

CT-RSA is a suitable replacement for RSA in evaluating migration of tibial implants - Phantom study of accuracy



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Introduction

Early migration in total knee arthroplasty (TKA) diagnosed using radiostereometric analysis (RSA) is associated with later revision (1-4). Computed tomography-based alternatives (CT-RSA) are gaining interest due to comparable results to RSA (5-7) but seems to underestimate migration (8). Validation of accuracy of both RSA and CT-RSA are needed in TKA to find the gold standard. Our aim was to validate accuracy in a phantom tibial implant of model-based RSA, marker-based-RSA and CT-RSA compared to a micromanipulator. The outcome measure is accuracy of medial (X) and proximal (Y) translation.

Methods and Materials

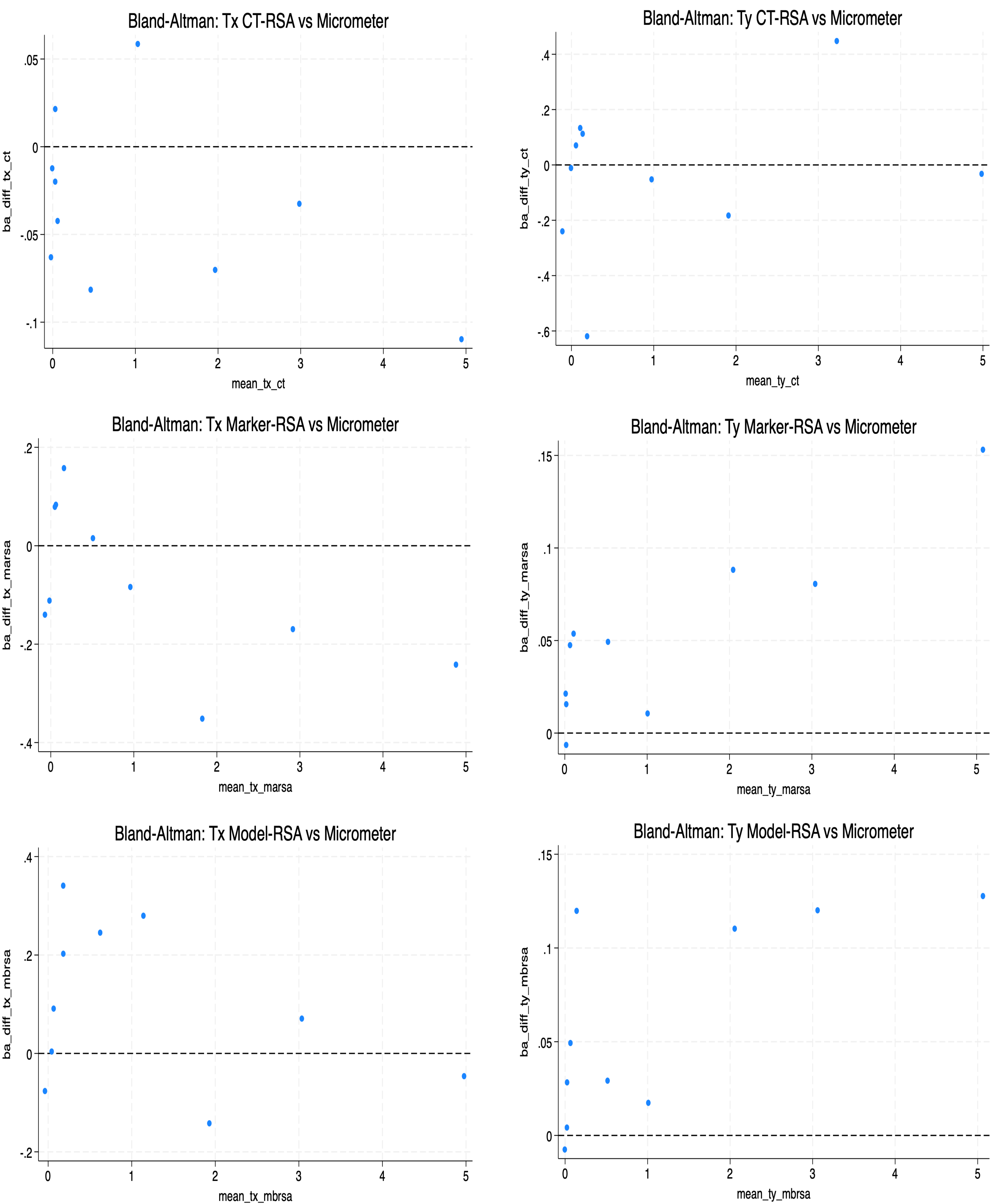
In a porcine phantom controlled X- and Y-translations of a tibial implant were performed using a micromanipulator. Model-based RSA, marker-based RSA and CT-RSA were compared. RSA scenes were analysed using RSAcore 4.2 (LUMC, Leiden, the Netherlands). CT scans were analyzed using CTMA (Sectra AB, Linköping).

Accuracy for all methods was calculated using the mean difference between the measured value and the true value for the migrations 0, 0.01, 0.02, 0.04, 0.08, 0.5, 1, 2, 3 and 5 mm in X- and Y-translations.

Results

	CT-RSA			Model-Based RSA			Marker-based RSA		
	Acc	SD	95% CI	Acc	SD	95% CI	Acc	SD	95% CI
Tx	-0,035	0,123	0,076	0,097	0,056	0,035	-0,076	0,109	0,067
Ty	-0,037	0,279	0,173	0,060	0,037	0,023	0,051	0,052	0,032

Results



Results cont.

Accuracy of CT-RSA is better than both RSA methods. Accuracy of CT-RSA underestimates migration for both X- and Y-translations. Model-based RSA overestimates for both migrations. Marker-based RSA underestimates for X-translation and overestimates Y-translation.



Discussion

CT-RSA underestimates migration but is also the most accurate for X and Y translations. However, the accuracy for all methods seem to be a little poorer than previous studies (9, 10). Usually, phantom studies have higher precision and accuracy, but air and the lack of soft-tissue surrounding the tibia seemed to reduce image quality. This could be alleviated by increasing the radiation dose, but we kept to the standard clinical protocol (8).

We conclude that this study strengthens the validity of CT-RSA and can be used for migration analysis. Accuracy of rotations should be conducted.

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