

# Early migration pattern of Vanguard® CR tibial component evaluated by two different radiostereometric analysis systems

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## Introduction

Two RSA systems, UmRSA and RSAcoreModel-based RSA (MB-RSA), are widely used to evaluate early migration of artificial joint implants. We previously reported the precision and the interclass correlation coefficient of these two different RSA systems for the evaluation of femoral stem migration of total hip arthroplasty<sup>1</sup>.

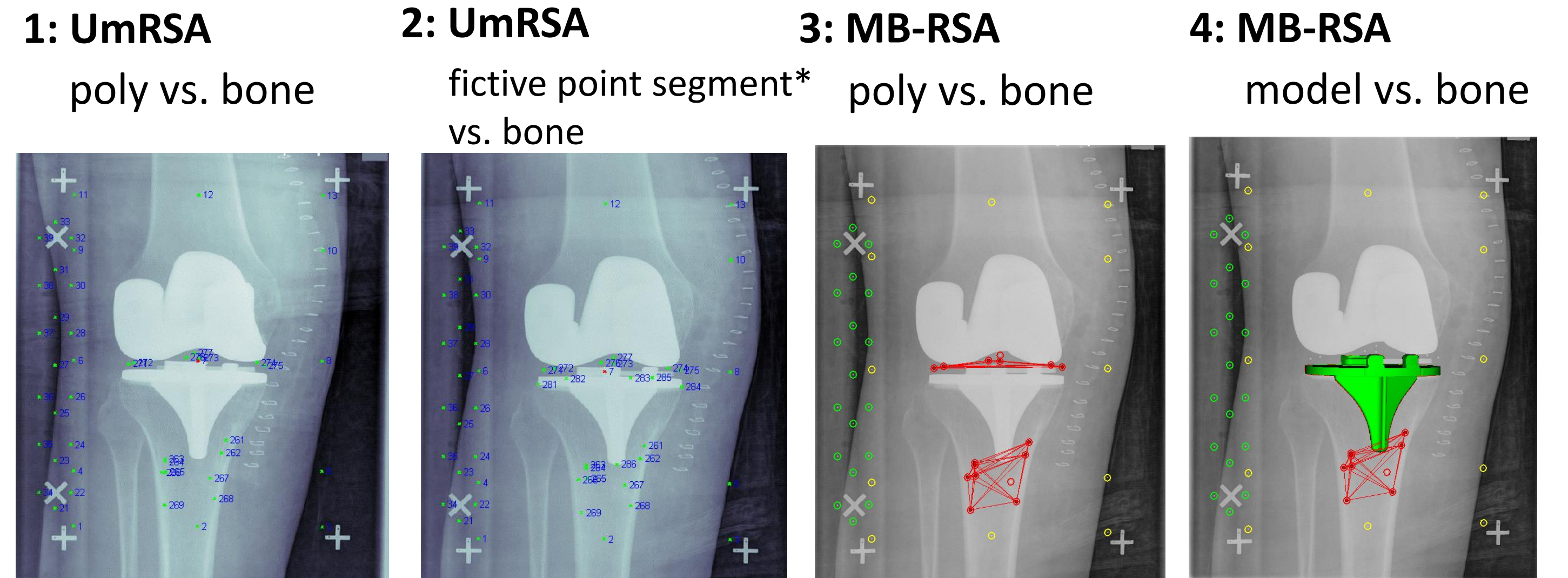
*We report on the 1 year micromotion of tibial implants of total knee arthroplasty (Vanguard CR, Biomet) using the two RSA system and compare the results.*

## Patients and methods

- 21 total knee replacements with cemented Vanguard CR.
- Marker placement: In the polyethylene and in the tibial bone.
- Cage: Umea43 (Um RSA biomedical).
- Exclusion criteria: Condition number  $\geq 150$ , Mean Error  $\geq 0.35$ , Difference between model and contour  $\geq 0.1$ .
- Calculation: Micromotion between double examinations (zero motion), at 3 months and at 1 year.

<sup>1</sup> Li et al. (2014) Comparison of two different Radiostereometric analysis (RSA) systems with markerless elementary geometrical shape modeling for the measurement of stem migration. Clin Biomech (Bristol, Avon).

