2016•2017
FACULTEIT GENEESKUNDE EN LEVENSWETENSCHAPPEN
master in de revalidatiewetenschappen en de kinesitherapie

Masterproef

Extra-articular impingement: a new cause of refractive groin pain following THA

Promotor :
Prof. dr. Frank VANDENABEELE

Copromotor :
Prof. dr. Annick TIMMERMANS
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Scriptie ingediend tot het behalen van de graad van master in de revalidatiewetenschappen en de kinesitherapie

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Acknowledgements

The author of this study would like to thank prof. dr. Frank Vandenabeele, prof. dr. Kristoff Corten and dr. Lucas Luyckx for their support during this research, and the patients for participating in this study.

Jens Hendrickx Molenakker 9 2320 Hoogstraten, juni 2017 J.H.

Research context

This observational study, situated within the musculoskeletal rehabilitation, was conducted in the hospital 'Ziekenhuis Oost-Limburg' (ZOL) in association with the University of Hasselt. The orthopaedic department of the hospital has a good reputation in placing total hip arthroplasties (THA's). Prof. dr. Kristoff Corten has great experience with a muscle sparing THA by using the mini anterior incision technique and within the research of THA's.

Recently, extra- articular impingement (EAI) was discussed as a new clinical entity. EAI is seen as a possible complication after THA. From this perspective, this study focused on optimizing the diagnosis and give result for the treatment of EAI.

This study was performed by a student Rehabilitation Sciences and Physiotherapy from the University of Hasselt, supervised by promotor prof. dr. Frank Vandenabeele, prof. dr. Kristoff Corten and dr. Lucas Luyckx.

Abstract

Background: Total hip arthroplasty (THA) is a widely used procedure in the treatment of degenerative hip pathologies. One of the possible complications after THA is refractive groin pain.

Objectives: This study aimed at introducing a new cause of groin pain following THA: extra-articular impingement (EAI). This was defined as impingement in midflexion between the anterior portion of the greater trochanter (GT) and the anterior inferior iliac spine (AIIS).

Participants: 20 patients were included. One of them was excluded for the clinical examination because of neurogenic claudication. All patients had revision surgery between January 2014 and April 2016 in hospital ' Ziekenhuis Oost- Limburg'.

Measurements: The outcome measurements were a specific clinical examination, a marcainisation test, questionnaires (HHS, HOOS, SF-36) and patient satisfaction questions.

Results: Minimum follow-up was 6 months, mean follow-up was 20 months.

Preoperative all patients had groin pain and pain around the GT during clinical examination. Further, limited ROM during endorotation in 45° of flexion and deep flexion was noticed. Postoperative this all disappeared in eighteen patients. Two patients did not improved because of other pathologies. Sixteen out of 20 patients had preoperative a positive marcainisation test. Four patients had obvious complaints so no marcainisation test was performed. The results of these two outcome measurements were the key factors for the EAI diagnosis. The differences between the mean scores of the questionnaires preoperative versus postoperative were all significant ($p=<0.0001$). Finally, all patients who had revision surgery were willing to undergo the same surgery again. Sixteen participants experienced the result as very good, three as good and one termed it poor.

Conclusion: EAI should be considered as a possible cause of refractive groin pain after THA. Specific clinical and diagnostic tests can be used to confirm the diagnosis. Revision surgery gave good pain relieve and improved the outcome.

Introduction

Total hip arthroplasty (THA) is a widely used procedure in the treatment of degenerative hip pathologies. The numbers are gradually increasing (Kurtz et al., 2005; Kurtz, Ong, Lau, Mowat, & Halpern, 2007). Results are good but some authors state that 10 – 15% of the patients is not satisfied after THA. (Hofstede, Gademan, Vliet Vlieland, Nelissen, & Marang-van de Mheen, 2016). The major cause of the dissatisfaction is persistent pain. Potential causes of pain include infection, femoral acetabular impingement and acetabular loosening. These complications can occur independently of the type of arthroplasty. (Bartelt, Yuan, Trousdale, & Sierra, 2010).

