

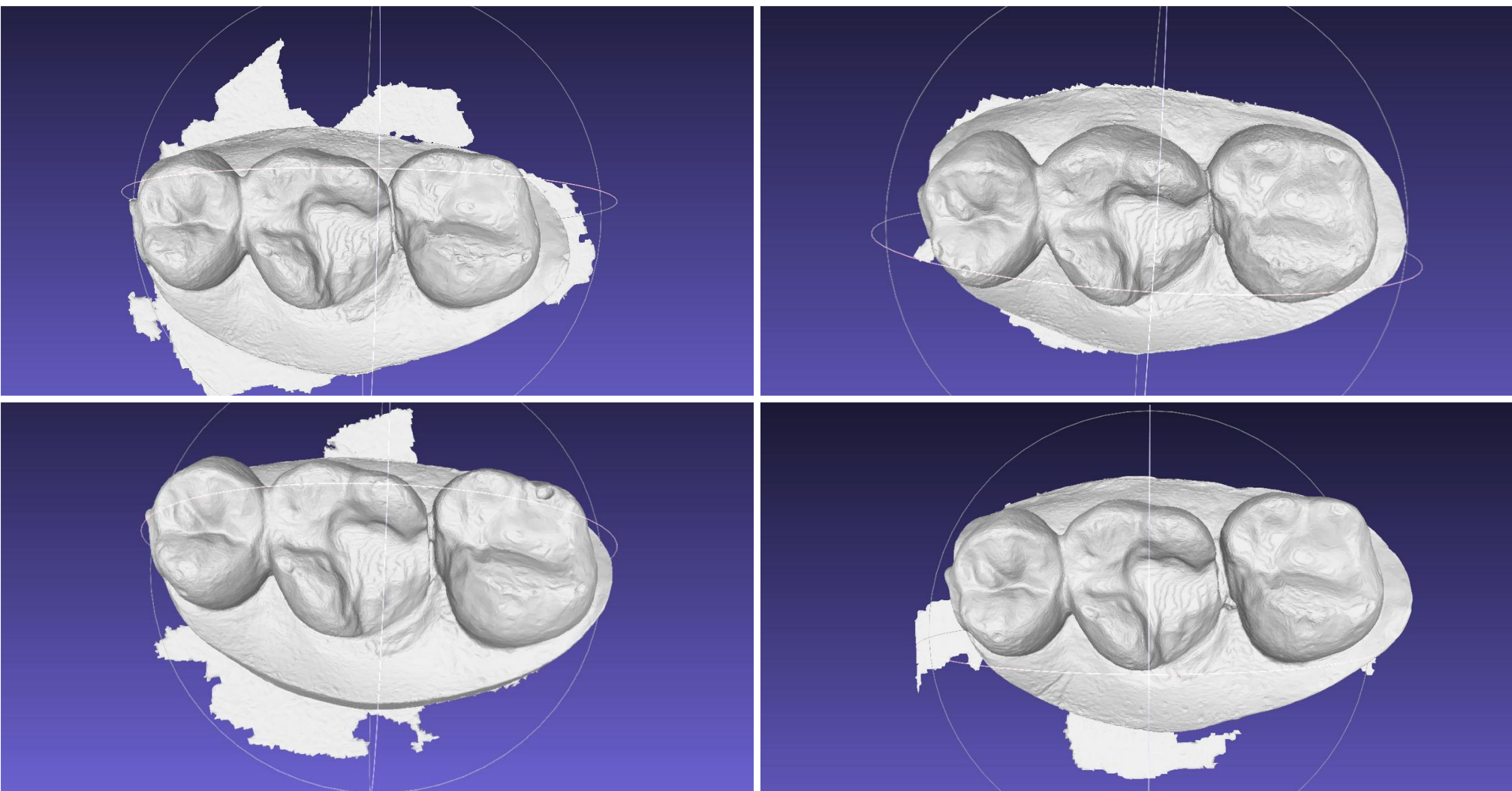
Evaluating artificial surface bridging in intraoral scans: A comparative in vitro study of six IO scanners
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INTRODUCTION & AIM

The aim of the study is to quantify the area of artificial surface bridging between non-contiguous tooth surfaces, using multiple scans from six different intraoral scanner devices.