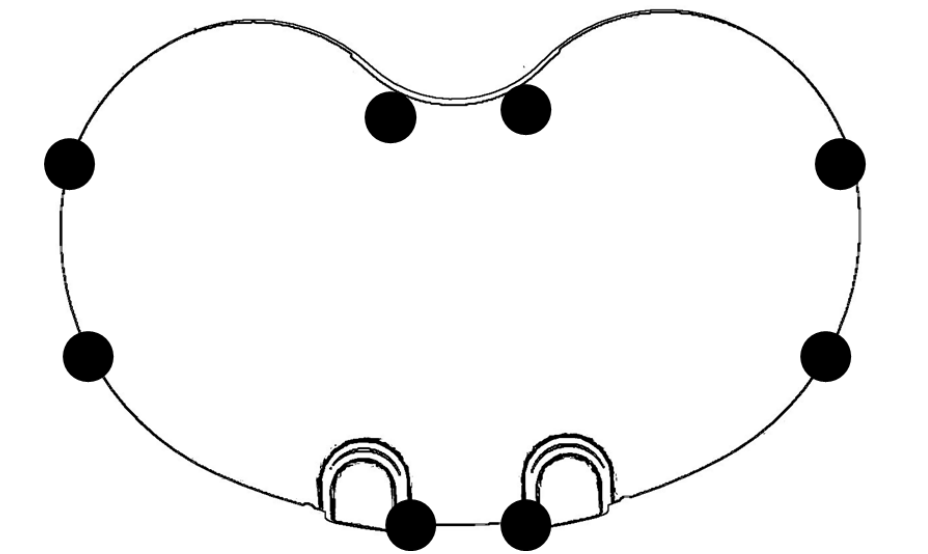
## 4 modes of RSA for the micromotion of tibial implants



\* Fictive points were marked around the metal implant in the first postoperative image, and transferred to the subsequent images in reference to the poly markers.

## Polyethylene marker placement

At least 8 markers were placed in each polyethylene.  
2 at the anterior, 2 at the posterior, 2 at the medial and 2 at the lateral part of the poly.



