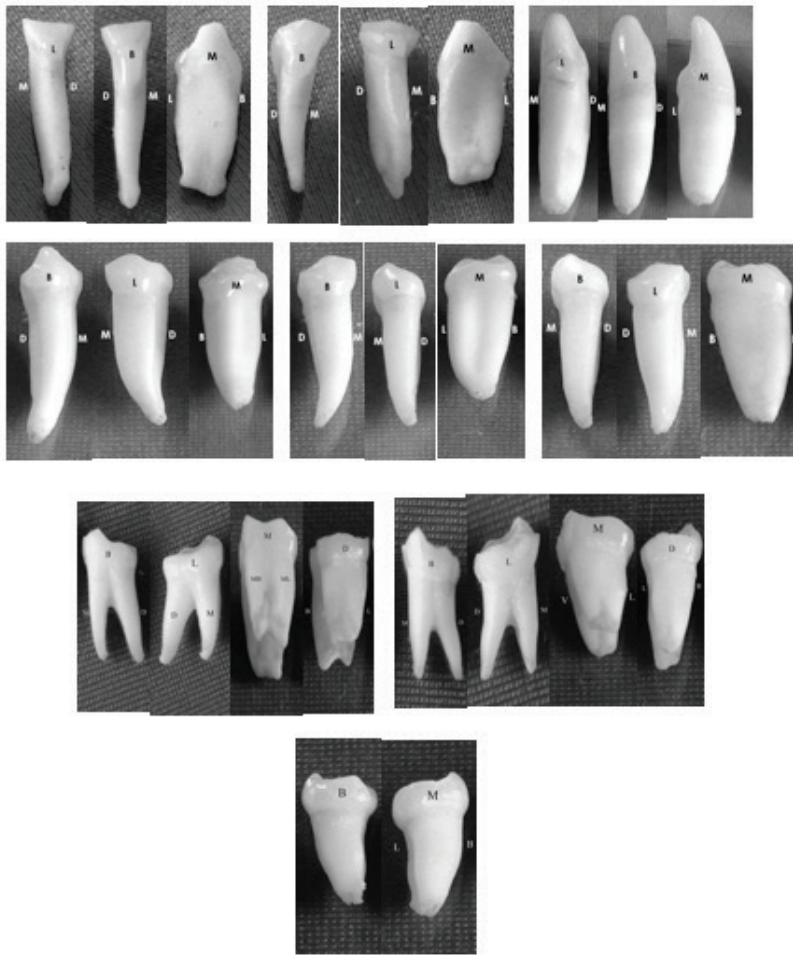


Figure 2 – Lower permanent teeth: (A) Central incisor; (B) Lateral incisor; (C) Canine; (D) First Pre molar; (E) Second Pre molar; (F) Third Pre molar; (G) First molar; (H) Second molar; (I) Third molar.

MARANHÃO, Pablo *et al.* Root morphology of the permanent dentition *Cebus apella*: morphometry and gross anatomy. *SALUSVITA*, Bauru, v. 37, n. 3, p. 527-535, 2018

MARANHÃO, Pablo et al. Root morphology of the permanent dentition *Cebus apella*: morphometry and gross anatomy. *SALUSVITA*, Bauru, v. 37, n. 3, p. 527-535, 2018

Table 2 - Lower teeth.

Lower		Root		
Arch	Mean length mm	Number	Shape	Direction
Central Incisor	0,6	Both	Both	Both
Lateral Incisor	0,5	01	M/D flat, thin	straight, M / D flat
Canine	1,5	01	Conic, voluminous	straight
Premolars	1°	All of them 01	All of them Voluminous, M/D	All of them Straight, with apical curvature
	2°			
	3°			
Molars	1°	Both	Both M/D flat	Mesial – Curved ; Distal - Straight Mesial and Distal - Straight
	2°	Mesial-0,6 / Distal-0,5		
	3°	0,5	01	Conic, voluminous, fusionade

\*On the 2 molar the bifurcation of Mesial and Distal roots occurs at apical third.

