

Statistical summary for reported insertion sites

Insertion sites	Number of studies	Random-effects			Heterogeneity				
		Event rate (%)	95% prediction interval	95% CI	I ² (95% CI)	H (95% CI)	Tau ²	Q (df)	P-value
Maxillary buccal insertion sites	43*	9.6%	2.5-30.3	7.6-12.1	68.9% (58-77)	1.8 (1.5-2.1)	0.47	141.485 (44)	< 0.001
Subgroup Interradicular: Maxillary first molar and second premolar	37	9.2%	3.4-22.4	7.4-11.4	55.6% (35-69)	1.5 (1.2-1.8)	0.25	81.099 (36)	< 0.001
Subgroup Interradicular: Maxillary canine and lateral incisor	4	9.7%	2.3-32.7	5.1-17.6	0% (0-85)	1 (1-2.6)	0	1.791 (3)	0.617
Subgroup: Zygomatic buttress	4	16.4%	0.06-98.2	4.9-42.5	83.7% (59-94)	2.5 (1.6-3.9)	1.28	18.412 (3)	< 0.001
Mandibular buccal insertion sites	11	12.3%	2-48.3	7.3-20.1	75% (55-86)	2 (1.5-2.7)	0.61	40.004 (10)	< 0.001
Subgroup Interradicular: Mandibular first molar and second premolar	8	13.5%	6.2-26.7	7.3-23.6	79.7% (61-90)	2.2 (1.6-3.1)	0.66	34.568 (7)	< 0.001
Subgroup Interradicular: Mandibular canine and first molar	3	9.9%	0.07-94.4	4.9-19.1	1.09% (0-90)	1 (1-3.1)	0.006	2.022 (2)	0.364
Palatal insertion sites	14	4.7%	1-18	2.7-8.1	37.5% (0-67)	1.3 (1-1.7)	0.38	20.820 (13)	0.077
Subgroup: Paramedian	6	4.8%	0.2-50	1.6-13.4	48.1% (0-79)	1.4 (1-2.2)	0.84	9.647 (5)	0.086
Subgroup: Parapalatal	5	5.5%	0.9-27.4	2.8-10.7	33.2% (0-75)	1.2 (1-2)	0.21	5.993 (4)	0.200
Subgroup: Midpalatal	3	1.3%	0-99.7	0.3-6	0% (0-90)	1 (1-3.1)	0	0.164 (2)	0.921

*Studies by Aras [43] and Viwattanatipa [94] reported two independent sites in this forest plot

Statistical summary for reported insertion sites (non-randomised studies removed)

Random-effects					Heterogeneity				
Exclusion of non-randomized studies	Number of studies	Event rate (%)	95% prediction interval	95% CI	I ² (95% CI)	H (95% CI)	Tau ²	Q (df)	P-value
Maxillary buccal insertion sites	19*	9.5%	3-25.8	6.9-12.8	58.1% (31-74)	1.5 (1.2-2)	0.29	45.347 (19)	< 0.001
Subgroup Interradicular: Maxillary first molar and second premolar	16	9.2%	2.7-26.3	6.5-12.8	61.1% (33-77)	1.6 (1.2-2.1)	0.31	38.557 (15)	< 0.001
Subgroup Interradicular: Maxillary first molar and second premolar	2	7.3%	-	2.6-18.9	8.3%	-	0.06	1.091 (1)	0.296
Subgroup: Zygomatic buttress	2	13.6%	-	3.5-40.6	54.4%	-	0.7	2.197 (1)	0.138
Mandibular buccal insertion sites	6	9%	4.2-69.8	3.5-21.5	74.9% (43-89)	2 (1.3-3)	1.02	19.947 (5)	0.001
Subgroup Interradicular: Mandibular first molar and second premolar	3	8.4%	0-100	1.4-37.8	85.6% (58-95)	2.6 (1.5-4.5)	2.17	13.942 (2)	< 0.001
Subgroup Interradicular: Mandibular canine and first molar	3	9.9%	0.07-94.4	4.9-19.1	1.09% (0-90)	1 (1-3.1)	0.006	2.022 (2)	0.364
Palatal insertion sites	3	3.8%	0-94.7	1.5-9.2	0% (0-90)	1 (1-3.1)	0	1.840 (2)	0.398
Subgroup: Paramedian	2	6.1%	-	1.8-18.9	0%	-	0	0.583 (1)	0.445
Subgroup: Parapalatal	1	2.1%	-	0.5-8.1	-	-	-	-	-

