

[DOI] 10.12016/j.issn.2096-1456.2020.02.005

· 临床研究 ·

下颌前磨牙C形根管的锥形束CT研究

孔倩颖¹, 梁立中²

1. 珠海市口腔医院种植科, 广东 珠海(519000); 2. 中山大学附属第五医院口腔科, 广东 珠海(519000)

【摘要】目的 采用锥形束CT(cone-beam computed tomography, CBCT)研究下颌前磨牙C形根管的发生率以及根管解剖形态,为临床诊疗提供参考。**方法** 收集508例患者共964颗下颌第一前磨牙,907颗下颌第二前磨牙的CBCT扫描数据,分析下颌前磨牙的根管形态及类型,C形根管的发生率、双侧对称性、解剖形态、根面沟位置。**结果** 下颌第一前磨牙C形根管发生率为4.1%,下颌第二前磨牙C形根管发生率为0.6%,差异有统计学意义($\chi^2 = 25.775, P < 0.001$)。下颌第一前磨牙C形根管双侧对称率为29%,下颌第二前磨牙无对称C形根管发生。C形根管各种构型在根管中的分布存在差异($P < 0.001$),C形根管下颌前磨牙的根管上段均未发现C形形态,多为圆形或椭圆形单根,C形构型主要存在于下颌前磨牙的根管中段和根尖段,以C2型多见。纳入研究的下颌前磨牙中,最常见的根管类型为Vertucci I单根管型,在下颌第一前磨牙和下颌第二前磨牙发生率分别为81.7%和98.3%,两者差异有统计学意义($\chi^2 = 140.544, P < 0.001$)。而下颌第一前磨牙的其他根管类型较下颌第二前磨牙多发,其Vertucci II、III、IV、V、C形根管发生率均高于下颌第二前磨牙($P < 0.001$)。C形根管下颌前磨牙均存在根面沟,位置大多位于近中舌侧。**结论** 下颌前磨牙C形根管形态复杂,CBCT可为临床诊疗提供直观准确的影像学依据。

【关键词】 C形根管; 根管形态; Vertucci分类; 下颌第一前磨牙; 下颌第二前磨牙; 锥形束CT; 解剖形态; 根面沟

【中图分类号】 R781.05 **【文献标志码】** A **【文章编号】** 2096-1456(2020)02-0088-05

【引用著录格式】 孔倩颖, 梁立中. 下颌前磨牙C形根管的锥形束CT研究[J]. 口腔疾病防治, 2020, 28(2): 88-92.

Cone-beam computed tomography study of C-shaped root canal of mandibular premolars KONG Qianying¹, LIANG Lizhong². 1. Department of Oral Implantology, Zhuhai Stomatology Hospital, Zhuhai 519000, China; 2. Department of Stomatology, The Fifth Affiliated Hospital of Sun Yat-sen University, Zhuhai 519000, China. Corresponding author: LIANG Lizhong, Email: llzhong@mail3.sysu.edu.cn, Tel: 86-756-2528844

【Abstract】 Objective To investigate the incidence and morphology of C-shaped root canals in mandibular premolars by cone-beam computed tomography (CBCT) imaging, which provides a reference for clinical diagnosis and treatment. **Methods** The CBCT scanning data of 964 mandibular first premolars and 907 mandibular second premolars in 508 cases were collected, and the root canal morphology, incidence of C-shaped root canals, bilateral symmetry and location of radicular grooves were analyzed. **Results** The incidence of C-shaped root canals in mandibular first premolars was 4.1% and that in mandibular second premolars was 0.6%. The incidence of C-shaped root canals of mandibular first premolars was significantly higher than that of mandibular second premolars ($\chi^2 = 25.775, P < 0.001$). The symmetrical ratio of C-shaped root canals in the mandibular first premolars was 29%. There were no symmetrical C-shaped root canals in the mandibular second premolars. There were significant differences in the distribution of the C-shaped root canal configuration in the root canal ($P < 0.001$). The C-shaped configuration mainly existed in the middle axial and apical level of the mandibular premolars. The C2 type was more common. No C-shape was found in the coronal level of the mandibular premolars. Vertucci I single tube type was the most common type of root canal for the mandibular premolars