A specific complication is persistent groin pain. This location is defined as the area extending from the inner thigh to the anterior border of the greater trochanter (GT) and from the anterior superior iliac spine (AIIS) to the base of the GT (Girard et al., 2014). The incidence of groin after THA can be as high as 18%. (Bartelt et al., 2010; Bin Nasser, Beaule, O'Neill, Kim, & Fazekas, 2010; Girard et al., 2014). Possible causes are iliopsoas impingement, aseptic loosening and the formation of a pseudotumor (Bartelt et al., 2010; Bisschop et al., 2013). Literature concerning risk factors for the development of groin pain after THA is inconsistent and further research is needed. As a consequence of groin pain a decreased functionality of the hip is seen. This causes a decrease in the patient's quality of life. (Forster-Horvath, Egloff, Valderrabano, & Nowakowski, 2014). It is often difficult to determine the specific cause of groin pain, but sometimes revision surgery is needed (Restrepo et al., 2014).

Another entity should be considered in the workup of groin pain after THA: extra- articular impingement (EAI). This new cause of groin pain following THA is defined as impingement in midflexion between the anterior portion of the GT and the AIIS (Corten, 2015).

The aim of this study is to provide insights in the diagnosis and give result for the treatment of EAI after THA.

Methods

Participants

All patients who had a revision surgery after THA because of EAI between January 2014 and April 2016 in hospital 'Ziekenhuis Oost- Limburg' (ZOL) were reviewed.

The patients (1) complained of groin pain and pain around the GT during particular movements, such as getting up out of a chair, endorotation of the femur in 45° of flexion and deep flexion combined with endorotation of the femur; (2) had preoperative a positive marcainisation test and (3) had a limited range of motion (ROM) in endorotation in 45° of flexion.

The study was approved by the Ethics Committee of ZOL and by the Ethics Committee of the University of Hasselt (15/11/2016, 16/071U). All patients signed the informed consent.

Procedure

The patients were invited to participate in the study prior to revision surgery. Pre-and postoperative, the clinical examination, the questionnaires and the patient satisfaction were measured in the same way. The marcainisation test was only investigated before surgery. The tests were conducted by the senior author of this article, with help of a master student in Rehabilitation Sciences from University of Hasselt. Minimum follow up postoperative was six months.

All the measurements took place in ZOL. All the measurements, results and extra information were noted in a patient file.

Outcome measurements

(1) Clinical examination

This clinical examination was a key test for the clinical diagnosis of EAI. During the clinical examination, the ROM and the presence of groin pain and pain around the GT during particular movements was measured. These movements were: (1) getting up out of a chair, (2) lying down, (3) exorotation of the femur, (4) endorotation of the femur in 45° of flexion, (5) deep flexion and endorotation of the femur and (6) endorotation of the femur in extension.

Figure 1: Getting up out of a chair. Paitents feel pain when the legs are placed in a neutral position (a). Exorotation of the legs gives pain relieve (b). Endorotation agravates the pain (c).

(2) Marcanisation test

Another key factor for the diagnosis of EAI was a marcainisation of the AIIS. This was all performed before surgery. The patients were injected around the AIIS with 20cc Marcaine under fluoroscopic control. This procedure is shown in figure 2. After infiltration the above mentioned clinical tests were repeated. If pain disappeared after infiltration, when performing the painful movements, the outcome was termed positive.

Positive test results in the clinical examination and of the Marcanisation test were indications for the clinical diagnosis of EAI.

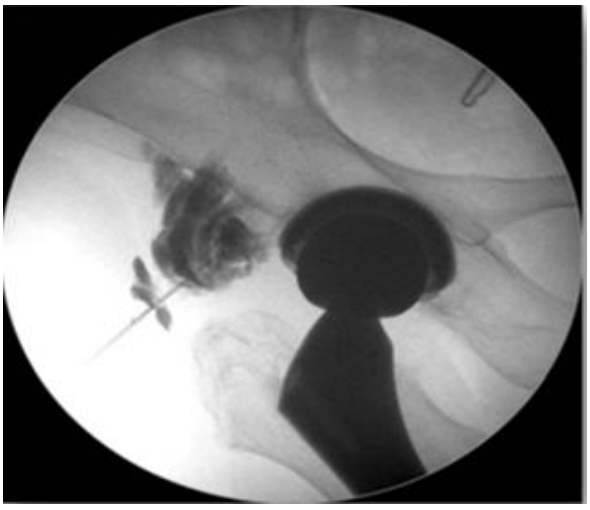

Figure 2: Marcainisation of the anterior inferior iliac spine

(3) Questionnaires

Harris Hip Score (HSS)