*Study by Aras [43] reported two independent sites in this forest plot

Statistical summary for risk factors

Risk factors	Random-effects					Heterogeneity			
	Number of studies	Risk ratio	95% prediction interval	95% CI	I ² (95% CI)	H (95% CI)	Tau ²	Q (df)	P-value
Influence of root contact	8	8.7	4.5-16.8	5.1-14.7	0% (0-68)	1 (1-1.8)	0	4.25 (7)	0.750
Influence of side of insertion	14*	1.57	1-2.4	1.05-2.35	0% (0-54)	1 (1-1.5)	0	4.407 (14)	0.992
Subgroup Interradicular: Mandibular first molar and second premolar	3**	1.22	0.02-64.5	0.66-2.25	0% (0-90)	1 (1-3.1)	0	0.243 (2)	0.885
Subgroup Interradicular: Mandibular canine and first molar	2	1	-	0.19-5.23	0%	-	0	0 (1)	1
Subgroup Interradicular: Maxillary first molar and second premolar	10	2	1-4	1.16-3.64	0% (0-62)	1 (1-1.6)	0	2.362 (9)	0.984
Influence of maxillary sinus perforation	3	5.26	0.0014-19878	1.47-18.74	0% (0-90)	1 (1-3.1)	0	1.053 (2)	0.591

*Study by Suzuki [88] reported two independent sites in this forest plot. Studies by Chopra [50] and Motoyoshi [74] reported mixed insertion sites for the side of insertion and were not included in this particular quantitative synthesis

** Study by Samrit [81] did not have adequate number of miniscrews to be included in the analysis of mandibular side of insertion failure rates. It was only considered for the maxillary first molar and second premolar side of insertion risk factor

Statistical summary for risk factors (non-randomised studies removed)

Random-effects					Heterogeneity				
Exclusion of non-randomized studies	Number of studies	Risk ratio	95% prediction interval	95% CI	I ² (95% CI)	H (95% CI)	Tau ²	Q (df)	P-value
Influence of root contact	2	5.06	-	1.81-14.12	0%	-	0	0.209 (1)	0.648
Influence of side of insertion	8*	1.68	0.9-3.2	0.98-2.88	0% (0-65)	1 (1-1.7)	0	3.209 (8)	0.921
Subgroup Interradicular: Mandibular first molar and second premolar	2	1.35	-	0.64-2.88	0%	-	0	0.025 (1)	0.875
Subgroup Interradicular: Mandibular canine and first molar	2	1	-	0.19-5.23	0%	-	0	0 (1)	1
Subgroup Interradicular: Maxillary first molar and second premolar	5	2.57	0.6-10.5	1.08-6.1	0% (0-79)	1 (1-2.2)	0	1.560 (4)	0.816

*Study by Suzuki [88] reported two independent sites in this forest plot

Statistical summary after excluding small studies

Random-effects					Heterogeneity				
Exclusion of small studies (less than 100 OMIs)	Number of studies	Effect estimate	95% prediction interval	95% CI	I ² (95% CI)	H (95% CI)	Tau ²	Q (df)	P-value
Influence of root contact	5	9.07 RR	3.6-22.8	5.14-16.01	0% (0-79)	1 (1-2.2)	0	2.168 (4)	0.7
Influence of side of insertion (Interradicular: Maxillary first molar and second premolar)	3	2.16 RR	0.008-586	0.893-5.217	0% (0-90)	1 (1-3.1)	0	0.755 (2)	0.68
Interradicular: Maxillary first molar and second premolar	8	7.8 ER	1.4-31.9	4.8-12.3	80.3% (62-90)	2.3 (1.6-3.1)	0.42	35.6 (7)	< 0.001

RR: risk ratio; ER: event rate (%)