



Original Article

Surgical treatment of femoroacetabular impingement using controlled hip dislocation after occurrence of slipped capital femoral epiphysis[☆]



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ABSTRACT

Objective: To present our experience and preliminary results from using controlled hip dislocation to treat cam-like femoroacetabular impingement, in teenagers and young adults with sequelae of slipped capital femoral epiphysis.

Methods: This was a retrospective analysis on 15 patients who were treated in a tertiary-level hospital between 2011 and 2013. The following data were collected for analysis from these patients' files: demographic data, surgical procedure reports, joint mobility evaluations, patients' perceptions regarding clinical improvement and whether they would choose to undergo the operation again, previous hip surgery and complications. The exclusion criteria were: follow-up shorter than six months, the presence of any other hip disease, osteotomy of the proximal femur performed at the same time as the osteochondroplasty and incomplete medical files with regard to the information needed for the present study.

Results: Fifteen patients (17 hips) who underwent osteochondroplasty to treat femoroacetabular impingement were evaluated. Nine of them were women, the mean age was 18 years old and the minimum follow-up was two years. Two patients underwent osteochondroplasty bilaterally; eight patients were operated on the left side and five on the right side. In 14 cases, the greater trochanter was lowered (relative lengthening of the neck) in association with the osteochondroplasty. For 13 patients, their previous surgery consisted of fixation of an occurrence of slipped capital femoral epiphysis; for six patients (eight hips), flexor osteotomy was performed previously; and for one patient, hip arthroscopy was performed previously. Fourteen patients presented improvement of mobility and hip pain relief, in comparison with before the operation, and they said that they would undergo the operation again. Two complications were observed: one of loosening of the fixation of the greater trochanter and one of heterotopic ossification.

[☆] Study conducted at Universidade Federal do Paraná, Hospital do Trabalhador, Curitiba, PR, Brazil.

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Conclusion: The preliminary results from this study suggest that osteochondroplasty through controlled surgical hip dislocation is a good option for treating femoroacetabular impingement. Through this method, the patients reported achieving improvement of joint mobility and hip pain, with few complications.

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Tratamento cirúrgico do impacto femoroacetabular pós- epifisiólise pelo método da luxação controlada do quadril

R E S U M O

Palavras-chave:

Impacto femoroacetabular
Osteocondroplastia
Luxação do quadril
Articulação do quadril

Objetivo: Relatar nossa experiência e os resultados preliminares com a luxação cirúrgica controlada do quadril no tratamento do impacto femoroacetabular (IFA) tipo CAM em adolescentes e adultos jovens com seqüela de epifisiólise femoral proximal.

Métodos: Análise retrospectiva de 15 pacientes tratados em hospital terciário, onde foram selecionados prontuários de pacientes que fizeram o procedimento de 2011 até 2013. Os dados coletados para análise foram: dados demográficos, descrição do procedimento cirúrgico, avaliação da mobilidade articular, impressão subjetiva do paciente no que se refere à melhoria clínica e se optariam por fazer a cirurgia novamente, cirurgias anteriores no quadril e complicações. Foram excluídos pacientes com seguimento menor do que seis meses, portadores de outras doenças do quadril, submetidos a osteotomias do fêmur proximal no mesmo momento da osteocondroplastia e cujo prontuário estivesse incompleto quanto às informações necessárias para o presente estudo.

Resultados: Foram avaliados 15 pacientes e 17 quadris submetidos a osteocondroplastia para o tratamento do IFA, nove pacientes eram do sexo feminino, média de 18 anos e seguimento mínimo de dois anos. Quanto à lateralidade, oito pacientes foram operados do lado esquerdo e cinco do lado direito, além de dois pacientes nos quais a osteocondroplastia foi feita de forma bilateral. Em 14 casos, abaixamento do trocânter maior (alongamento relativo do colo) foi associado à osteocondroplastia. Treze pacientes tinham como cirurgia prévia a fixação da epifisiólise, em seis (oito quadris) foi feita osteotomia flexora prévia e um fez uma artroscopia do quadril. Em 14 pacientes houve melhoria da mobilidade e da dor no quadril, quando comparada com o pré-operatório. Esses 14 pacientes relataram que fariam a cirurgia novamente. Foram observadas duas complicações, uma soltura da fixação do trocânter maior e uma ossificação heterotópica.