The HHS is a list composed of a questionnaire and an observation list. The observation list was not used because a more specific clinical examination was done (first outcome measurement). The HHS questionnaire consists of the items pain and functionality. Without the observational list, the total score is 91. The item pain consists of one question and has a maximum score of 44. The item functionality has seven questions and has a maximum score of 47. A higher score correlates with less pain and better functionality. The total scores and the scores of both items will be converted to percentages. The total score reliability, test-retest reliability (r=0.95), interrater correlations (r=0.74-1.00) and the validity are excellent (Soderman & Malchau, 2001; Thorborg, Roos, Bartels, Petersen, & Holmich, 2010).

Hip disability and Osteoarthritis Outcome Score (HOOS)

The HOOS contains of 40 items that are categorized in five domains: symptoms, pain, ADL, sports and quality of life ("(http//: www. meetinstrumentenzorg. nl),"). The item symptoms has five questions with a maximum score of 20. Pain has ten questions with a maximum score of 40. The item ADL has seventeen questions with a maximum score of 68. Sports and quality of life has both four questions with a maximum score of sixteen. Each item is scored on a four point ordinal scale. A lower score correlates with less symptoms and pain, a better functionality during ADL and sports and a better quality of life. The score of each item and the total scores will be converted to percentages. The calculation of an item score to a percentage will be done by the following formula: 100-((mean score of the questions of that item/4)*100). The calculation of the total score is: 100-(patient score of the subscale*100)/(total score of the subscale). The test has a good reliability, internal consistency (r=0.82-0.98) and validity. (de Groot et al., 2007; A. Nilsdotter & Bremander, 2011; A. K. Nilsdotter, Lohmander, Klassbo, & Roos, 2003; Rampazo-Lacativa, Santos, Coimbra, & D'Elboux, 2015; Ware & Sherbourne, 1992).

Short health survey (SF-36)

The SF-36 is a questionnaire used to measure the health status. The list has 36 questions and has following items: physical functioning (ten questions), physical role functioning (four questions), emotional role functioning (three questions), vitality (four questions), mental health (five questions), social functioning (two questions), bodily pain (two questions), general health perceptions (five questions) and health change (one question). The number of answer options variates between two and six. For the items social functioning and health change a lower score means a better social functioning and a positive health change. For the other items, a higher score means a better physical-, physical role- and emotional role functioning and a better vitality, mental health, bodily pain and general health perceptions. The score of each item and the total scores will be converted to percentages.

This test can be used in different pathologies. Validity for hip problems is shown. Also reliability and internal consistency are good. (Hays & Shapiro, 1992; Rampazo-Lacativa et al., 2015; Thorborg et al., 2010; Ware & Sherbourne, 1992)

(4) Patient satisfaction

To quantify the subjective effect of surgery, patients were asked if they would be willing to undergo the same surgery again. The patients could answer with yes or no. Further, satisfaction about the result was investigated by asking the patients how satisfied they were. The patients had following answer options: very good, good, poor or terrible.

Data-analysis

Descriptive statistics were used to describe the general and clinical characteristics. Non-parametric statistics were used because some conditions (normality and sample size) for parametric testing were not met. Wilcoxon Signed Rank tests were used to compare pre-and postoperative clinical outcome scores. The level of significance was set at $p < 0.05$. Statistical analysis was performed using the SPSS software (IBM SPSS Statistics 24, New York, USA).

Results

Participants

Twenty four patients were reviewed. One patient was excluded because of a malpositioned socket, which wasn't revised because of an increased mortality risk. Another patient was excluded because of a low grade infection. Finally, two patients were excluded because they had a combined procedure (EAI and psoas release). Twenty patients were available for research. After the data collection, one patient was excluded for the clinical examination because of severe neurogenic claudication complaints, which confounded the results of his hip function. This participant completed the questionnaires, the patient satisfaction questions and underwent a preoperative marcainisation test. The flowchart is shown in figure 3.

Minimum follow-up for all participants was 6 months with a mean follow-up of 20 months after revision surgery.

