

Appendix 3

Summary Table of the Root Numbers of the Permanent Mandibular Teeth

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See Appendix 4 for a list of references.

Permanent Mandibular Teeth: Number of Roots										
	NUMBER OF ROOTS						No. of Studies	References	No. of Teeth	Most Common Anomaly or Variation (Number of Case Reports In Brackets)
	Most Common	1	2	3	4	Other				
Central incisors	1 Root	100%					13	Verna, GR et al 2017 (118), Kamtane, S and Ghodke, M 2016 (119), Zhengyan, Y et al 2016 (120), Kayaoglu, G et al 2015 (121), Han, T et al 2014 (122), Lin, Z et al 2014 (123), Aminsobhani, M et al 2013 (124), Sert, S and Bayirli, GS 2004 (3), Çaliskan, MK et al 1995 (4), Vertucci FJ 1974 (125), Madiera MC and Hetem S 1973 (126), Pineda F and Kuttler Y 1972 (6), Barrett MT 1925 (7)	9728	Dens invaginatus (6) Dens evaginatus (talon cusp) (6) 2 canals (6)
Lateral incisors	1 Root	100%					13	Verna, GR et al 2017 (118), Kamtane, S and Ghodke, M 2016 (119), Zhengyan, Y et al 2016 (120), Kayaoglu, G et al 2015 (121), Han, T et al 2014 (122), Lin, Z et al 2014 (123), Aminsobhani, M et al 2013 (124), Sert, S and Bayirli, GS 2004 (3), Çaliskan, MK et al 1995 (4), Vertucci, FJ 1974 (125), Vertucci, FJ 1974 (125), Madiera, MC and Hetem, S 1973 (126), Pineda, F and Kuttler, Y 1972 (6), Barrett, MT 1925 (7)	9664	2 canals (5) Dens invaginatus (4)
Canines	1 Root	96.7%	3.3%				10	Soleymani, A et al 2017 (127), Shemesh, A et al 2016 (128), Zhengyan, Y et al 2016 (120), Kayaoglu, G et al 2015 (121), Han, T et al 2014 (122), Amin-sobhani, M et al 2013 (124), Ouellet, R 1995 (129), Pecora, JD et al 1993 (130), Alexandersen, V 1963 (131), Barrett, MT 1925 (7)	16452	2 roots and 2 canals (8) 2 roots and 3 canals (3) 1 root and 2 canals (3)

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	NUMBER OF ROOTS						No. of Studies	References	No. of Teeth	Most Common Anomaly or Variation (Number of Case Reports In Brackets)
	Most Common	1	2	3	4	Other				
First premolar	1 Root	94.3%	4.8%	0.1%	0.1%		26	Alkaabi, W et al 2017 (132), Bürklein, S et al (2017) (9), Dou, L et al 2017 (133), Abraham, SB and Gopinath, VK 2015 (134), Bulut, DG et al 2015 (11), Huang, Y-D et al 2015 (135), Kazemipoor, M et al 2015 (136), Kazemipoor, M et al 2015 (137), Kong, L-j et al 2015 (138), Llana, C et al 2014 (139), Singh, S and Pawar, M 2014 (140), Alhadainy, HA 2013 (141), Yang, H et al, 2013 (142), Yu, X et al 2012 (143), Jain, A and Bahuguna, R 2011 (144), Khedmat, S et al 2010 (145), Awawdeh, LA and Al-Qudah, AA 2008 (146), Rahimi, S et al 2007 (147), Iyer, VH et al 2006 (148), Sert, S and Bayirli, GS 2004 (3), Zaatar, El et al 1997 (19), Çaliskan, MK et al 1995 (4), Geider, P et al 1989 (149), Vertucci, F 1978 (150), Schulze, C 1970 (151), Barrett, MT 1925 (7)	14137	3 roots and 3 canals (5) 1 root and 2 canals (5) 1 root and 3 canals (5) Dens evaginatus (4) 2 roots and 2 canals (3) 3 canals (3) C-shaped canal (4)
Second premolar	1 Root	98.4%	1.4%	0.1%			20	Bürklein, S et al (2017) (9), Bulut, DG et al 2015 (11), Kazemipoor, M et al 2015 (136), Kazemipoor, M et al 2015 (137), Lena, C et al 2014 (139), Singh, S and Pawar, M 2014 (140), Bolhari, B et al 2013 (152), Yu, X et al 2012 (143), Parekh, V et al 2011 (153), Rahimi, S et al 2009 (1), Awawdeh, LA and Al-Qudah, AA 2008 (146), Rahimi, S et al 2007 (147), Sert, S and Bayirli, GS 2004 (3), Zaatar, El et al 1997 (19), Çaliskan, MK et al 1995 (4), Geider, P et al 1989 (149), Vertucci, F 1978 (150), Zillich, R and Dowson, J 1973 (154), Visser, JB 1948 (155), Barrett, MT 1925 (7)	8002	3 canals (12) 2 roots and 2 canals (11) C-shaped canal (7) Dens evaginatus (6) 3 roots and 3 canals (6)