## Results

### 1: Quality of the examinations

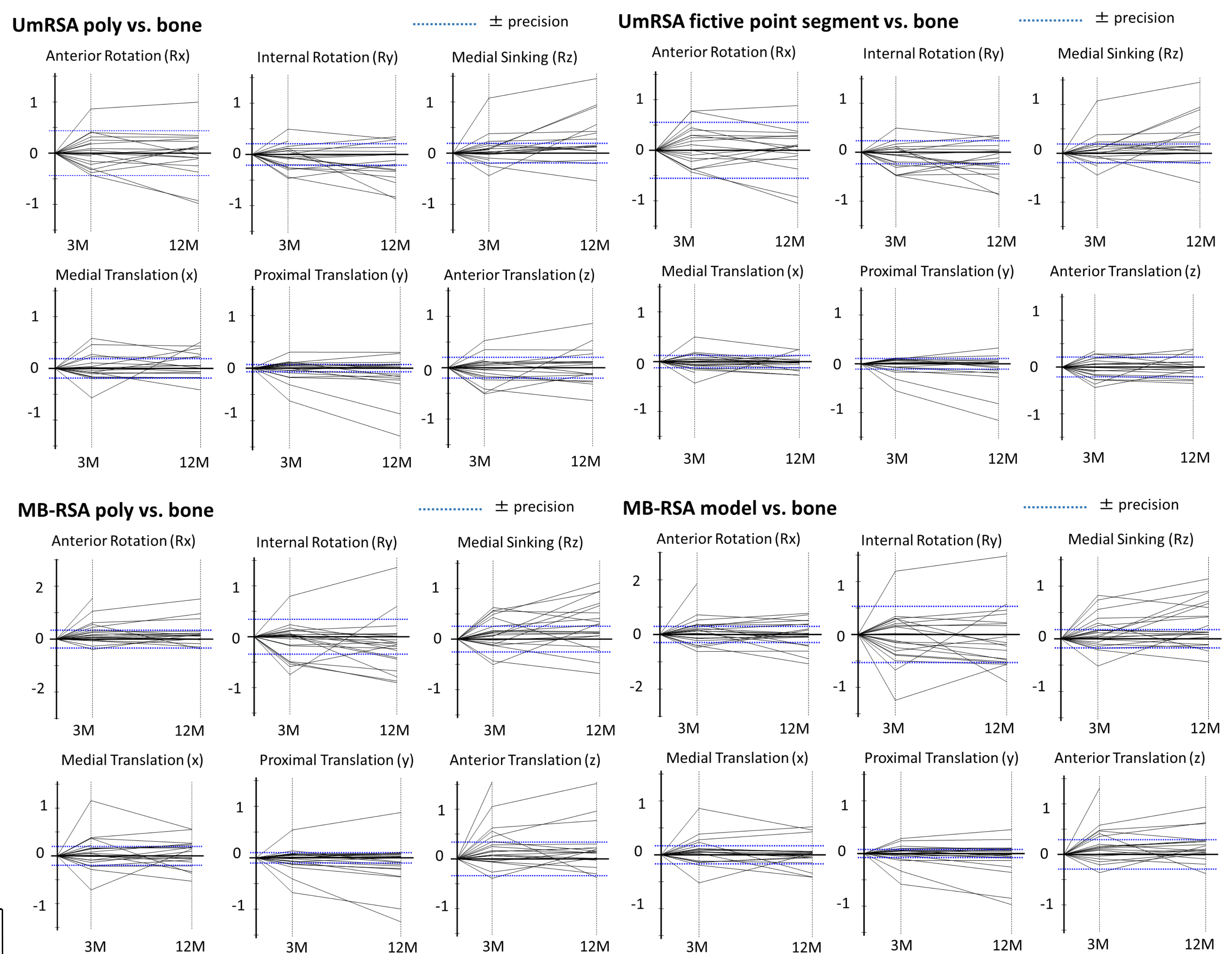
	Number of examinations		Used markers, CN and ME		
	Total	Not available*	Marker number	CN	ME
UmRSA	233	53 (22.7%)	UmRSA Poly 4.7 (±1.2)	60.1 (±25.1)	0.0653 (±0.0408)
MB-RSA (poly)	233	45 (19.3%)	Tibia 7.1 (±1.4)	44.3 (±16.2)	0.1502 (±0.0962)
MB-RSA (model)	233	37 (15.9%)	UmRSA Poly 4.5 (±1.1)	23.3 (±1.1)	0.0803 (±0.0549)
			Tibia 6.3 (±1.3)	27.5 (±11.5)	0.1204 (±0.0549)

\* Excluded or not possible to calculate.