Subject characteristics

Subject characteristics are displayed in table 1. Twenty participants were included in the analysis of the marcainisation test, the questionnaires and the patient satisfaction (mean age = 57.19; range 30 – 77 year). Eight participants had a THA on the left side, the other twelve participants on the right side. The ratio men: women was 8:12. For the clinical examination, nineteen patients were analysed (mean age= 57.30; range 30-77 year) and the ratio men: women was 7:12. Eleven participants had a THA on the right side.

The aim of the revision surgery was resolving the conflict between the GT and ASIS. The type of revision procedures is listed in table 2.

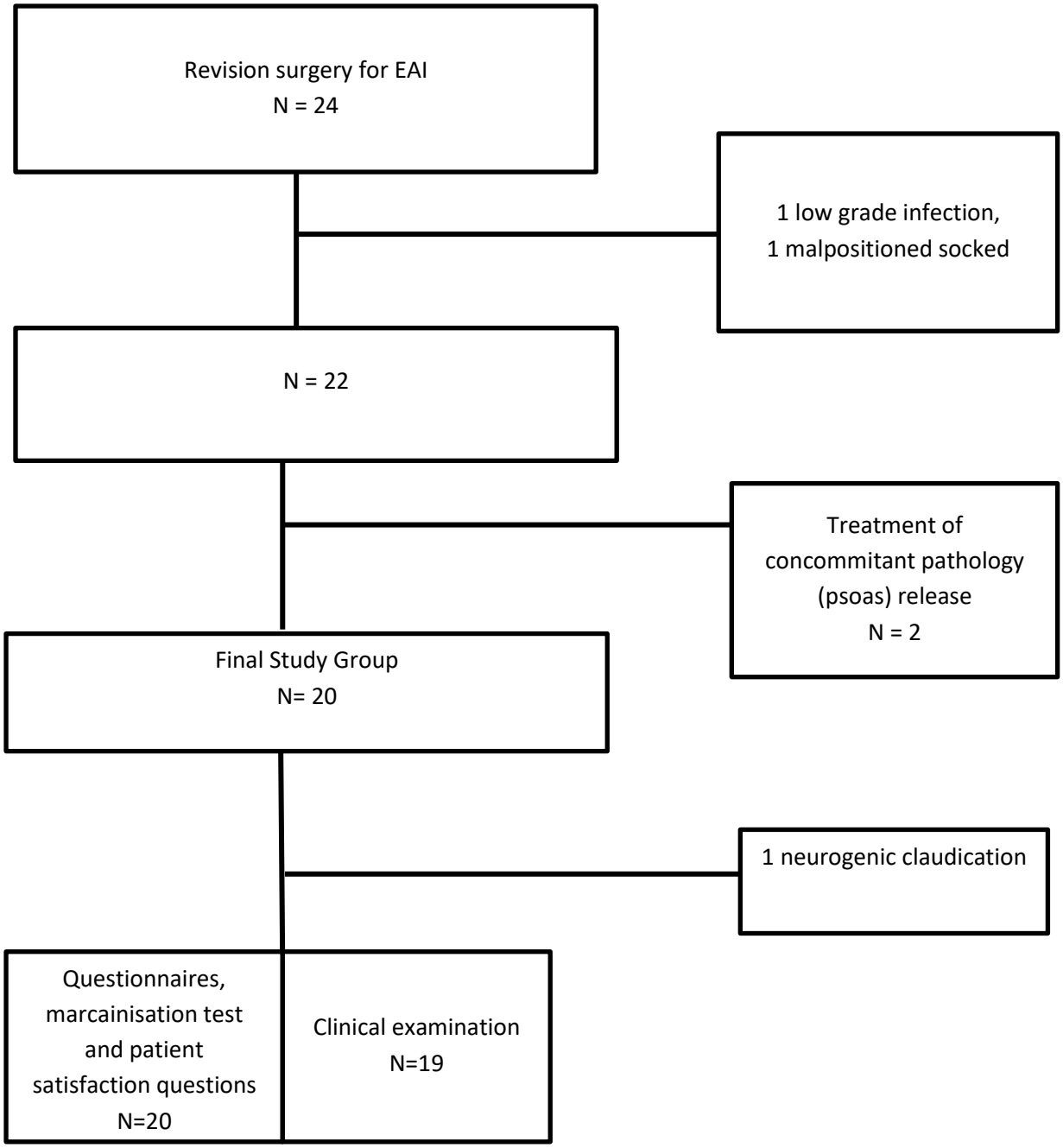

Figure 3: Study Lay-out

Table 1: Subject characteristics

	Marcainisation test, questionnaires and patient satisfaction	**Clinical examination**
Number of patients	20	19
Mean age (in years)	57.19	57.30
Ratio men:women	8:12	7:12
Ratio left:right	8:12	8:11