【收稿日期】 2018-12-18; **【修回日期】** 2019-08-06

【基金项目】 广东省科技发展专项资金(公益研究与能力建设方向)项目计划(2016A020215031)

【作者简介】 孔倩颖, 主治医师, 硕士, Email: 314833802@qq.com

【通信作者】 梁立中, 副主任医师, 博士, Email: llzhong@mail3.sysu.edu.cn, Tel: 86-756-2528844



开放科学(资源服务)标识码(OSID)

included in this study; the incidences were 81.7% and 98.3% for the mandibular first and second premolars, respectively, and the difference was statistically significant ($\chi^2 = 140.544, P < 0.001$). The other root canal types of mandibular first premolars were more than those of mandibular second premolars. The incidences of Vertucci II, III, IV, and V and C-shaped root canals in mandibular first premolars were significantly higher than those in mandibular second premolars. C-shaped root canal mandibular premolars had radicular grooves, and most of them were located at the mesiolingual side. **Conclusion** The morphology of the C-shaped root canal in mandibular premolars was complicated. CBCT can provide direct and accurate imaging evidence for clinical diagnosis and treatment.

【Key words】 C-shaped root canal; root canal morphology; Vertucci classification; mandibular first premolar; mandibular second premolar; cone-beam computed tomography; anatomical morphology; radicular groove

J Prev Treat Stomatol Dis, 2020, 28(2): 88-92.

根管治疗术前对根管及牙根解剖形态的充分了解是治疗成功的关键一步,复杂的根管解剖结构常造成治疗困难或治疗失败。多种多样的根管系统中,C形根管被认为是最复杂最难以治疗彻底的类型,常见于下颌第二磨牙^[1],近年来有学者报道其存在于上颌磨牙^[2]和下颌前磨牙^[3]。C形根管系统存在复杂多样的变异和难以清理的弧形、窄长或网状等不规则峡区,以及牙根根面沟引起的牙周问题等,都成为临床治疗的难点^[4]。目前对下颌前磨牙C形根管的研究仍非常有限。本研究分析珠海市口腔医院508例患者CBCT扫描数据,研究下颌第一前磨牙和第二前磨牙的牙根和根管形态结构,为临床诊疗提供参考。

1 材料和方法

1.1 研究对象

收集2014~2018年于珠海市口腔医院就诊行CBCT检查的患者共508例(男性247例,女性261例),年龄(38 ± 12.4)岁,964颗下颌第一前磨牙,907颗下颌第二前磨牙。纳入标准:所有病例下颌前磨牙牙根发育完全,可清晰读取其解剖结构。排除已行牙髓治疗,牙根吸收,和根尖未发育完全的患牙。

1.2 研究方法

使用I-CAT 17-19锥形束CT(I-CAT CBCT, Imaging Sciences International LLC, USA)进行全牙列扫描,电压120 kv,电流5 mA,扫描层厚0.2~0.25 mm。收集信息如下:①根管形态和类型(Vertucci分类);②C形根管出现的情况和位置(前磨牙C形根管定义为:根管系统内任何位置出现C1或C2构型的前磨牙^[5]);③C形根管下颌前磨牙在根上1/3(釉牙本质界下2 mm)、根中1/3、根尖1/3(距根尖孔2 mm内)的横截面形态和分类(参照Fan等^[5]C

形根管分类方法,C1:根管横截面为连续“C”字形,中间无分隔;C2:根管横截面为类似于“C”字形中断形成的分号形状;C3:根管横截面为两个独立的圆形或椭圆形;C4:根管横截面只有一个圆形、椭圆形或者一根直线;C5:横截面有3个或者更多独立的根管;C6:未见明显根管影像);④根面沟存在情况和位置。