	NUMBER OF ROOTS						No. of Studies	References	No. of Teeth	Most Common Anomaly or Variation (Number of Case Reports In Brackets)
	Most Common	1	2	3	4	Other				
First molar										Radix entomolaris (32) 2 roots and 5 canals (3M and 2D) (20) 2 roots and 4 canals (3M and D) (10) 2 roots and 5 canals (2M and 3D) (8) 2 roots and 6 canals (3M and 3D) (7)
Caucasian & others (excluding Asian & NA Native)	2 Roots (M&D)	0.2%	96.3%	3.5%			28	Madani, ZS et al 2017 (156), Mohammadzadeh Akhlaghi, N et al 2017 (157), Celikten, B et al 2016 (158), Martins, JN et al 2016 (37), Rodrigues, CT et al 2016 (159), Peiris, R et al 2015 (160), Chourasia, HR et al 2012 (161), Colak, H et al 2012 (162), Chandra, SS et al 2011 (163), Al-Qudah, AA and Awawdeh, LA 2009 (164), Schafer, E et al 2009 (165), Pattanshetti, N et al 2008 (50), Reuben, J et al 2008 (166), Shahi, s et al 2008 (167), Ahmed, HA et al 2007 (168), Peiris, R et al 2007 (169), Al-Nazhan, S 1999 (170), Sperber, GH and Moreau, JL 1998 (171), Zaatar, EI et al 1998 (172), Zaatar, EI et al 1997 (19), Rocha, LF et al 1996 (173), Younes et al 1990 (174), Curzon, MEJ 1974 (175), Curzon, MEJ 1973 (176), de Souza-Freitas, JA et al 1971 (177), Skidmore, AE and Bjorndal, AM 1971 (178), Barrett, MT 1925 (7)	9639	
Asian & NA Native	2 Roots (M&D)	0.4%	77.5%	22.1%			17	Zhang, X et al 2015, Jang, J-K et al 2013 (179), Kim, S-Y et al 2013 (180), Zhang, R et al 2011 (181), Huang, CC et al 2010 (182), Wang, Y et al 2010 (183), Chen, G et al 2009 (184) Gulabivala, K et al 2002 (185), Gulabivala, K et al 2001 (186), Yew, S and Chan, K 1993 (187), Morita, M 1990 (188), Harada, Y et al 1989 (189), Onda, S et al 1989 (190), Walker, R 1988 (191), Reichart, PA and Metah, D 1981 (192), Curzon, MEJ 1974 (175), de Souza-Freitas, JA et al 1971 (177)	11632	