Table 2: Type of revison surgery

Type of revision procedure	Number of patients
Head exchange	3
Socket revision	2
Resection excessive bone	8
Head exchange and resection excessive bone	7

Test results

(1) Clinical examination

All the patients had preoperative groin pain and pain around the GT during particular movements, such as getting up out of a chair. A limited endorotation in 45° of flexion, pain during endorotation in 45° of flexion and pain during deep flexion and endorotation was noted. In all cases, pain disappeared when lying down or when the femur was exorotated. There was no pain during endorotation in extension. These characteristics must be presented preoperative for the clinical diagnosis of EAI.

Postoperative, eighteen patients had an absence of groin pain, unlimited endorotation in 45° of flexion, no pain during endorotation in 45° of flexion and no pain during deep flexion and endorotation postoperative. This indicated that the EAI was resolved.

Two patients included in this study had pain postoperative when the femur was exorotated. In both cases, these patients had already preoperative several luxations (5 times) or subluxations. Both patients noted that the complaints disappeared after surgery.

(2) Marcainisation test

Sixteen out of 20 patients had a preoperative marcainisation test which was considered positive (16/16). This means that the tests of the clinical examination were repeated and the pain disappeared after infiltration. This indicated an EAI was present. Two participants had obvious complaints so the senior author decided that a marcainisation test wasn't necessary. One participant had proven recidivating luxations (5 times) and one participant had subluxations.

(3) Questionnaires

Harris Hip Score (HHS)

The mean preoperative HHS percentage score was 46 which improved significant to percentage 82 postoperative ($p<0.0001$). The item pain had a mean preoperative percentage score of 15.2 and a mean postoperative percentage score of 34. The functionality improved from percentage 23.8 preoperative to percentage 35.8 postoperative. Both improvements were significant ($p<0.0001$). A detailed description of all results is visualized in table 3.

Hip disability and Osteoarthritis Outcome Score (HOOS)

The mean preoperative HOOS percentage score was 9.8 which improved significantly ($p=<0.0001$) to a mean score of percentage 35.1 postoperative. Pain improved significantly ($p=<0.0001$) from a mean preoperative percentage score of 10.5 to a mean postoperative percentage of 43.9. Symptoms were preoperative scored with percentage 12.7 and postoperative scored with percentage 41.1, which was a significant improvement ($p=<0.0001$).

Concerning the other items (ADL, sport and quality of life) all patients had also significantly higher postoperative percentage scores. ($p=<0.0001$).

Short health survey (SF-36)

The mean total preoperative SF-36 score improved significant from percentage 40.7 to a postoperative percentage of 62.9 ($p=<0.0001$).

The mean scores of all the nine items were postoperative significant higher than preoperative. Concerning the items 'physical role functioning' and 'emotional role functioning', static analysis showed significant improvement of respectively 0.025 and 0.007. All the other items had a p-value of <0.0001.

(4) Patient satisfaction

All patients said they would be willing to undergo the same surgery again. Sixteen patients described the result as very good, three as good and one termed the result poor.

Table 3: Comparison of means pre- and postoperative

	Mean preoperative	Mean postoperative	P-value
HHS			
Pain	15.3	34	<0.0001*
Functionality	23.8	35.8	<0.0001*
Total	46.9	77.8	<0.0001*
HOOS			
Pain	10.5	43.9	<0.0001*
Symptoms	12.7	41.1	<0.0001*
ADL	15.8	45.2	<0.0001*
Sport	5.6	22.7	<0.002*
QOL	4.5	26.7	<0.0001*
Total	9.8	35.2	<0.0001*
SF-36			
Physical functioning	34.1	60.9	0.001*
Physical role functioning	11.9	38.7	0.025*
Emotional role functioning	34.9	58.7	0.007*
Vitality	49	61.8	<0.0001*
Mental health	58.5	68.6	<0.0001*
Social functioning	57.6	75.1	<0.0001*
Bodily pain	33.1	65.6	<0.0001*
General health perceptions	48.1	64.1	<0.0001*
Health change	39.3	72.6	<0.0001*
Total	40.7	62.9	<0.0001*

