Med. J. Cairo Univ., Vol. 90, No. 3, June: 957-963, 2022
www.medicaljournalofcairouniversity.net

Early Results of Constrained Total Hip in Unstable Surgeries

MOSTAFA M.A. MELEEGY, M.Sc.; AHMED N. MORRAH, M.D.; IHAB ELDESOUKY, M.D.; AHMED H. ABDEL-AZEEM, M.D. and MOHAMED M.Z. ELASLAMBOULY, M.Sc.

The Department of Orthopedic Surgery, Faculty of Medicine, Cairo University

Abstract

Background: The constrained acetabular cups are widely used to treat instability after hip arthroplasty.

Aim of Study: To assess the hip joint function pre and post-operatively after the use of constrained acetabular component.

Patients and Methods: This cross-sectional study included 20 patients who underwent hip arthroplasty. These cases had hip instability either preoperatively or intra-operatively and they were all treated with hip arthroplasty involving the use of constrained acetabular component (The Single Articulation or Double Articulation Constrained cup). The follow-up period ranged from 12 to 30 months (the average was 20.4 months).

Results: When compared to the initial (preoperative) Harris hip score, a significant rise of the Harris hip score was measured at 3 months and 1 year postoperatively, [mean 25 vs. 77 vs. 91, respectively]. The improvement between 3 months and 1 year was slight and statistically significant. In the current study, 15 cases (75%) passed uncomplicated; while 5 cases had complications; two cases were dislocated, another two cases developed post-operative infection, one of them was combined with trochanter nonunion, and another case suffered from trochanter nonunion.

Conclusion: We concluded that the use of constrained acetabular component is an effective option in the treatment of patients with instability of the hip.

Key Words: *Constrained total hip – Unstable hip – Complication.*

Introduction

ONE of the most common complications after total hip arthroplasty (THA) is the instability of the joint either dislocation or subluxation **[1,2]**. Instability following primary THA is the most common indication for revision arthroplasty and the prevalence of chronic instability has been reported to range between 1-5% after primary THA, and as high as 5%-20% in revision THA **[3]**.

Dislocation of THA is defined by the loss of contact between the femoral head and acetabular component that requires intervention to relocate the joint. Subluxation is partial dislocation and refers to an often-transient loss of contact that usually is self-reduced **[4,5]**.

Over the last fifteen years, the use of the constrained acetabular components has become a common option for salvage of recurrent dislocation after total hip arthroplasty or for patients at high risk for dislocation **[6]**.

One of the main advantages of a constrained liner is its ability to provide stability without the need to revise a well-fixed and well-positioned acetabular component **[7]**. Another advantage is that it does not limit the use of secondary procedures, such as trochanteric advancement **[8]**.

A major theoretical complication of constrained liner may be fixation loss of the acetabular component before bony ingrowth to the porous surface. It is advisable to use at least peripheral screws to achieve initial stability. Also because of the constraining mechanism, there is decreased range of motion before impingement. Additionally, there are possible adverse effects on polyethylene wear and osteolysis. Constrained liners should only be used as a last best effort to maintain a stable hip for the patient with no additional dislocations with acceptance of the increased risk of polyethylene wear, osteolysis, and loosening **[9,10]**.

In this current work, was to assess the hip joint function pre and post-operatively after the use of constrained acetabular component.

Correspondence to: Dr. Mostafa M.A. Meleegy,
E-Mail: dr.mmeleegy@gmail.com

Patients and Methods

The current study was a cross-sectional study conducted at Cairo University Hospitals, Naser Institute and Air force Military Hospital during the period between February 2013 to October 2016. The study included 20 patients who underwent hip arthroplasty. These cases had hip instability either preoperatively or intra-operatively and they were all treated with hip arthroplasty involving the use of constrained acetabular component (The Single Articulation or Double Articulation Constrained cup). The follow-up period ranged from 12 to 30 months (the average was 20.4 months).

Patients who were included in this study were subjected to primary THA but at higher risk of dislocation, patients who required revision or conversion of THA with a history or clinical examination suggestive of abductor muscles deficiency, and patients with recurrent hip dislocation and patients who had intraoperative multidirectional hip instability. We excluded patients with active infection or potential source of infection, and patients with primary THA without any neuromuscular abnormality or muscles deficiency (no sign of instability).