Conclusões: Os resultados preliminares deste estudo sugerem que a osteocondroplastia pela técnica da luxação cirúrgica controlada do quadril é uma boa opção no tratamento do impacto femoroacetabular. Por esse método os pacientes relataram melhoria da mobilidade articular e dor no quadril e tiveram poucas complicações.

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Introduction

Slipped Capital Femoral Epiphysis (SCFE) (epiphysiolysis) is a condition that affects pre-adolescents and adolescents without a definite cause. In moderate and severe grades, this pathology causes changes in the epiphysis and the femoral neck shape, and can predispose femoroacetabular impingement (FAI). This impingement predisposes biomechanical changes, pain, and deterioration of the acetabular articular cartilage. In turn, these factors may increase the risk of early hip osteoarthritis.

Recently, controlled surgical dislocation of the hip was shown to be an appropriate method for treating FAI, providing

improvements in hip pain and mobility, as well as preventing arthrosis.^{1,2} This technique, initially described by Ganz et al.,³ is based on the anatomical knowledge of the preservation of the medial femoral circumflex artery pathway,⁴ allowing for an excellent visualization of the femoral epiphysis and acetabulum, and thus minimizing the risk of avascular necrosis. It also allows, when necessary, correction of the extra-articular impingement, through femur osteotomies and distal transfer of the greater trochanter.⁵

This study aimed to report the preliminary results of controlled surgical hip dislocation in the treatment of CAM-type FAI secondary to SCFE in adolescents and young adults.

Material and methods

This study retrospectively included patients with FAI secondary to SCFE, in which an osteochondroplasty was performed using the controlled hip dislocation method.

Data were collected through analysis of medical records.

Patients with a minimum follow-up of six months, who were previously diagnosed with SCFE and underwent this technique, were included.

Exclusion criteria comprised patients with less than six months of follow-up; diagnosis of FAI caused by other hip pathologies; patients who underwent osteotomy of the proximal femur at the same time of osteochondroplasty; patients with hip osteoarthritis (Tonnis 0), as this is a relative contraindication for the procedure; and patients whose medical records were incomplete or were lost to follow-up.

All surgeries were performed by the same surgeon. Surgical technique comprised posterolateral access, osteotomy of the greater trochanter, preservation of the rotator muscles and the obturator internus tendon, anterior T-shaped capsulotomy (this is an alteration in the technique described by Ganz,³ who performed a Z-shaped capsulotomy, which does not interfere with femoral neck exposure, labrum, and acetabulum), anterior dislocation of the hip, complete exposition of the epiphysis and femoral neck, chondroplasty, impingement removal, and acetabular inspection to assess chondral injury and damage to the acetabular labrum. After osteochondroplasty, the range of motion of the hip was tested; control was conducted with an image intensifier to assess the absence of impingement.

Subsequently, capsule was sutured and the greater trochanter was fixed with two or three 4.5-mm cortical screws. In cases where the greater trochanter was raised, causing trochanteric impingement, a transfer was made, with distal fixation of the trochanter (a relative lengthening of the femoral neck) (Figs. 1-4).

Postoperatively, full weight support on the limb was not allowed for a mean of six weeks, which is the estimated time for consolidation of the greater trochanter. Physical therapy was started from the first postoperative day aiming to increase range of motion.

The data collected for analysis were sex (gender), age at time of surgery, the affected side, date of surgery, description



Fig. 1 – X-ray in anteroposterior incidence of a patient with FAI, after *in situ* fixation of SCFE.



Fig. 2 – X-ray in profile of a patient with FAI, after *in situ* fixation of the SCFE.

of the surgical procedure, previous hip surgery, subjective impression of the patient regarding clinical improvement (mobility and pain) and whether they would choose to have surgery again, and complications related to this procedure.

Complications were determined in accordance with the adaptation proposed by Sink et al.⁶ of the classification of surgical complications by Clavien⁷ and Dindo et al.,⁸ as described below:



Fig. 3 – X-ray in anteroposterior incidence, six months post-osteochondroplasty using the method of controlled dislocation of the hip, with lengthening of the femoral neck and removal of the cannulated screw.