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	NUMBER OF ROOTS						No. of Studies	References	No. of Teeth	Most Common Anomaly or Variation (Number of Case Reports In Brackets)
	Most Common	1	2	3	4	Other				
All studies	2 Roots (M&D)	0.3%	86.0%	13.7%			45	Madani, ZS et al 2017 (156), Mohammadzadeh Akhlaghi, N et al 2017 (157), Celikten, B et al 2016 (158), Martins, JN et al 2016 (37), Rodrigues, CT et al 2016 (159), Peiris, R et al 2015 (160), Chourasia, HR et al 2012 (161), Colak, H et al 2012 (162), Chandra, SS et al 2011 (163), Al-Qudah, AA and Awawdeh, LA 2009 (164), Schafer, E et al 2009 (165), Pattanshetti, N et al 2008 (50), Reuben, J et al 2008 (166), Shahi, s et al 2008 (167), Ahmed, HA et al 2007 (168), Peiris, R et al 2007 (169), Al-Nazhan, S 1999 (170), Sperber, GH and Moreau, JL 1998 (171), Zaatar, El et al 1998 (172), Zaatar, El et al 1997 (19), Rocha, LF et al 1996 (173), Younes et al 1990 (174), Curzon, MEJ 1974 (175), Curzon, MEJ 1973 (176), de Souza-Freitas, JA et al 1971 (177), Skidmore, AE and Bjorndal, AM 1971 (178), Barrett, MT 1925 (7), Zhang, X et al 2015, Jang, J-K et al 2013 (179), Kim, S-Y et al 2013 (180), Zhang, R et al 2011 (181), Huang, CC et al 2010 (182), Wang, Y et al 2010 (183), Chen, G et al 2009 (184), Gulabivala, K et al 2002 (185), Gulabivala, K et al 2001 (186), Yew, S and Chan, K 1993 (187), Morita, M 1990 (188), Harada, Y et al 1989 (189), Onda, S et al 1989 (190), Walker, R 1988 (191), Reichart, PA and Metah, D 1981 (192), Curzon, MEJ 1974 (175), de Souza-Freitas, JA et al 1971 (177)	21271	

	NUMBER OF ROOTS						No. of Studies	References	No. of Teeth	Most Common Anomaly or Variation (Number of Case Reports In Brackets)
	Most Common	1	2	3	4	Other				
Second molar	2 Roots (M&D)	23.2%	53.7%	1.8%	0.1%		27	Madani, ZS et al 2017 (156), Pawar, AM et al 2017 (193), Akhaghi, NM et al 2016 (194), Celikten, B et al 2016 (158), Kim, SY et al 2016 (195), Martins, JN et al 2016 (37), Shemesh, A et al 2015 (196), Silva, EJNL et al 2013 (197), Zare Jahromi, M et al 2013 (198), Zhang, R et al 2011 (181), Zheng, Q et al 2011 (199), Neelakantan, P et al 2010 (200), Al-Qudah, AA and Awawdeh, LA 2009 (164), Rahimi, S et al 2008 (201), Ahmed, HA et al 2007 (168), Peiris, R et al 2007 (169), Cheung, LHM et al 2006 (202), Gulabivala, K et al 2002 (185), Gulabivala, K et al 2001 (186), Zaatar, El et al 1997 (19), Rocha, LF da Costa et al 1996 (173), Manning, SA 1990a (203), Onda, S et al 1989 (190), Walker, RT 1988 (204), Weine, FS et al 1988 (205), Kotoku, K 1985 (206), Barrett, MT 1925 (7)	13932	C-shaped canal (19) Taurodontism (18) Fusion with a paramolar (7) 3 roots (MB, MLI, and D) and 3 canals (6) 1 root and 1 canal (6)
Third molar	2 Roots (M&D)	42.8%	53.3%	3.7%	0.1%	0%	10	Somasundaram, P et al 2017 (207), Park, J-B et al 2013 (208), Kuzekanani, M et al 2012 (209), Sert, S et al 2011 (60), Gulabivala, K et al 2002 (185), Gulabivala, K et al 2001 (186), Sidow, SJ et al 2000 (62), Guerisoli, DM et al 1998 (63), Ogiwara, I et al 1981 (210), Barrett, MT 1925 (7)	14001	Highly variable; variation is the norm