METHOD

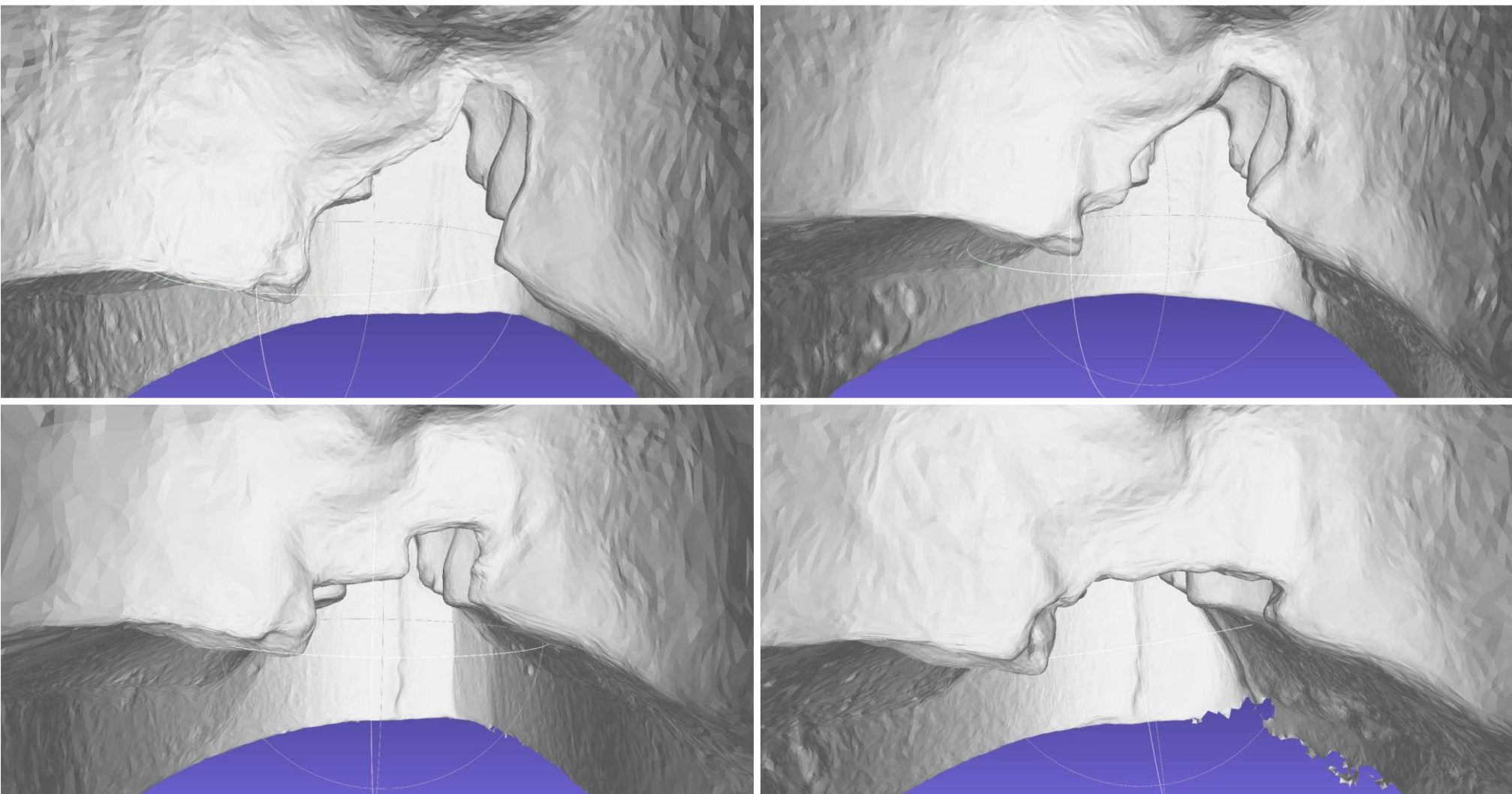
A typodont master model featuring an onlay preparation on the maxillary left first molar (tooth 26) was scanned using a laboratory-grade scanner. To obtain controlled interproximal gaps, an artificial digital separation was created between the prepared surface of tooth 26 and the adjacent second molar (tooth 27). Interdental distances of 100 µm, 300 µm, 500 µm, and 700 µm were digitally modeled, generating four different STL files. Each file was 3D printed using polyurethane resin. Each model was scanned ten times by six different intraoral scanners: 3Shape TRIOS, Dentsply Sirona Primescan, iTero Element, Carestream CS 3800, Medit i900, and SIRIOS. The resulting STL files were analyzed using the software MeshLab for metrological evaluation. Bridging surface areas were measured and analyzed using descriptive statistics and post hoc tests.



Occlusal view of the Interdental Distances

RESULTS & DISCUSSION

The statistical results showed that at 100 µm the mean ranged from 4.35 to 5.60 mm²; at 300 µm, from 1.57 to 5.11 mm²; at 500 µm, from 2.00 to 4.75 mm²; and at 700 µm, from 2.03 to 4.35 mm². The Friedman test revealed statistically significant differences among the experimental groups. Post-hoc Bonferroni tests confirmed significant differences among the analyzed IOS systems at interproximal distances of 0.1, 0.3, 0.5, and 0.7 mm.



