

补充材料 (Online Resources)

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Online Resource 1 Spearman correlation matrix of patient-level variables (N = 88)

		Crowding	Root Resorption	Alveolar Bone Hu	Age	Duration	Gender
Crowding	Correlation Coefficient	1.000	-0.403	-0.065	0.195	-0.106	0.238
	P Value		<0.01	0.035	<0.001	<0.001	<0.001
Root Resorption	Correlation Coefficient	-0.403	1.000	0.166	-0.098	0.125	-0.088
	P Value	<0.001		<0.001	0.001	<0.001	0.004
Alveolar Bone Hu	Correlation Coefficient	-0.065	0.166	1.000	0.023	0.192	-0.011
	P Value	0.035	<0.001		0.465	<0.001	0.711
Age	Correlation Coefficient	0.195	-0.098	0.023	1.000	-0.059	0.273
	P Value	<0.001	0.001	0.465		0.056	<0.001
Duration	Correlation Coefficient	-0.106	0.125	0.192	-0.059	1.000	-0.043
	P Value	<0.001	<0.001	<0.001	0.056		0.158
Gender	Correlation Coefficient	0.238	-0.088	-0.011	0.273	-0.043	1.000
	P Value	<0.001	0.004	0.711	<0.001	0.158	

Online Resource 2 Collinearity assessment of patient-level variables (N = 88)

Model	t	P Value	Collinearity Statistics	
			Tolerance	VIF
(Constant)	10.987	<0.001		
Crowd	-13.301	<0.001	0.915	1.093
Alveolar Bone Hu	4.577	<0.001	0.959	1.042
Gender	0.504	0.614	0.890	1.123
Age	-0.895	0.371	0.905	1.105
Duration	2.039	0.042	0.952	1.050

Online Resource 3 Tests of fixed effects in the GLMM for the internal training set (N = 60 patients, 720 teeth)

Source	F	Df1	Df2	P value
Corrected Model	5.888	6	713	<0.001
Gender	0.878	1	713	0.349
Age	0.530	1	713	0.467
Duration	0.021	1	713	0.885
Alveolar Bone Hu	7.445	1	713	0.007
Crowd	13.181	2	713	<0.001

Online Resource 4 Estimates of fixed effect coefficients in the GLMM for the internal training set

Variable	Coefficient(β)	Std. Error	95% CI	t	P Value
Intercept	0.031	0.0203	(-0.009,0.071)	1.528	0.127
Gender (Male VS Female)	0.005	0.0055	(-0.006,0.016)	0.937	0.349
Age	0.000	0.0006	(-0.002,0.001)	-0.728	0.467
Duration	0.000	0.0028	(-0.005,0.006)	0.144	0.885
Alveolar Bone Density (Hu)	2.07×10^{-5}	7.59×10^{-6}	(5.81×10^{-6} , 3.56×10^{-5})	2.729	0.007
Crowding -Mild VS Severe	0.010	0.0030	(0.004,0.016)	3.256	0.001
-Moderate VS Severe	0.020	0.0040	(0.012,0.028)	5.085	<0.001

Online Resource 5 Bootstrap internal validation results for the final model (1,000 repetitions)

Variable	Original	Boot Mean	Bias	Boot SE	Lower95	Upper95
(Intercept)	5.3746	5.406	0.0315	1.0082	3.682	7.6373
Gender	-0.2554	-0.2571	-0.0017	0.4426	-1.1508	0.5568
Age_z	-0.2089	-0.2005	0.0084	0.2273	-0.6511	0.2219
Duration_z	0.2411	0.2584	0.0173	0.2087	-0.1068	0.7038
Crowd	-4.1217	-4.1421	-0.0204	0.5074	-5.2589	-3.302
BoneHU_z	-0.1492	-0.1645	-0.0153	0.1942	-0.5768	0.2046

Online Resource 6 Tests of fixed effects in the GLMM for the temporal validation set (N = 28 patients, 336 teeth)

Source	F	Df1	Df2	P value
Corrected Model	12.507	6	329	<0.001
Gender	0.367	1	329	0.545
Age	2.148	1	329	0.144
Duration	13.129	1	329	<0.001
Alveolar Bone Hu	1.448	1	329	0.230
Crowd	14.825	2	329	<0.001

Online Resource 7 Estimates of fixed effect coefficients in the GLMM for the temporal validation set

Variable	Coefficient(B)	Std. Error	95% CI	t	P Value
Intercept	0.005	0.0248	(-0.043,0.054)	1.528	0.829
Gender (Male VS Female)	-0.004	0.0060	(-0.015,0.008)	0.937	0.545
Age	-0.001	0.0006	(-0.002,0.000)	-0.728	0.144
Duration	0.015	0.0042	(0.007,0.023)	0.144	<0.001
Alveolar Bone Density (Hu)	1.593×10^{-5}	1.3235×10^{-5}	(-1.011×10^{-5} , 4.196×10^{-5})	2.729	0.230
Crowding -Mild VS Severe	0.036	0.0066	(0.023,0.049)	3.256	0.023
-Moderate VS Severe	0.013	0.0052	(0.003,0.024)	5.085	0.003

Online Resource 8 Sensitivity analysis results

Metric	Full Validation Set (n=28, 336 teeth)	Sensitivity Analysis (n=16, 192 teeth)
Pearson's r	0.680	0.598
ICC	0.618	0.525
AUC	0.915	0.825
RMSE	2.79%	2.56%