All scores are displayed in pecentages *p<0.05

Discussion

This observational study aimed to introduce a new clinical entity, EAI after THA. Results showed that surgery for EAI was successful. Both the subjective measurements and the clinical scores improved significantly. The mean HHS improved from a preoperative percentage 42 to a postoperative percentage of 77. The same was seen for the mean HOOS. The overall health improved by resolving the conflict, which was shown by an improvement in the mean SF36. Postoperative results were not as good as after primary THA, but there was a fast improvement especially in pain and function scores. This strongly confirms our hypothesis that EAI is a new cause of refractive groin pain after THA.

In the study, EAI was defined as a new cause of persistent groin pain after THA. To our knowledge, this has not been described earlier in literature.

Concerning native hips, several forms of EAI were described, such as ischiofemoral impingement, subspine impingement, iliopsoas impingement, deep gluteal syndrome and pectineofoveal impingement (Nakano, Yip, & Khanduja, 2017). EAI in native hips and EAI following THA are a bit the same. In both types there is a subspine impingement what causes a mechanical conflict between an enlarged or malorientated AIIS and the distal anterior femoral neck. Only THA patients don't have an enlarged AIIS.

THA has a high satisfaction rate, still 10-15% of patients complain of persistent pain (Hofstede et al., 2016). Groin pain is a typical location of pain in patients following THA. Prevalence varies from 0.4 to 18.3%.

Extrinsic causes have to be excluded. For example local neurological or vascular pathology, inguinal hernia, metastatic cancer and dissecting retroperitoneal pathology as well as distant causes including spinal pathology and radiculopathy (Henderson & Lachiewicz, 2012). When infection and component loosening were excluded, iliopsoas tendinitis was the most common cause of groin pain in THA patients (Ala Eddine et al., 2001; O'Sullivan et al., 2007). In patients with a hip resurfacing prosthesis, groin pain was often attributed to local adverse tissue reactions and pseudotumors in metal on metal prostheses. (Bartelt et al., 2010; Lavigne, Laffosse, Ganapathi, Girard, & Vendittoli, 2011).

EAI after THA had specific signs and symptoms that differ from psoas impingement. EAI patients had no pain with active flexion or straight leg raise, but pain in midflexion associated with a decreased internal rotation. The algorithm used to differentiate between the two is shown in table 4. A key factor in establishing the diagnosis was a positive chair up test and a positive marcainisation test.

Because of a mechanical conflict between the GT and the AIIS, revision surgery was indicated. The goal of this surgery was resolving the conflict. Mostly, this could be done by resecting some bone of the anterior part of the GT. If this was not enough, a longer head had to be used (to give more offset). In restricted cases a cuprevision can be performed to be able to use an offset liner.

Table 4: Differentiation between extra-articular impingement and psoas impingement.

PAIN		
	EAI	**Psoas**
Midflexion	+	-
Deep flexion	+	+/-
SLR	-	+
Active flexion 90°	-	+
Timing post-op	Immediately	Gradually
Location	Groin and lateral	Groin
Chair rise	+	-

It is important to acknowledge the limitations of this research. The most important remark was the relative small sample size. Only twenty patients were included. This can be explained by the fact that EAI is a new clinical entity, recruitment of the patients happened in a short period (28 months) and only one institution was involved. Another limitation was that postoperative clinical scores weren't filled in at fixed times. There was much variation between patients, although every patient had a minimum follow-up time of six months.

Despite these limitations, the strength of this research can be confirmed by several illustrations. For example, small faults in data processing were prevented with a double check of two examiners. The clinical examination was done by two independent examiners. Furthermore patient characteristics were well distributed.

This is, to our knowledge, the first research about EAI. Further research on this topic is required. Still, this study could be an important base for other orthopedic surgeons, doctors, physiotherapists and other health professionals.

In conclusion, extra-articular impingement is a cause of refractive groin pain after THA. Specific clinical and diagnostic tests were used to confirm the diagnosis. Revision surgery gave pain relieve and improved the outcome on pain, functioning and quality of life.

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Auteursrechtelijke overeenkomst

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Extra-articular impingement: a new cause of refractive groin pain following THA

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