

THE EFFECT OF MAGNETIC RESONANCE IMAGING RESOLUTION ON DIGITAL DENTAL IMPLANT PLANNING FOR THE EDENTULOUS MANDIBLE: AN IN VITRO STUDY

J. I. de Oliveira, H. Parize, G. Mendonca, F. Munhoz, C. Cordeiro, N. Meier, J. Kleinheinz, D. Lagana, L. Bohner, N. Sesma



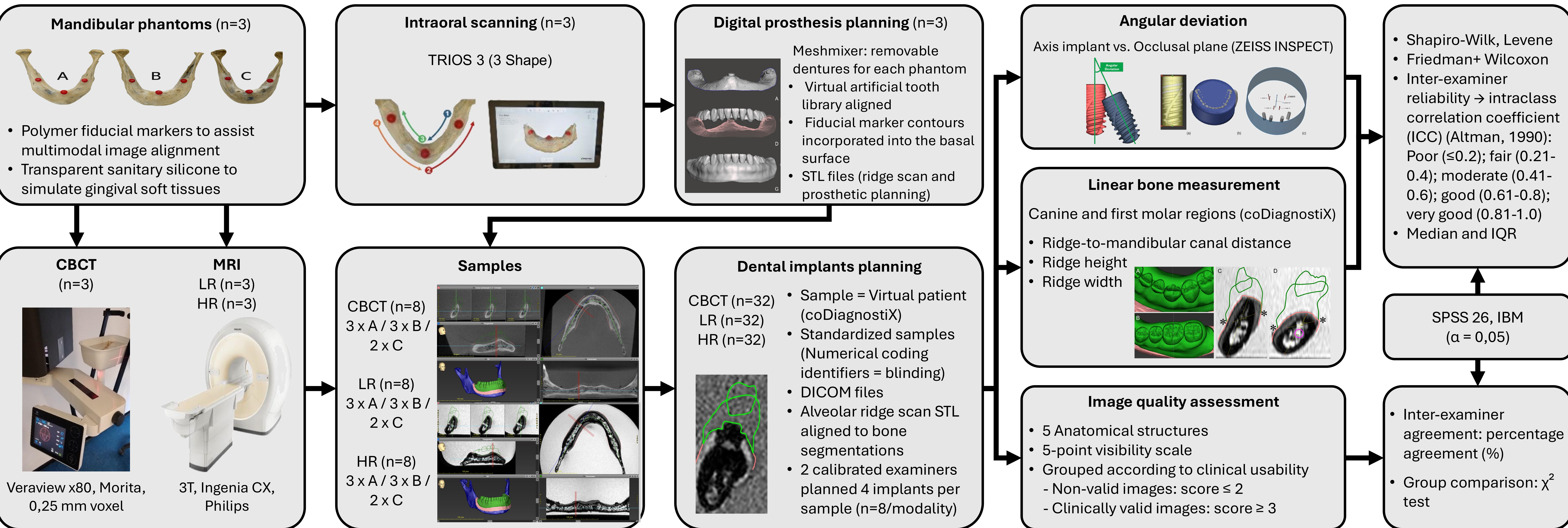
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Introduction

- Cone-beam computed tomography (CBCT) is the standard imaging technique for three-dimensional evaluation of bone anatomy, but it exposes patients to ionizing radiation and lacks soft tissue contrast.
- Magnetic resonance imaging (MRI) provides a non-ionizing alternative that enables the visualization of both hard and soft tissues.
- This study evaluated the effect of low-resolution (LR) and high-resolution (HR) MRI on diagnostic accuracy and image quality for digital dental implant planning in the edentulous mandible, compared with CBCT.

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Method



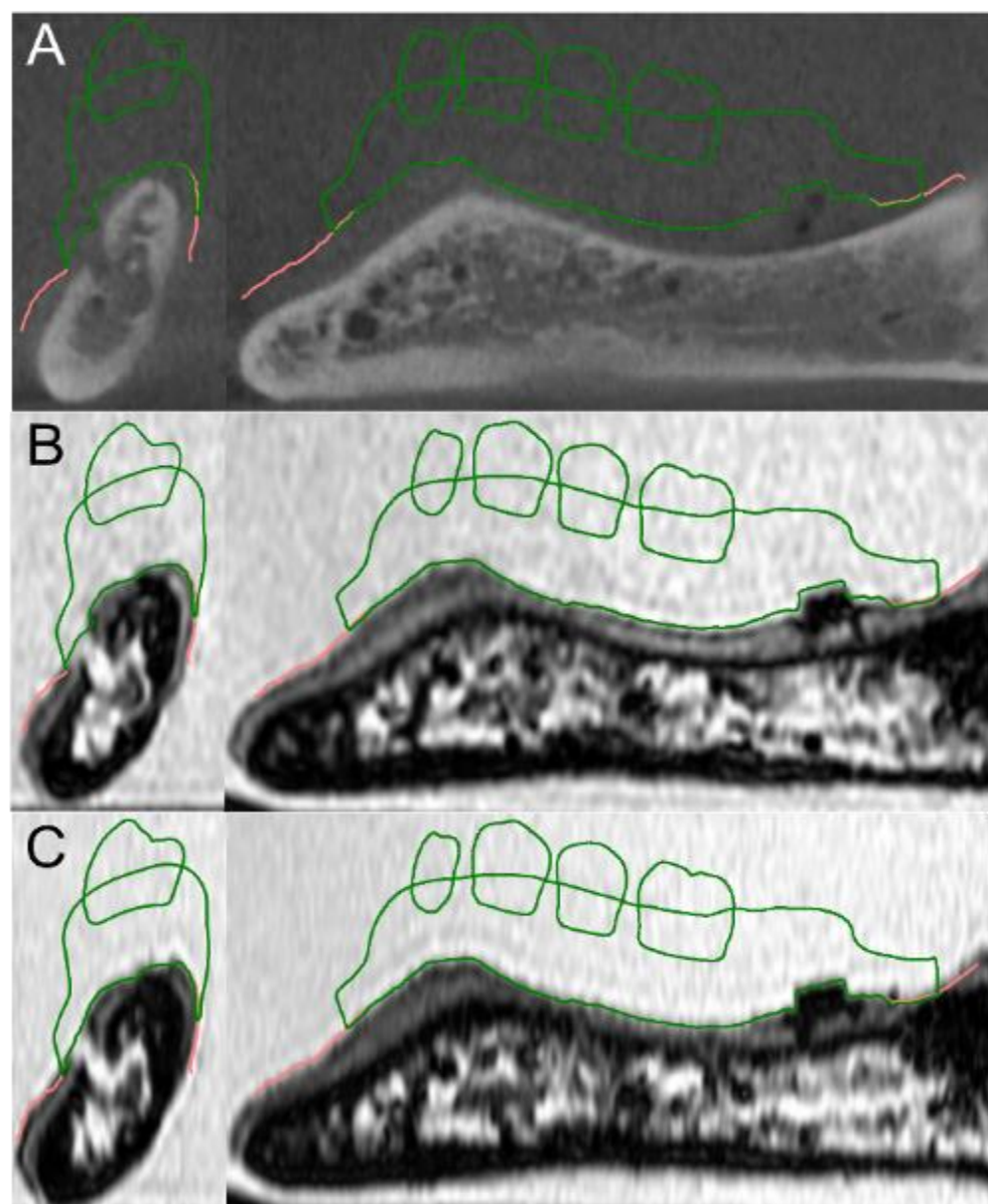
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Results