1.3 统计学分析

使用SPSS 22.0软件进行统计分析,下颌第一前磨牙和下颌第二前磨牙的各种根管类型发生率比较用卡方检验,C形根管构型的根管内分布、下颌前磨牙根面沟的位置分布比较用Fisher确切概率法, $P < 0.05$ 为差异有统计学意义。

2 结果

2.1 下颌前磨牙C形根管发生率

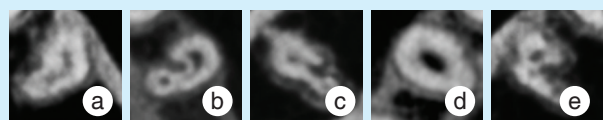
964颗下颌第一前磨牙中,C形根管发生率为4.1%(40/964);907颗下颌第二前磨牙中,C形根管发生率为0.6%(5/907),差异有统计学意义($\chi^2 = 25.775, P < 0.001$)。

2.2 下颌前磨牙C形根管的左右对称性

31例下颌第一前磨牙出现C形根管结构的患者中,22例患者于单侧出现C形根管,9例患者双侧下颌第一前磨牙发现C形根管结构,双侧对称率占29%。5例下颌第二前磨牙出现C形根管结构的患者中,C形根管均出现在单侧,无双侧对称。

2.3 下颌前磨牙C形根管解剖

对45个C形根管的CBCT截面图分析结果显示,根管上段均未发现C形形态,主要为圆形或椭圆形单根,根中段可见C1、C2等构型,以C2型多见,根尖段过渡为C3、C4、C5等多种形态(图1),C型根管构型主要集中在根管中下段(图2)。表1



a: C1 root canal configuration; b: C2 root canal configuration; c: C3 root canal configuration; d: C4 root canal configuration; e: C5 root canal configuration

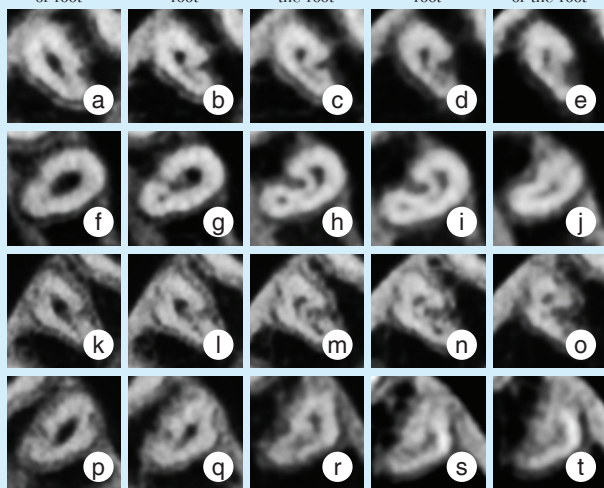
Figure 1 CBCT cross-section of various C-shaped root canal configurations of mandibular premolars

图1 下颌前磨牙各种C形根管构型的CBCT横截面图

显示C形根管各种构型在根管中的分布存在差异 ($P < 0.001$)。

下颌前磨牙中,最常见的根管类型为Vertucci I 单根管型,在下颌第一前磨牙和颌第二前磨牙发生率分别为81.7%和98.3%,颌第二前磨牙Vertucci I 型根管发生率高于颌第一前磨牙 ($\chi^2 = 140.544, P < 0.001$)。而颌第一前磨牙Vertucci II、III、IV、V、C形根管发生率均高于颌第二前磨牙 ($P < 0.001$, 表2)。

Cervical third of root Upper middle of root Midthird of the root Lower middle of root Apical third of the root



a ~ e: C-shaped root canal morphology changes from C4 (a) to C1 (c ~ e); f ~ j: C-shaped root canal morphology changes from C4 (f) to C2 (h) and back to C4 (j); k ~ o: C-shaped root canal morphology changes from C4 (k) to C2 (m) then to C5 (o); p ~ t: C-shaped root canal morphology changes from C4 (p) to C1 (r ~ t)

