Appendix 2

Summary Table of the Root Canal Systems of the Permanent Maxillary Teeth

Blaine Cleghorn, and William Christie

See Appendix 4 for a list of references.

Permanent Maxillary Teeth: Number of Canals

	NUMBER OF CANALS						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 *2 or more canals	1 Canal	99.1%	0.9%*				9	Da Silva, EJ et al 2016 (64), Altunsoy, M et al 2014 (65), Rahimi, S et al 2009 (1), Weng, X-L et al 2009 (2), Sert, S and Bayirli, GS 2004 (3), Çaliskan, MK et al 1995 (4), Vertucci, F 1984 (5), Pineda, F and Kuttler, Y 1972 (6), Barrett MT 1925 (7)	2635	Dens evaginatus (17) 2 roots and 2 canals (14) 1 root and 2 canals (10) Fusion (9) Dens invaginatus (7)
Lateral incisors *2 or more canals	1 Canal	96.0%	4.0%*				9	Da Silva, EJ et al 2016 (64), Altunsoy, M et al 2014 (65), Weng, X-L et al 2009 (2), Sert, S and Bayirli, GS 2004 (3), Çaliskan, MK et al 1995 (4), Vertucci, F 1984 (5), Bjorndal, AM and Skidmore, AE 1983 (8), Pineda, F and Kuttler, Y 1972 (6), Barrett MT 1925 (7)	2531	Dens invaginatus (58) Palatogingival groove (20) Dens evaginatus (talon cusp) (17) 2 roots and 2 canals (10) 1 root and 2 canalsa(10)
Canines *2 or more canals	1 Canal	95.6%	4.4%*				10	Da Silva, EJ et al 2016 (64), Altunsoy, M et al 2014 (65), Somalinga, NS et al 2014 (66), Weng, X-L et al 2009 (2), Sert, S and Bayirli, GS 2004 (3), Çaliskan, MK et al 1995 (4), Vertucci, F 1984 (5), Bjorndal, AM and Skidmore, AE 1983 (8), Pineda, F and Kuttler, Y 1972 (6), Barrett MT 1925 (7)	2815	Dens invaginatus (7) 1 root and 2 canals (2) Dens evaginatus (talon cusp) (2) 2 roots (2)
First premolar										3 roots and 3 canals (20) Furcation groove (palatal of B root) (3) Dens evaginatus (2)
Caucasian & others (excluding Asian & NA Native)*	2 Canals	11.3%	85.7%	1.7%		1.4%	20	Bürklein, S et al (2017) (9), Abella, F et al 2015 (10), Gupta, S et al (2015) (12), Ok, E et al 2014 (67), Ng'ang'a, RN et al 2010 (14), Weng, X-L et al 2009 (2), Ateih, M 2008 (15), Awawdeh, L et al 2008 (16), Sert, S and Bayirli, GS 2004 (3), Kartal, N et al 1998 (18), Zaatar, EI et al 1997 (19), Çaliskan, MK et al 1995 (4), Pecora, JD et al 1991 (20), Bellizzi, R and Hartwell, G 1985 (68), Vertucci, F and Gegauff, A 1979 (21), Carns, EJ and Skidmore, AE 1973 (22), Green, D 1973 (23), Pineda, F and Kuttler, Y 1972 (6), Mueller, AH 1933 (24), Barrett, MT 1925 (7), Hess, W 1925 (69)	6368	
Asian & NA Native	2 Canals	34.2%	63.2%	0.4%		2.4%	4	Weng, X-L et al 2009 (2), Cheng, XL and Weng, YL 2008 (26), Loh, HS et al 1998 (27), Walker, RT 1987 (204)	1574	
All studies		15.8%	81.2%	1.4%		1.6%	24	Bürklein, S et al (2017) (9), Abella, F et al 2015 (10), Gupta, S et al (2015) (12), Ok, E et al 2014 (67), Ng'ang'a, RN et al 2010 (14), Weng, X-L et al 2009 (2), Ateih, M 2008 (15), Awawdeh, L et al 2008 (16), Cheng, XL and Weng, YL 2008 (26), Sert, S and Bayirli, GS 2004 (3), Kartal, N et al 1998 (18), Loh, HS et al 1998 (27), Zaatar, EI et al 1997 (19), Çaliskan, MK et al 1995 (4), Pecora, JD et al 1991 (20), Walker, RT 1987 (29), Bellizzi, R and Hartwell, G 1985 (68), Vertucci, F and Gegauff, A 1979 (21), Carns, EJ and Skidmore, AE 1973 (22), Green, D 1973 (23), Pineda, F and Kuttler, Y 1972 (6), Mueller, AH 1933 (24), Barrett, MT 1925 (7), Hess, W 1925 (69)	7942	
Second premolar	1 or 2 Canals	47.1%	50.8%	0.8%		1.3%	19	Bürklein, S et al (2017) (9), Elnour, M et al 2016 (30), Abella, F et al 2015 (10), Ok, E et al 2014 (67), Yang, L et al 2014 (31), Jayamisha Raj, UJ and Sumitha, M 2009 (70), Weng, X-L et al 2009 (2), Sert, S and Bayirli, GS 2004 (3), Kartal, N et al 1998 (18), Zaatar, EI et al 1997 (19), Çaliskan, MK et al 1995 (4), Pecora, JD et al 1992 (32), Sikri, VK and Sikri, P 1991 (33), Bellizzi, R and Hartwell, G 1985 (68), Vertucci, F 1984 (5), Green, D 1973 (23), Pineda, F and Kuttler, Y 1972 (6), Mueller, AH 1933 (24)	5815	3 roots and 3 canals (16) Dens evaginatus (2)