Font: authorship

## DISCUSSION

*The description of the morphology of the teeth of Cebus apella supports the adaptation of this animal for research endodontic. However, few data exist regarding the stomatognathic system. Therefore, this study sought to describe the anatomical aspects of their teeth.*

*The dental formula showed (in this paper) present typical peculiarities, like the existence of the third premolar, totaling 36 teeth. The number and shape of the Cebus apella teeth are similar to the human beings, presenting a few differences: the length in general is shorter; the apical third of upper and lower central and lateral incisors are flattened mesiodistally; all upper premolars present two roots; the first and second upper molars have two roots. Thus, the present study provides comprehensive information to the existing literature concerning the variation in root canal*

*morphology of the maxillary and mandibular teeth of Cebus apella. The group believes that this animal can be used as experimental model for dental research because its anatomical features are very similar to the human beings, in according with Cleaton e Austin (1978), Fejerskov (1979), Brigham (1985), Malagnino et al. (1997), Daris (2002), Silva et al. (2014), Ozcan et al. (2016) and Ahmad e Alenezi (2016) and also because the Primates National Center (PNCE) provides support to raise the animal in captivity for scientific finality. New studies have been made to complement the anatomic findings in order to amplify our knowledge about of this animal.*

## CONCLUSION

*The authors conclude that the morphometry and gross anatomy the Cebus apella teeth can be used as experimental model in substitution to the humans in dental researches, presenting a few differences: the length in general is shorter; the apical third of upper and lower central and lateral incisors are flattened mesiodistally; all upper premolars present two roots; the first and second upper molars have two roots. Thus, these data may help new researches to complement the histological characteristics of teeth in Cebus apella to amplify our knowledge about of this animal.*

## ACKNOWLEDGMENTS

*Animal supported by Brazilian Institute of Environmental Resources and Protection (IBAMA) (processo n. 02018.005455/02-13).*

MARANHÃO, Pablo et al. Root morphology of the permanent dentition *Cebus apella*: morphometry and gross anatomy. *SALUSVITA*, Bauru, v. 37, n. 3, p. 527-535, 2018



MARANHÃO, Pablo *et al.* Root morphology of the permanent dentition *Cebus apella*: morphometry and gross anatomy. *SALUSVITA*, Bauru, v. 37, n. 3, p. 527-535, 2018

## REFERENCES

AHMAD, I. A.; ALENEZI, M. A Root and Root Canal Morphology of Maxillary First Premolars: A Literature Review and Clinical Considerations. *J Endod.* New York, v. 42, n. 6, p. 861-72, 2016.

BRIGHAM, K. L. The use of animal in research. *N Engl J Med.* Massachusetts, v. 5, p. 89-110, 1985.

CLEATON, J. P.; AUSTIN, J. C. The role of laboratory animals in dental research. *J South Afr Vet Assoc.* South Africa, v. 49, p. 239-241, 1978.

CORNER, B. D.; RICHTSMEIER, J. T. Morphometric analysis of craniofacial growth in *Cebus apella*. *Am J Phys Antropol.* United States, v. 84, p. 323-342, 1991.

DARIS, R. S. **Primate Dentition: An Introduction to the Teeth of Non-Human Primates.** Cambridge: Cambridge University Press, 2002.

FEJERSKOV, O. Human dentition and experimental animals. *J Dent Res.* Virginia, v. 58, p. 725-734, 1979.

HERSHKOVITZ, P. **Living New World Monkeys (Platyrrhini) with an Introduction to Primates.** Ltd. London: The University of Chicago Press, 1977.

MALAGNINO, V.; GALLOTTINI, L.; PASSARIELLO, P. Some unusual clinical cases on root anatomy of permanent maxillary molars. *J Endod.* New York, v. 23, n. 2, p. 127-8, 1997.

OZCAN, G.; SEKerci, A. E.; CANTEKIN, K.; AYDINBELGE, M.; DOGAN, S. Evaluation of root canal morphology of human primary molars by using CBCT and comprehensive review of the literature. *Acta Odontol Scand.* Copenhagen, v. 74, n. 4, p. 250-8, 2016.

SILVA, E. J.; NEJAIM, Y.; SILVA, A. I.; HAITER-NETO, F.; ZAIA, A. A.; COHENCA, N. Evaluation of root canal configuration of maxillary molars in a Brazilian population using cone-beam computed tomographic imaging: an in vivo study. *J Endod.* New York, v.40, p. 2, p. 173-6, 2014.

WHITTAKER, D. K. The enamel-dentine junction of human and *Macaca irus* teeth: a light and electron microscopic study. *J Anat.* London, v. 125, p. 323-335, 1978.