Preoperative evaluation: All patients were subjected to preoperative history taking, complete clinical examination, and radiological examination. Harris Hip Score is used to evaluate the patients clinically preoperatively and postoperatively. The final result of the score was assessed as the following excellent: (90-100), good: (80-89), fair: (70-79), and poor: (<70). The aim of radiological examination was to determine the amount of bone stock in the acetabulum and whether it is sufficient for fixation of the acetabular component or require bone graft, determine degree of limb shortening, determine the width of the medullary canal, determine transverse head-neck ratio, determine type of implanted prosthesis and bone cement in conversion and revision cases, determine any apparent cause of instability.

Operative stage: In all patients spinal and epidural anesthesia was used then all patients were positioned laterally, and a slightly curved incision was centered over the greater trochanter.

Standard posterior approach was used in all the 20 cases. When reaching the femur, the femur was retracted anteriorly and medially and rotated slightly to determine which position provides the best acetabular exposure. Six cases required a Wagner's osteotomy to enable the safe removal of cement as well as reaming the distal femur in a position that enables neutral stem alignment. Other four cases required acetabular reconstruction by using mesh and morselized bone allograft. After implant and cement removal and application of the new stem, the osteotomy was repaired with multiple cerclage wires.

Out of the 20 cases upon which surgery was done, 12 cases required using a long-stem prosthesis. 10 of these stems were cementless and two were cemented. For the rest of the cases (8 cases), standard cementless stems were used. In 10 cases cemented cup with a snap-fit acetabular liner component was used, in 5 cases cementless cup with a captive liner was used. In the rest of the cases (5 cases) cemented Dual mobility cup was used.

The primary arc of motion and stability were tested; Firstly, with the hip and knee extended, external rotation to look for anterior instability, Secondly, flexing the hip to 90 degrees and internally rotating the leg to assess posterior instability. The angle formed between the coronal plane and the tibia at the point that the hip dislocates is a good guide of stability, a minimum of 45 degrees is recommended.

Postoperative evaluation: The transfer procedure was supervised. The legs were held with the operated hip abducted and externally rotated. Pillow was applied in-between the legs immediately after the patient was transferred to the bed, to prevent adduction of the hip. Walking was started on the second postoperative day and the walking aids were used for balance only. For cases with Wagner osteotomy, [11] fenestration or impacted graft full weight-bearing was delayed until radiological evidence of healing. Some patients needed outpatient physiotherapy for extra muscle strengthening.

All patients underwent clinical examination using Harris hip score and radiographic evaluation at regular periods during their follow-up.

Results

Demographic data and past history are shown in Table (1). The mean age of included patients was 58.2 years. Four cases at (36-46) age group and 4 cases at (47-56) age group while 7 cases at (57-66) age group and 5 cases at (67-76) age group.

Of the 20 patients, 12 (60%) of who underwent hip joint arthroplasty were type 3 and 8 (40%) were type 6 according to Paperosky's classification. Of those who underwent constrained acetabular component hip arthroplasty 10 cases (50%) were snap-fit, 5 cases (25%) underwent captive cup, and 5 (25%) other cases underwent dual mobility cup.

Table (1): Demographic data and past history of included cases.

Age (Years)	
Mean	58.2
Range	36-76
Sex:	[No. (%)]
Male	10 (50%)
Female	10 (50%)
Disease/Problem:	No.
Diabetes	3
Hypertension	4
Rheumatoid arthritis	1
Hypertension and DM	2
Myasthenia gravis	1
HCV	1
Number of previous surgeries:	No.
One previous surgery	12
Two previous surgeries	6
No previous surgeries	2

In all included cases, Harris hip score was used, in order to objectively assess hip joint function preoperatively, as well as 3 months and 1 year postoperatively. The mean initial (preoperative) Harris hip score was 25. There was a significant rise in the Harris hip score measured 3 months and 1 year postoperatively, when compared to the initial (preoperative) Harris hip score [mean 25 vs.77 vs. 91, respectively]. The improvement between 3 months and 1 year was slight and statistically significant (Fig. 1).

In the current study, 15 cases (75%) passed uncomplicated; while 5 cases had complications are summarized in Fig. (2).

Our results showed that two cases were dislocated. These cases used captive cup liner and the dislocation occurred after vigorous movements.

Another two cases developed post-operative infection; one of them was combined with trochanter nonunion.

In addition, another case was suffered from trochanter nonunion and treated conservatively (Fig. 4).