First molar (three roots) *2 or more canals							3 roots (MB, DB and Palatal) and 4-5 canals (1-2 MB, DB and 2 Palatal) (26)
MB	2 Canals	40.2%	59.8%*	71	Alrahabi, M and Zafar, MS 2015 (40), Marroquin, B et al 2015 (71), Singh, S and Pawar, M 2015 (42), Bhuyan, AC et al 2014 (43), Kim, Y et al 2013 (72), Gu, Y et al 2011 (73), Peeters, HH et al 2011 (74), Somma, F et al 2009 (75), Weng, X-L et al 2009 (2), Abiodun-Solanke, IM et al 2008 (76), Alacam, T et al 2008 (77), Khraisat, A and Smadi, L 2007 (78), Rwenyonyi, CM et al 2007 (51), Eder, A et al 2006 (79), Smadi, L and Khraisat, A 2006 (80), Jung, I-Y et al 2005 (81), Scott, AE and Apicella, MJ 2004 (82), Sert, S and Bayirli, GS 2004 (3), Alavi, AM et al 2002 (61), Schwarze, T et al 2002 (83), Wasti, F et al 2001 (84), al Shalabi, RM et al 2000 (52), Weine, FS et al 1999 (85), Imura, N et al 1998 (86), Çaliskan, MK et al 1995 (4), Thomas, RP, Moule, AJ and Bryant, R 1993 (53), Pecora, JD et al 1992 (87), Kulild, JC and Peters, DD 1990 (88), Gilles, J and Reader, A 1990 (89), Vertucci, F 1984 (5), Gray, R 1983 (54), Acosta Vigouroux SA and Trugeda Bosaans, SA 1978 (90), Seidberg, BH et al 1973 (91), Pineda, F and Kuttler, Y 1972 (6), Sykaras, SN and Economou, PN 1971 (92), Weine, FS 1969 (93), Okamura, T 1927 (94), Hess, W 1925 (69), Zürcher, E 1925 (95), Moral, H 1914 (96), Ghobashy, AM et al 2017 (35), Khademi, A et al 2, MS017 (36), Betancourt, P et al 2016 (97), Coelho, MS et al 2016 (98), Naseri, M et al 2016 (38), Tian, X-M et al 2016 (39), Guo, J et al 2014 (44), Silva, EJ et al 2014 (46), Abuabara, A et al 2013 (99), Plotino, G et al 2013 (47), Reis, AG et al 2013 (100), Kim, Y et al 2012 (56), Lee, J-H et al 2011 (101), Zhang, R et al 2011 (48), Zheng, Q-H et al 2010 (49), Abiodun-Solanke, IM et al 2008 (76), Pattanshetti, N et al 2008 (50), Hartwell, G et al 2007 (102), Wolcott, J et al 2002 (103), Buhrley, LJ et al 2002 (104), Sempira, HN and Hartwell, GR 2000 (105), Stropko, JJ 1999 (106), Zaatar, EI et al 1997 (19), Fogel, HM, Peikoff, MD and Christie, WH 1994 (107), Weller, RN and Hartwell, GR 1989 (108), Neaverth, EJ et al 1987 (109), Hartwell, G and Bellizzi, R 1982 (110), Pomeranz, HH and, Fishelberg, G 1974 (111), Slowey, RR 1974 (112), Nosonowitz, DM and Brenner, MR 1973 (113), Seidberg, BH et al 1973 (91)	18333	3 roots (MB, DB and Palatal) and 5 canals (2MB, 2DB and Palatal) (12) Taurodontism (10) Fused roots and C-shaped canal (10) 4 roots (MB, DB and 2 Palatal) and 4 canals (MB, DB and 2 Palatal) (9)
DB	1 Canal	98.6%	1.4%*	33	Ghobashy, AM et al 2017 (35), Naseri, M et al 2016 (38), Tian, X-M et al 2016 (39), Alrahabi, M and Zafar, MS 2015 (40), Briseno-Marroquin, B et al 2015 (71), Singh, S and Pawar, M 2015 (42), Bhuyan, AC et al 2014 (43), Guo, J et al 2014 (44), Silva, EJ et al 2014 (46), Plotino, G et al 2013 (47), Kim, Y et al 2012 (56), Zhang, R et al 2011 (48), Zheng, Q-H et al 2010 (49), Abiodun-Solanke, IM et al 2008 (76), Weng, X-L et al 2009 (2), Pattanshetti, N et al 2008 (50), Rwenyonyi, CM et al 2007 (51), Sert, S and Bayirli, GS 2004 (3), Alavi, AM et al 2002 (61), Wasti, F et al 2001 (84), al Shalabi, RM et al 2000 (52), Zaatar, EI et al 1997 (19), Çaliskan, MK et al 1995 (4), Thomas, RP, Moule, AJ and Bryant, R 1993 (53), Pecora, JD et al 1992 (87), Vertucci, F 1984 (5), Gray, R 1983 (54), Hartwell, G and Bellizzi, R 1982 (110), Acosta Vigouroux SA and Trugeda Bosaans, SA 1978 (90), Pineda, F and Kuttler, Y 1972 (6), Hess, W 1925 (69), Zürcher, E 1925 (95)	8635	