### 2: Calculation of zero-motion (precision)

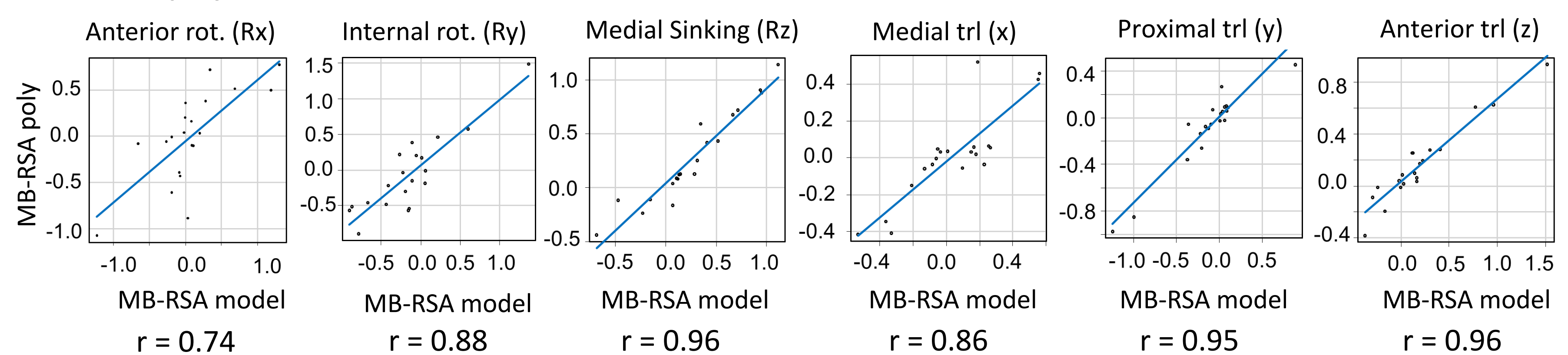
		Rot X	Rot Y	Rot Z	Trl X	Trl Y	Trl Z	N =
		Mean	-0.0308	-0.0058	-0.0225	0.0239	0.0031	
SD	0.1990	0.1020	0.0851	0.0821	0.0339	0.0947	53	
Abs mean +1.96 SD	0.4368	0.2099	0.1913	0.1875	0.0688	0.2029	53	
Mean	-0.0455	-0.0121	-0.0128	0.0121	0.0138	0.0079	53	
SD	0.2511	0.1114	0.0869	0.0555	0.0487	0.0990	53	
Abs mean +1.96 SD	0.5535	0.2354	0.1911	0.1239	0.1095	0.2121	53	
Mean	0.0085	0.0041	-0.0385	-0.1062	-0.0084	0.0091	54	
SD	0.3544	0.1689	0.1182	0.0913	0.0494	0.1569	54	
Abs mean +1.96 SD	0.7993	0.3433	0.2547	0.1976	0.1008	0.3379	54	
Mean	-0.0364	0.0180	-0.0013	0.0017	0.0032	-0.0324	55	
SD	0.1399	0.2713	0.0822	0.0769	0.0378	0.1409	55	
Abs mean +1.96 SD	0.2935	0.5318	0.1747	0.1680	0.0780	0.2913	55	

### 3: Time change

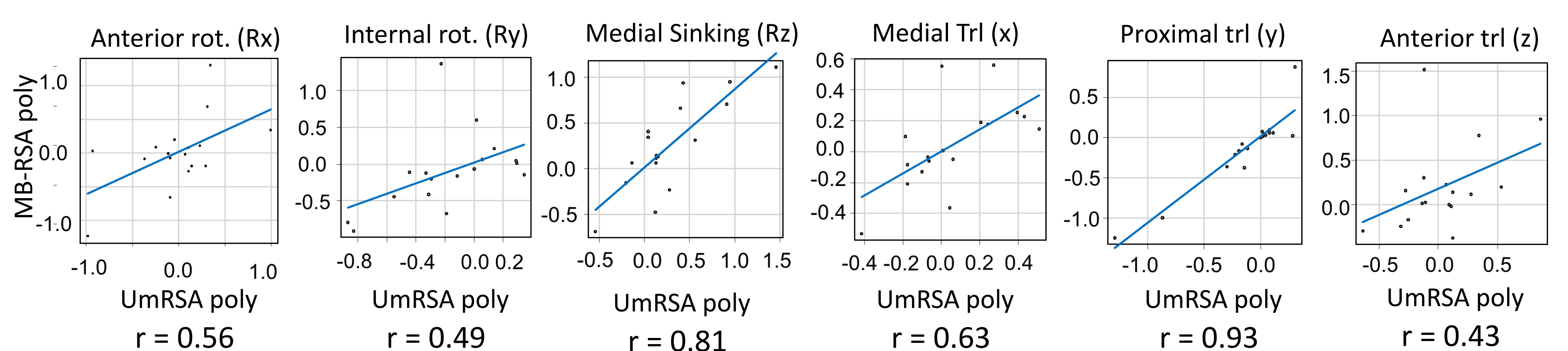


### 4: Correlation at 12 months

#### MB-RSA poly vs. model



#### UmRSA poly vs. MB-RSA poly



## Discussion

- With uniplanar cage, many markers were not identified in some patients.
- Condition numbers were calculated higher in UmRSA than MB-RSA, resulting in a higher exclusion rate of examinations in UmRSA.
- In MB-RSA, poly segments and models showed good correlation.
- Poly segments in UmRSA and MB-RSA showed moderate correlation.
- The difference between UmRSA and MB-RSA might be because of the impaired identification of poly markers with a uniplanar cage.

## Conclusion

- Tibial component of Vanguard CR were generally stable up to 1 year.
- All the 4 modes of RSA had sufficient precision for Z rotation, y translation and x rotation.