Figure 2 CBCT cross-sectional view of 4 cases of C-shaped root canals of mandibular premolars showing changes in root canal morphology from the cervical to the apical segment

图2 4例C形根管下颌前磨牙的CBCT横截面图显示从根上到根尖段的根管形态变化

表1 C形根管各种构型在根管中分布

Table 1 Distribution of various configurations of C-shaped root canals in root canals

C-shaped root canal morphology	Cervical-third of root	Middle-third of the root	Apical-third of the root	<i>n</i>	<i>P</i>
C1	0	7	2		< 0.001
C2	0	36	0		
C3	0	0	33		
C4	45	0	8		
C5	0	2	2		
Total	45	45	45		

2.4 C形根管下颌前磨牙根面沟的位置分布

45个C形根管下颌前磨牙均具有根面沟结构,位置大多位于近中舌侧(40个);颌第一前磨牙与颌第二前磨牙的根面沟分布差异无统计意义 ($P = 0.461$, 表3)。

3 讨论

近年来陆续有学者报道下颌前磨牙根管存在

表2 下颌前磨牙根管类型分布

Table 2 Distribution of root canal types of mandibular premolars

Vertucci type	Mandibular first premolar	Mandibular second premolar	χ^2	<i>P</i>
	Number of teeth	Number of teeth		
I (1-1)	788(81.7%)	892(98.3%)	140.544	< 0.001
II (2-1)	30(3.1%)	5(0.6%)	16.694	< 0.001
III (1-2-1)	22(2.3%)	0	20.945	< 0.001
IV (2-2)	17(1.8%)	0	16.141	< 0.001
V (1-2)	67(7.0%)	5(0.6%)	51.714	< 0.001
C	40(4.1%)	5(0.6%)	25.775	< 0.001
Total	964	907		

表3 C形根管下颌前磨牙根面沟分布

Table 3 Distribution of radicular groove of mandibular premolars with C-shaped root canals

	Mesiolingual side	Lingual side	Total	<i>P</i>
	n(%)	n(%)		
Mandibular first premolar	36(90%)	4(10%)	40	0.461
Mandibular second premolar	4(80%)	1(20%)	5	

多种形态变异^[6-7],据现有针对下颌第一前磨牙的离体解剖研究显示,C形根管发生率存在地域和种族差异,例如巴西地区的C形根管发生率为18.57%^[8],伊朗地区为6.6%^[9],中国台北为18%^[10]。另有CBCT研究结果显示下颌第一前磨牙C形根管在中国西部地区发生率为1.1%^[11],葡萄牙和土耳其地区发生率相似,分别为2.3%和2.1%^[12-13]。而下颌第二前磨牙C形根管发生率更低,在中国西部地区、葡萄牙和中国台湾研究结果显示其发生率分别为0.6%、0.6%和2.2%^[11,12,14]。本研究收集1 871个下颌前磨牙CBCT扫描数据,结果显示下颌第一前磨牙C形根管发生率为4.1%,高于以上CBCT研究结果,下颌第二前磨牙C形根管发生率为0.6%,与上述研究结果一致。多项研究结果差异甚大,可能与样本量不同,以及研究人群地域差异有关。以上报道部分采用离体标本研究,离体研究对象均为由于各种原因无法治疗而拔除的牙齿,无法代表正常人群的根管形态。本研究对象均为活体,相比离体牙研究样本更真实反应人群中下颌前磨牙根管形态多样性。