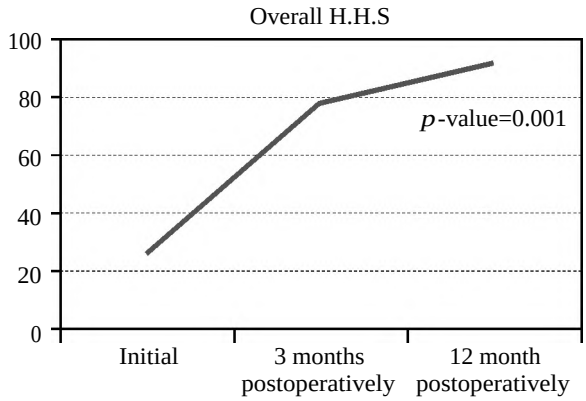


Fig. (1): Curve showing Harris Hip Score assessed Preoperatively, as well as 3 months and 1 years Postoperatively.

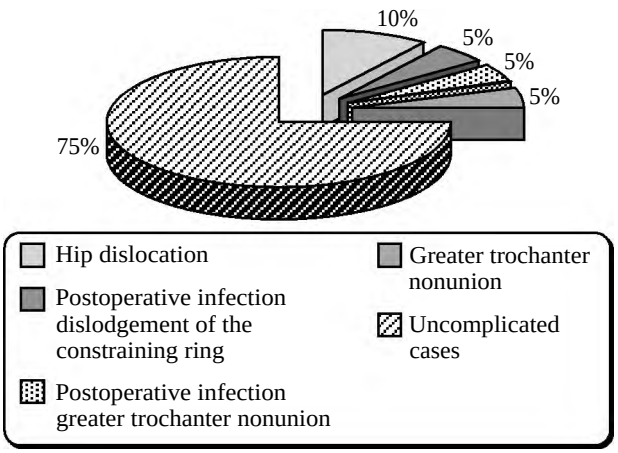


Fig. (2): Percentage and type of postoperative complication.

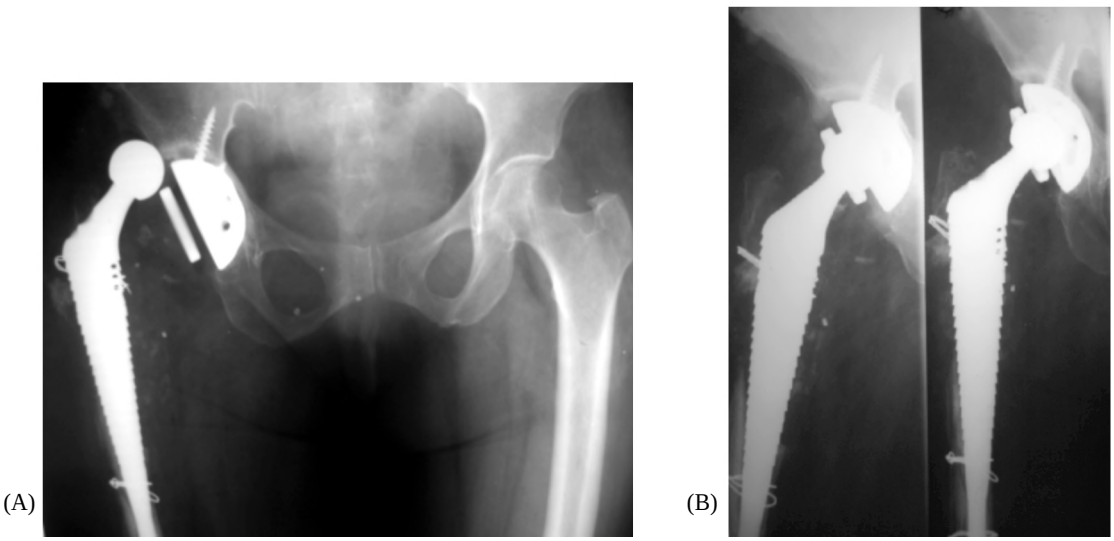
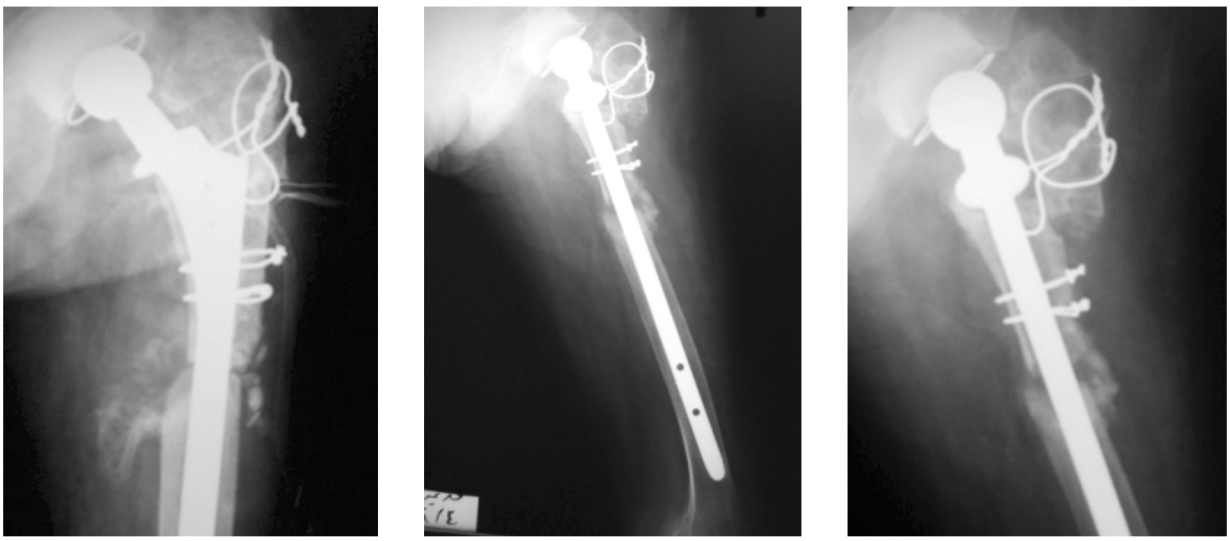