Fig. 4 – X-ray in profile, six months postoperatively.

Sink et al.⁶ classification:

Grade I: requires no change in the post-operative management.

Grade II: requires change in the post-operative management.

Grade III: require surgical or radiological management.

Grade IV: associated with long-term morbidity.

Grade V: death.

The collected data were evaluated using an Excel® spreadsheet.

This study was approved by the Research Ethics Committee of the institution under the following number: CAAE: 30485814.4.0000.5225.

Results

From February 2011 to December 2013, 15 patients (17 hips) underwent osteochondroplasty to treat FAI secondary to SCFE. Minimum follow-up was of two years and maximum of four years and six months in the last clinical and radiographic evaluation.

Nine patients were female. Two patients underwent bilateral osteochondroplasty; in eight, on the left side; and in five, on the right side. Age at surgery ranged from 14 to 26 years, with a mean of 18 years. In 14 hips, in addition to the osteochondroplasty, a distal transfer of the greater trochanter was performed (relative lengthening of the femoral neck). Previous surgeries to treat SCFE were *in situ* fixation in 13 patients (15 hips); in six patients (eight hips), flexion osteotomy; and one patient had undergone arthroscopy (Table 1).

As a subjective impression of the patients, 14 reported improvements in joint mobility and pain when compared with preoperative period. These same 14 patients reported that they would undergo surgery again.

The last control X-rays of the 15 patients – at least two years after surgery – showed no signs of coxarthrosis. Two complications were observed: one loosening of the greater trochanter fixation, which was not treated and evolved into pseudarthrosis, classified as type III/IV by the criteria of Sink et al.⁶ (type III, complication that requires surgical intervention, and type IV, long-term sequelae). Other was one heterotopic ossification, classified as type I (complication that does not change the postoperative course, without clinical relevance). In the

Table 1 – Epidemiology, associated and prior surgeries.

Patient	Sex	Side	Age at surgery	Trochanter lowering	Prior surgery
1-A	Female	Bilateral – R	19	No	<i>in situ</i> fix., flex. ost.
1-B	Female	Bilateral – L	17	Yes	<i>in situ</i> fix., flex. ost.
2-A	Male	Bilateral – R	26	Yes	<i>in situ</i> fix., flex. ost.
2-B	Male	Bilateral – L	23	No	<i>in situ</i> fix., flex. ost.
3	Female	Left	14	Yes	<i>in situ</i> fix.
4	Female	Right	25	Yes	<i>in situ</i> fix., flex. ost.
5	Female	Left	17	Yes	<i>in situ</i> fix.
6	Male	Left	17	Yes	No
7	Female	Left	16	Yes	<i>in situ</i> fix.
8	Male	Right	19	Yes	<i>in situ</i> fix.
9	Female	Left	17	Yes	<i>in situ</i> fix.
10	Male	Left	16	Yes	No
11	Male	Left	15	Yes	<i>in situ</i> fix., flex. ost.
12	Male	Right	16	Yes	<i>in situ</i> fix.
13	Female	Right	20	Yes	<i>in situ</i> fix., flex. ost.
14	Female	Right	22	No	<i>in situ</i> fix., arthro.
15	Female	Left	17	Yes	<i>in situ</i> fix., flex. ost.

Patient 1 and 2 underwent bilateral surgery. *in situ* fix., *in situ* fixation; flex. ost., flexion osteotomy; arthro, arthroscopy.

Table 2 – Results.

Patient	Improved mobility	Would undergo surgery again	Complications
1	Yes	Yes	No
2	Yes	Yes	No
3	Yes	Yes	No
4	Yes	Yes	No
5	Yes	Yes	No
6	Yes	Yes	No
7	Yes	Yes	No
8	Yes	Yes	No
9	Yes	Yes	No
10	Yes	Yes	No
11	Yes	Yes	No
12	Yes	Yes	No
13	Yes	Yes	Heterotopic ossification
14	Yes	Yes	No
15	No	No	Loosening of the greater trochanter

present study, no cases of avascular necrosis, femoral neck fractures, and sciatic nerve injury were observed (Table 2).