Bridging Areas

CONCLUSION

Bridging artifacts were present across all tested distances, within the limits of the study. The outcomes at 0.7 mm showed values that could be regarded as potentially suitable for clinical use.

SCANNING_SYSTEM			Statistic	Std. Error
Dis0.1	Trios 5	Media	5,0840	,04400
	Primescan	Media	5,0950	,07602
	Element iTero	Media	4,6390	,03226
	Carestream 3800	Media	4,3530	,05348
	Medit i900	Media	5,6030	,26425
	Sirios	Media	4,8910	,05939
Dis0.3	Trios 5	Media	3,7330	,21175
	Primescan	Media	1,5700	,33564
	Element iTero	Media	4,9710	,09104
	Carestream 3800	Media	4,5990	,13659
	Medit i900	Media	5,1150	,16083
	Sirios	Media	3,6900	,06272
Dis0.5	Trios 5	Media	2,5720	,27574
	Primescan	Media	2,0090	,20804
	Element iTero	Media	2,9890	,07821
	Carestream 3800	Media	3,1660	,02758
	Medit i900	Media	2,7140	,40017
	Sirios	Media	4,7500	,04417
Dis0.7	Trios 5	Media	2,2270	,09609
	Primescan	Media	2,0370	,10531
	Element iTero	Media	2,5090	,05223
	Carestream 3800	Media	2,7570	,04664
	Medit i900	Media	2,5410	,35120
	Sirios	Media	4,3500	,05230

Descriptive Statistics

Hypothesis Test Summary				
Null Hypothesis		Test	Sig.	Decision
1	The distributions of TRIOS_0, PRIMESCAN_0.1, ELEMENT 0.1, CARESTREAM_3800_0.1, I900_0.1 and SIRIOS_0.1 are the same.	Related-Samples Friedman's Two-Way Analysis of Variance by Ranks	.000	Reject the null hypothesis.
	Asymptotic significances are displayed. The significance level is .05.			

Hypothesis Test Summary				
Null Hypothesis		Test	Sig.	Decision
1	The distributions of TRIOS_0.3, PRIMESCAN_0.3, ELEMENT 0.3, CARESTREAM_3800_0.3, I900_0.3 and SIRIOS_0.3 are the same.	Related-Samples Friedman's Two-Way Analysis of Variance by Ranks	.000	Reject the null hypothesis.
	Asymptotic significances are displayed. The significance level is .05.			

Hypothesis Test Summary				
Null Hypothesis		Test	Sig.	Decision
1	The distributions of TRIOS_0.5, PRIMESCAN_0.5, ELEMENT 0.5, CARESTREAM_3800_0.5, I900_0.5 and SIRIOS_0.5 are the same.	Related-Samples Friedman's Two-Way Analysis of Variance by Ranks	.000	Reject the null hypothesis.
	Asymptotic significances are displayed. The significance level is .05.			

Hypothesis Test Summary				
Null Hypothesis		Test	Sig.	Decision
1	The distributions of TRIOS_0.7, PRIMESCAN_0.7, ELEMENT 0.7, CARESTREAM_3800_0.7, I900_0.7 and SIRIOS_0.7 are the same.	Related-Samples Friedman's Two-Way Analysis of Variance by Ranks	.000	Reject the null hypothesis.
	Asymptotic significances are displayed. The significance level is .05.			

Friedman Test

SCANNING_SYSTEM			Test K-W	p-value
Dis0.1	CARESTREAM 3800	TRIOS 5	3,100	0,003
	CARESTREAM 3800	i900	-3,900	0,000
	ELEMENT	TRIOS 5	3,000	0,005
	ELEMENT	i900	-3,800	0,000
Dis0.3	PRIMESCAN	CARESTREAM 3800	-3,600	0,000
	PRIMESCAN	I900	-4,200	0,000
	ELEMENT	CARESTREAM 3800	-2,600	0,028
	ELEMENT	I900	-3,200	0,002
Dis0.5	PRIMESCAN	ELEMENT	-3,100	0,003
	PRIMESCAN	SIRIOS	-4,200	0,000
	TRIOS 5	SIRIOS	-3,500	0,000
	I900	CARESTREAM 3800	-3,100	0,003
Dis0.7	PRIMESCAN	CARESTREAM 3800	-2,750	0,015
	PRIMESCAN	ELEMENT	-3,150	0,002
	PRIMESCAN	SIRIOS	-4,450	0,000
	TRIOS 5	SIRIOS	-3,600	0,000
	I900	SIRIOS	-3,350	0,001

Bonferroni Multiple Comparison Test

CONFLICT OF INTEREST
The author's declare no conflicts of interest.

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