Continued

Palatal	1 Canal	99.3%	0.7%*				34	Ghobashy, AM et al 2017 (35), Naseri, M et al 2016 (38), Marceliano-Alves, M et al 2016, Tian, X-M et al 2016 (39), Alrahabi, M and Zafar, MS 2015 (40), Briseno-Marroquin, B et al 2015 (71), Singh, S and Pawar, M 2015 (42), Bhuyan, AC et al 2014 (43), Guo, J et al 2014 (44), Silva, EJ et al 2014 (46), Plotino, G et al 2013 (47), Kim, Y et al 2012 (56), Zhang, R et al 2011 (48), Zheng, Q-H et al 2010 (49), Abiodun-Solanke, IM et al 2008 (76), Weng, X-L et al 2009 (2), Pattanshetti, N et al 2008 (50), Rwenyonyi, CM et al 2007 (51), Sert, S and Bayirli, GS 2004 (3), Alavi, AM et al 2002 (61), Wasti, F et al 2001 (84), al Shalabi, RM et al 2000 (52), Zaatar, EI et al 1997 (19), Çaliskan, MK et al 1995 (4), Thomas, RP, Moule, AJ and Bryant, R 1993 (53), Pecora, JD et al 1992 (87), Vertucci, F 1984 (5), Gray, R 1983 (54), Hartwell, G and Bellizzi, R 1982 (110), Acosta Vigouroux SA and Trugeda Bosaans, SA 1978 (90), Pineda, F and Kuttler, Y 1972 (6), Hess, W 1925 (69), Zürcher, E 1925 (95)	8804	
Second molar (three roots) *2 or more canals										4 roots (MB, DB and 2 Palatal) and 4 canals (MB, DB and 2 Palatal) (57) 3 roots and 4 canals (MB, DB and 2 Palatal canals) (7) 3 roots and 5 canals (3 MB, DB and Palatal canals) (3)
MB	1 Canal	56.5%	43.5%*				35	Ghobashy, AM et al 2017 (35), Khademi, A et al 2017 (36), Wolf, TG et al 2017 (114), Betancourt, P et al 2016 (97), Coelho, MS et al 2016 (98), Tian, X-M et al 2016 (39), Singh, S and Pawar, M 2015 (42), Silva, EJ et al 2014 (46), Plotino, G et al 2013 (47), Reis, AG et al 2013 (100), Han, X et al 2012 (115), Kim, Y et al 2012 (56), Zhang, R et al 2011 (48), Weng, X-L et al 2009 (2), Rwenyonyi, CM et al 2007 (51), Sert, S and Bayirli, GS 2004 (3), Alavi, AM et al 2002 (61), Schwarze, T et al 2002 (83), al Shalabi, RM et al 2000 (52), Stropko, JJ 1999 (106), Imura, N et al 1998 (86), Zaatar, EI et al 1997 (19), Çaliskan, MK et al 1995 (4), Eskoz, N and Weine, FS 1995 (116), Singh, C et al 1994 (117), Pecora, JD et al 1992 (87), Kulild, JC and Peters, DD 1990 (88), Gilles, J and Reader, A 1990 (89), Vertucci, F 1984 (5), Hartwell, G and Bellizzi, R 1982 (110), Pomeranz, HH and Fishelberg, G 1974 (111), Nosonowitz, DM and Brenner, MR 1973 (113), Pineda, F and Kuttler, Y 1972 (6), Hess, W 1925 (69)	8059	
DB	1 Canal	99.5%	0.5%*				21	Ghobashy, AM et al 2017 (35), Wolf, TG et al 2017 (114), Tian, X-M et al 2016 (39), Singh, S and Pawar, M 2015 (42), Silva, EJ et al 2014 (46), Plotino, G et al 2013 (47), Kim, Y et al 2012 (56), Zhang, R et al 2011 (48), Weng, X-L et al 2009 (2), Rwenyonyi, CM et al 2007 (51), Sert, S and Bayirli, GS 2004 (3), Alavi, AM et al 2002 (61), al Shalabi, RM et al 2000 (52), Zaatar, EI et al 1997 (19), Çaliskan, MK et al 1995 (4), Singh, C et al 1994 (117), Pecora, JD et al 1992 (87), Vertucci, F 1984 (5), Hartwell, G and Bellizzi, R 1982 (110), Pineda, F and Kuttler, Y 1972 (6), Hess, W 1925 (69)	5053	
Palatal	1 Canal	99.8%	0.2%*				20	Ghobashy, AM et al 2017 (35), Wolf, TG et al 2017 (114), Tian, X-M et al 2016 (39), Singh, S and Pawar, M 2015 (42), Silva, EJ et al 2014 (46), Plotino, G et al 2013 (47), Kim, Y et al 2012 (56), Zhang, R et al 2011 (48), Weng, X-L et al 2009 (2), Rwenyonyi, CM et al 2007 (51), Sert, S and Bayirli, GS 2004 (3), Alavi, AM et al 2002 (61), al Shalabi, RM et al 2000 (52), Zaatar, EI et al 1997 (19), Çaliskan, MK et al 1995 (4), Pecora, JD et al 1992 (87), Vertucci, F 1984 (5), Hartwell, G and Bellizzi, R 1982 (110), Pineda, F and Kuttler, Y 1972 (6), Hess, W 1925 (69)	5003	
Third molar	3 canals	9.8%	13.4%	51.5%	20.4%	2.2%	6	Rawtiya, M et al 2016 (59), Singh, S and Pawar, M 2015 (42), Weng, X-L et al 2009 (2), Alavi, AM 2002 (61), Sidow, SJ et al 2000 (62), Guerisoli, DM et al 1998 (63)	715	4 roots (3) C-shaped canal (1)

*NA Native = North American Native