Discussion

FAI has been described as a series of anatomical changes in the hip, which may be located in the femoral epiphysis (CAM), in the acetabulum (PINCER), or combined. These deformities cause damage to the acetabular labrum and acetabular cartilage, therefore leading to hip degeneration.^{9,10} As these abnormalities progress, they cause pain and decrease hip function. In the medical literature, several studies have demonstrated that FAI is one of the main causes of secondary hip osteoarthritis.⁹⁻¹⁴

Hips with sequelae from childhood and adolescence diseases, such as Legg-Calve-Perthes disease and SCFE, develop serious and complex deformities; their resolution with limited access or hip arthroscopy is difficult. In these cases, surgical dislocation provides a wide access to the femoral epiphysis, to the transition from the neck to the femoral head, and to the acetabulum, allowing for the treatment of labral tear, osteochondroplasty, redirection osteotomy, and distal transfer of the greater trochanter (relative lengthening of the femoral neck).¹⁵

Another option in this approach, often mentioned in the literature, is femoral intra- or extracapsular osteotomies. However, long-term studies that assessed intertrochanteric osteotomy for the treatment of SCFE sequelae without femoral neck osteochondroplasty were not successful in their attempt to change the natural course of coxarthrosis.^{15,16}

In the present study, nine female patients were included; the literature indicates a higher incidence of SCFE in males. This can be explained by the fact that the present study did not show the incidence of epiphysiolysis, but rather the patients in the clinic who had SCFE and FAI complaints.

In the present study, osteochondroplasties were performed using the controlled surgical hip dislocation technique in patients with proximal femoral epiphysiolysis sequelae. Thirteen hips had been fixed with cannulated screws to prevent the progression of the slip; eight hips had undergone flexion and derotational intertrochanteric osteotomy in an attempt

to improve mobility; and one patient had undergone an arthroscopy in order to treat the CAM.

Prior to surgical treatment of FAI, these patients complained of limitations in hip mobility. The physical examination showed a positive impingement test (pain on flexion, adduction, and internal hip rotation) and X-rays also showed signs of hip impingement; no hips had coxarthrosis signals. Thus, osteochondroplasty with controlled dislocation was indicated, with or without distal transfer of the greater trochanter on the principle of femoral neck lengthening, which would improve the abductor mechanism.

Results obtained were improvement in pain and especially in mobility. In the subjective assessment, 14 patients were satisfied and reported that they would undergo surgery again. The contralateral side procedure was performed in two patients, and only one patient reported dissatisfaction with the result of the surgical procedure and would not undergo surgery again.

The present results reflect the trend indicated in the literature, which shows a significant improvement in pain and mobility with osteochondroplasty using the described technique for FAI.^{6,10,15,17}

However, although these studies showed good improvement in the short- and medium-term, this surgical procedure and hip arthroscopy are relatively recent; therefore, a longer follow-up time is necessary to determine whether they change the natural course of coxarthrosis.^{5,10,17,18}

The most prevalent complications reported in this procedure are heterotopic ossification, avascular necrosis of the femoral head, sciatic nerve injury, pseudarthrosis of the greater trochanter, femoral neck fractures, and thromboembolic diseases (TEP, DVT); most of these were described in the multicenter study by Sink et al.⁶

One case of heterotopic ossification was observed in the present study; it did not change the way the post-operative period was conducted nor the end result. Another complication found was loosening of the greater trochanter fixation in the first postoperative month due to early gait, which was not allowed. A new fixation was indicated, but parents and patient opted not to do the procedure. This complication has evolved to pseudarthrosis and consequently to gait with gluteus medius insufficiency.

As a clinical inference, it is reasonable to estimate that longer follow-up of the present sample is needed to assess change in the installation of hip arthroplasty, as well as to analyze long-term results.

Conclusions

The preliminary results of this study indicate that osteochondroplasty using the technique of controlled surgical hip dislocation is an option to treat FAI. Patients reported improvements in hip mobility and pain. The few reported complications may be related to the steep learning curve for this surgical technique.

Conflicts of interest

The authors declare no conflicts of interest.

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