本研究发现下颌前磨牙C形根管系统错综复杂,从根管口到根尖段形态变化多样,C形根管根上1/3横截面主要呈现为圆形或椭圆形单根,复杂的C1及C2等构型常开始于根中部1/3,以C2型多见,根尖段可过渡为C2、C3、C4、C5等多种形态,C形根管构型主要存在于根中下1/3,与Fan等^[5]报道一致,由此有学者提出下颌前磨牙开髓孔应在颊舌方向上适当延伸,以便于显微镜下更好暴露根中下1/3根管结构,并预弯器械,往颊舌侧多个方向仔细探查,避免遗漏^[14]。研究表明C形根管来源于牙齿发育过程中的上皮根鞘融合不全形成有纵向根面沟的牙根^[15],本研究结果证实出现C形根管的下颌前磨牙均具有根面沟的结构,其位置多位于近中舌侧,提示患牙根管治疗后如需桩冠修复,其桩道制备应限于未出现C形构型的根管冠上1/3段,并谨慎设计桩道的大小及长度,防止侧穿。

本研究结果显示,在31例出现C形根管下颌第一前磨牙的患者中,22例患者于单侧出现C形根管结构,9例患者双侧下颌第一前磨牙均发现C形根管结构,下颌第一前磨牙C形根管对称率为29%;而下颌第二前磨牙无对称的C形根管病例出现。多项研究显示各地区下颌前磨牙C形根管双侧对称率各不相同,Martins等^[12]报道葡萄牙地区

下颌第一前磨牙和下颌第二前磨牙C形根管对称发生率分别为38.9%和25.0%;Chen等^[14]报道中国台湾地区下颌第二前磨牙C形根管双侧发生率为62.5%,提示C形根管发生可能具有对称性,若一侧下颌前磨牙出现C形根管,应留意对侧可能出现同样情况,作为临床检查的参考,提高变异根管的发现率。

CBCT克服传统放射技术的限制,真实清晰显示牙齿矢状面、冠状面、横截面的形态结构,为牙髓治疗在根管系统多样性方面提供可靠依据^[16]。临床检查根尖片若发现根管影像在根中下1/3突然变窄、偏移或消失,应考虑根管变异的可能。通过CBCT明确根管形态,同时利用根管显微镜的照明和放大功能,结合超声技术,对变异根管进行识别。本实验应用CBCT研究下颌前磨牙根管系统的三维图像,清晰显示了其多种形态变异,为临床诊疗提供了充分依据。

综上所述,下颌前磨牙C形根管系统变异多样,临床医生诊疗前应充分认识其复杂性,利用CBCT和根管显微镜等辅助设备对根管形态作充分了解 and 预判。

参考文献

- [1] Kato A, Ziegler A, Higuchi N, et al. Aetiology, incidence and morphology of the C-shaped root canal system and its impact on clinical endodontics[J]. *Int Endod J*, 2014, 47(11): 1012-1033.
- [2] Martins JN, Mata A, Marques D, et al. Prevalence and characteristics of the maxillary C-shaped molar[J]. *J Endod*, 2016, 42(3): 383-389.
- [3] Ordinola-Zapata R, Monteiro Bramante C, Gagliardi Minotti P, et al. Micro-CT evaluation of C-shaped mandibular first premolars in a Brazilian subpopulation[J]. *Int Endod J*, 2015, 48(8): 807-813.
- [4] Karabucak B, Bunes A, Chehoud C, et al. Prevalence of apical periodontitis in endodontically treated premolars and molars with untreated canal: a cone-beam computed tomography study[J]. *J Endod*, 2016, 42(4): 538-541.
- [5] Fan B, Yang J, Gutmann JL, et al. Root canal systems in mandibular first premolars with C-shaped root configurations. Part I: micro-computed tomography mapping of the radicular groove and associated root canal cross-sections[J]. *J Endod*, 2008, 34(11): 1337-1341.
- [6] Kottoor J, Albuquerque D, Velmurugan N, et al. Root anatomy and root canal configuration of human permanent mandibular premolars: a systematic review[J]. *Anat Res Int*, 2013: 254250.
- [7] 刘钦捷, 罗明, 梁衍平, 等. 下颌第一前磨牙3牙根3根管临床报告及文献回顾[J]. *口腔疾病防治*, 2017, 25(10): 656-660.
Liu QJ, Luo M, Liang YP, et al. Clinical report and literature review of mandibular first premolar with three roots and three root