- A total of 96 implants were digitally planned (32 per modality).



Anatomical structures and prosthetic reference in dental implant planning software. (A) CBCT, (B) LR, (C) HR

Table 1. Inter-examiner reliability - angular deviation (ICC)

Region	Imaging modality	ICC	ICC classification
Anterior	CBCT	0.948	Very good
	MRI – LR	0.866	Very good
	MRI – HR	0.584	Moderate
Posterior	CBCT	0.295	Fair
	MRI – LR	−0.154	Poor
	MRI – HR	−0.304	Poor

Table 3. Linear bone measurements according to imaging modality

Measurement		Modality	ICC	ICC classification	Median (mm)	IQR	Friedman p
Alveolar ridge height	Anterior	CBCT	0.972	Very good	21.10	7.90	0.305
		MRI – LR	0.937	Very good	21.85	7.68	
		MRI – HR	0.969	Very good	22.45	7.18	
	Posterior	CBCT	0.957	Very good	17.20	6.03	0.717
		MRI – LR	0.931	Very good	18.80	5.82	
		MRI – HR	0.964	Very good	17.60	5.33	
Alveolar ridge width	Anterior	CBCT	0.920	Very good	10.20	3.12	0.811
		MRI – LR	0.949	Very good	9.85	3.30	
		MRI – HR	0.968	Very good	9.50	3.40	
	Posterior	CBCT	0.827	Very good	10.00	1.85	0.646
		MRI – LR	0.780	Good	9.65	1.72	
		MRI – HR	0.969	Very good	10.05	2.60	
Ridge mandibular canal distance		CBCT	0.837	Very good	6.30	5.73	0.740
		MRI – LR	0.971	Very good	5.45	5.65	
		MRI – HR	0.783	Good	6.70	4.78	

Table 2. Angular deviation according to anatomical region, examiner, and imaging modality

Region	Examiner	Modality	Median (°)	IQR	Friedman p
Anterior	1	CBCT	2.79	6.43	0.607
		MRI - LR	4.51	4.88	
		MRI – HR	4.39	6.39	
	2	CBCT	4.23	6.78	0.197
		MRI – LR	6.64	5.87	
		MRI – HR	6.80	7.02	
Posterior	1	CBCT	15.42	10.30	0.687
		MRI – LR	16.38	8.44	
		MRI – HR	15.67	6.48	
	2	CBCT	13.93	4.34	0.417
		MRI – LR	13.90	8.84	
		MRI – HR	10.49	5.82	

Table 4. Image quality assessment according to anatomical structure

Structure	Modality	Agreement (%)	Not valid for clinical use (%)	Valid for clinical use (%)	χ^2 test p
Cortical bone	CBCT	100.00	0.00	100.00	0.344
	MRI-LR	75.00	12.50	87.50	
	MRI-HR	75.00	12.50	87.50	
Trabecular bone	CBCT	100.00	0.00	100.00	0.132
	MRI-LR	50.00	25.00	75.00	
	MRI-HR	75.00	12.50	87.50	
Mental foramen	CBCT	87.50	5.00	95.00	0.587
	MRI-LR	100.00	0.00	100.00	
	MRI-HR	75.00	12.50	87.50	
Alveolar ridge	CBCT	100.00	0.00	100.00	0.132
	MRI-LR	75.00	12.50	87.50	
	MRI-HR	50.00	25.00	75.00	
Mandibular nerve canal	CBCT	60.00	20.00	80.00	0.270
	MRI-LR	50.00	50.00	50.00	
	MRI-HR	50.00	37.50	62.50	

Conclusion

- MRI resolution did not influence diagnostic accuracy, specifically implant angular deviation and linear measurements, nor image quality for digital implant planning in edentulous mandible phantoms when compared with CBCT.
- However, interexaminer disagreement was observed in image quality assessment.