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Correlation between score values and morpho-functional parameters in THA

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Abstract

Morpho-functional analysis is a major aspect of preoperative planning for THA. This study aims to investigate whether pain or movement restrictions correlate with the morphofunctional parameters pelvic tilt, pelvic bend and pelvic rotation. Pre- and postoperative CT and EOS images, as well as score values of 201 Japanese patients were analyzed. No statistical relevant correlation between the score values and the parameters could be found ($|r_{max}| = 0{,}38$). However, the statistical power was found to be low for our data ($(1-\beta \sim 0.10)$). Further research with larger data sets is desirable.

1 Introduction

For preoperative planning of THA, analysis of the patient´s morphology is essential. The importance of the pelvic tilt is shown in many investigations so far. But pain or movement restrictions might also lead to changes in pelvic rotation, e.g. caused by difference in femoral antetorsion, and pelvic bend, e.g. caused by leg length discrepancy.

Besides morphological optimized implantation, the patients´ confidence is a relevant part for evaluation of a successful THA implantation. There is a high variety of questionnaires that can be used as measure for this aspect [1,2,3]. The aim of this study was to investigate whether there is correlation between pain or movement restrictions (reported in questionnaires) and pelvic morphofunctional parameters.

2 Material & Methods

A dataset of 201 Japanese patients that underwent primary THA was used. Each patient received pre- and postoperatively CT imaging, standing EOS imaging and lateral radiograph. In addition, Harris

Hip Score (HHS), Japanese Orthopaedic Association hip score (JOA) and Japanese Hip Evaluation Questionnaire (JHEQ) were recorded before and after surgery.

Pelvic morphofunctional parameters were derived from CT and EOS images as described by Fischer et al. [4].

The pain value, as well as the total score are taken as measure for pain and movement restrictions.

The correlation between morphofunctional parameters and pain or score values (PSV) is determined for the following aspects:

RQ1: Do the morphofunctional parameters show any correlation to PSV?

RQ2: Can preoperative PSV be predictor for postoperative pelvic tilt?

RQ3: Can preoperative pelvic tilt be predictor for postoperative PSV?

3 Results

For all aspects of the research questions the correlation was low ($|r_{max}| = 0{,}38$) **(Figure 1)**. Highest correlation was found for correlation between the postoperative PSV (HHS and JOA) and pre– and postoperative pelvic tilt (r = 0,33 to r = 0,38). Considering pain, the same tendency can be found, but the correlation coefficients remain lower (r = 0,20 to r = 0,27).

The morphological parameters showed large scattering. A post-hoc power analysis confirmed a low statistical power (1-β ~ 0.10). An a-priori power analysis for determination of sample size based on the result of the post-hoc power analysis proposed a sample size of about 2500 cases for achieving a statistical power of about 80%.

A

		PreopPain			PreopScore			PostopPain			PostopScore			PainChange			ScoreChange		
		Harris	JOA	JHEQ	Harris	JOA	JHEQ	Harris	JOA	JHEQ	Harris	JOA	JHEQ	Harris	JOA	JHEQ	Harris	JOA	JHEQ
PreopTilt	standing	-0,02	-0,02	-0,04	0,06	0,09	0,10												
	supine	-0,01	-0,01	-0,03	0,09	0,11	0,08												
PreopBend	standing	0,02	0,02	-0,11	0,10	0,09	-0,01												
	supine	-0,02	-0,03	-0,23	0,05	0,09	-0,13												
PreopRotation	standing	0,15	0,15	0,13	0,15	0,13	0,20												
	supine	-0,01	-0,01	-0,14	-0,02	0,00	-0,15												
PostopTilt	standing							0,21	0,20	0,11	0,34	0,38	0,11						
	supine							0,27	0,26	0,01	0,34	0,36	0,18						
PostopBend	standing							0,01	0,01	-0,07	-0,04	-0,03	-0,09						
	supine							0,04	0,05	-0,07	0,01	0,01	-0,08						
PostopRotation	standing							-0,02	-0,03	-0,01	0,05	0,03	0,02						
	supine							-0,01	0,01	-0,03	-0,13	-0,10	-0,12						
TiltChange	standing													0,05	0,06	0,02	-0,01	-0,02	0,00
	supine													0,08	0,08	-0,06	0,06	0,08	0,13
BendChange	standing													-0,09	-0,09	-0,09	-0,05	-0,10	-0,06
	supine													-0,09	-0,08	0,04	-0,04	-0,03	0,04
RotationChange	standing													0,16	0,15	0,08	0,15	0,11	0,05
	supine													-0,04	-0,04	-0,01	-0,04	-0,05	-0,07

B

		PreopPain			PreopScore		
		Harris	JOA	JHEQ	Harris	JOA	JHEQ
PostopTilt	standing	-0,05	-0,05	-0,06	0,08	0,09	0,07
	supine	-0,04	-0,03	-0,05	0,08	0,10	0,05

C

		PostopPain			PostopScore		
		Harris	JOA	JHEQ	Harris	JOA	JHEQ
PreopTilt	standing	0,24	0,23	0,13	0,34	0,38	0,13
	supine	0,27	0,27	0,10	0,33	0,34	0,11

Figure 1: (A) Correlation coefficients for RQ1. (**B**) Correlation coefficients for RQ2. (**C**) Correlation coefficients for RQ3.

4 Discussion / Outlook

The results do not show a strong correlation for any of the studied aspects. This may be due to the low statistical power or the too small sample size in relation to the high dispersion of the morphofunctional parameters. For this, further studies with a larger sample size would be desirable.

But, assuming that with larger statistical power the correlation coefficients show identical tendencies, conclusions can be made.

The relevance of pelvic bend and pelvic rotation cannot be shown. Focusing on pelvic tilt in preoperative planning is compliant with our results [5,6]. Preoperative pelvic tilt is not correlated with preoperative PSV. Thus, preoperative determination of pelvic tilt is feasible even for patients with high pain and movement restrictions. Furthermore, the tendency of correlation between postoperative PSV and postoperative pelvic tilt emphasizes the importance of this parameter in preoperative planning process.

In previous studies we identified the preoperative factors age, lumbar lordosis angle, preoperative supine pelvic tilt and preoperative standing pelvic tilt as factors for improving the prediction of the postoperative sagittal orientation of the pelvis after total hip arthroplasty [4]. With this study the correlation between preoperative PSV and postoperative pelvic tilt could not be shown, which means that PSV might not be used to optimize prediction of postoperative pelvic tilt.

But preoperative pelvic tilt might be a predictor for postoperative PSV. Further research is needed for prediction analysis for postoperative PSV.

5 References

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