- canals[J]. J Prev Treat Stomatol Dis, 2017, 25(10): 656-660.
- [8] Boschetti E, Silva-Sousa YTC, Mazzi-Chaves JF, et al. Micro-CT evaluation of root and canal morphology of mandibular first premolars with radicular grooves[J]. Braz Dent J, 2017, 28(5): 597-603.
- [9] Khademi A, Mehdizadeh M, Sanei M, et al. Comparative evaluation of root canal morphology of mandibular premolars using clearing and cone beam computed tomography[J]. Dent Res J (Isfahan), 2017, 14(5): 321-325.
- [10] Sun Y, Lu TY, Chen YC, et al. The best radiographic method for determining root canal morphology in mandibular first premolars: a study of Chinese descendants in Taiwan[J]. J Den Sci, 2016, 11(2): 175-181.
- [11] Yu X, Guo B, Li KZ, et al. Cone-beam computed tomography study of root and canal morphology of mandibular premolars in a western Chinese population[J]. BMC Med Imaging, 2012, 12: 18.
- [12] Martins JN, Francisco H, Ordinola-Zapata R. Prevalence of C-shaped configurations in the mandibular first and second premolars: a cone-beam computed tomographic *in vivo* study[J]. J Endod, 2017, 43(6): 890-895.
- [13] Arslan H, Capar ID, Ertas ET, et al. A cone-beam computed tomographic study of root canal systems in mandibular premolars in a Turkish population: Theoretical model for determining orifice shape[J]. Eur J Dent, 2015, 9(1): 11-19.
- [14] Chen YC, Tsai CL, Chen YC, et al. A cone-beam computed tomography study of C-shaped root canal systems in mandibular second premolars in a Taiwan Chinese subpopulation[J]. J Formos Med Assoc, 2018, 117(12): 1086-1092.
- [15] Dou L, Li D, Xu T, et al. Root anatomy and canal morphology of mandibular first premolars in a Chinese population[J]. Sci Rep, 2017, 7(1): 750.
- [16] 刘忠俊, 张治勇, 邝锐芳, 等. CBCT检测下颌第一磨牙近中根管峡区的发生率[J]. 口腔疾病防治, 2018, 26(11): 43-47.
- Liu ZJ, Zhang ZY, Kuang RF, et al. CBCT detection of the incidence of middle mesial canal and isthmus in the mandibular first molar[J]. J Prev Treat Stomatol Dis, 2018, 26(11): 43-47.

(编辑 罗燕鸿, 曾雄群)



官网



公众号

· 短讯 ·

热烈祝贺《口腔疾病防治》杂志被世界著名检索系统DOAJ收录

本刊编辑部于2019年5月16日收到The DOAJ Team的邮件正式通知《口腔疾病防治》杂志已被DOAJ收录。

DOAJ(Directory of Open Access Journals)为全球最具影响力的开放获取期刊数据库之一,由瑞典Lund大学于2003年创建,该系统对期刊遴选和收录的标准高、要求严;收录期刊的文章均经过严格的同行评议或评审,质量高并与期刊同步免费下载全文,在学术研究方面有极高的参考价值。目前,DOAJ已收录全世界130个国家13 280种期刊,涵盖自然科学和社会科学各个领域。截止2017年12月31日,我国被DOAJ收录的期刊为121种,其中大陆71种,香港地区20种,台湾地区30种。

《口腔疾病防治》杂志被DOAJ收录,将进一步提高本刊的国际影响力,促进本刊国际化发展。

南方医科大学口腔医院《口腔疾病防治》编辑部