Fig. (3): (A) Dislocation of the femoral head with the constraining ring in place after 3 months (case no. 3), (B): X-ray after open reduction of the dislocation and exchange the insert.



(A) (B) (C)

Fig. (4): (A) Anteroposterior radiograph hip and upper femur postoperative 6 months. (B) Anteroposterior radiograph hip and upper femur postoperative 12 months. (C) Lateral radiograph hip and upper femur postoperative 12 months.

Discussion

The use of the constrained acetabular component has been proposed to treat the challenging cases of hip instability **[12,13]**.

In our study, the clinical results were satisfactory with good pain relief and resumption of a good level of activity. The mean follow-up period was 15.6 months. All the included cases had an initial (preoperative) poor Harris hip score. Of them, 10 (50%) turned into fair, and 8 (40%) turned into good, while 2 (10%) remained poor at 3 months postoperatively. At one-year follow-up none of the included cases had a poor Harris hip score, 11 cases (55%) turned to excellent and 9 (45%) other cases turned to good. This result matches those observed in earlier studies that reported that stability was restored and the Harris hip score improved significantly (no pain and good functional outcome) **[12-14]**.

There were no major intraoperative complications to note, however patients suffered from blood loss as these were major surgeries and required blood transfusion.

In the current study, two cases had postoperative dislocation. These cases used captive cup liner and the dislocation occurred after vigorous movement and was treated by open reduction and a change of the insert It's worth noting that the primary diagnosis of these cases was severe abductor muscle deficiency. Our low rate of dislocation may be due to the limited use of captive cup liner (only 5 cases). Satisfactory results were noted on follow-up visits. Clinical and radiological evaluation proved stable hip and no signs of infection. Another two cases developed post-operative infection. Culture and sensitivity were done and along with debridement of the wounds and I.V antibiotics were given according to the culture until they were completely cured. In addition, two cases of post-operative greater trochanter nonunion; one of them was combined with infection as mentioned before, and managed by open reduction and exchange of the insert. The other case was treated conservatively due to the poor general condition of the patient (heart ejection fraction below 20%), anesthesia was considered very risky and as a result, no further surgery was done.

In the study done by Della et al., **[14]** at a minimum of 2 years, 9 of the 55 hips (16%) dislocated. Out of these 9 dislocations, 8 occurred in patients who had undergone revision to a constrained liner for recurrent instability without femoral or acetabular component revision.

While in a study done by Callaghan et al., **[15]** had a dislocation rate of 7.1 % at ten years of follow-up. However, the success in achieving stability must be balanced by the evidence of early loosening of the component.

In another study to evaluate the effect of the constrained liner on the range of motion, Khan et al., **[12]** had an overall rate of aseptic loosening of 11.8% (4 of 34). In this study, no cases of loosening were recorded during the radiological follow-up and this may be attributed to the relatively short period of follow-up of 2 years.

Cooke C et al., [16] conducted a study on Fifty-eight patients who had received a constrained acetabular implant for recurrent instability (46), girdle stone reimplant (8), correction of leg-lengthening (3), and periprosthetic fracture (1). Eight patients (13.8%) required reoperation for the failure of the constrained implant. Seven of the 8 failures occurred in patients with recurrent instability. These results coincided with the results of this study with regards to the percentage of failure after the application of the constrained liner.

In another study conducted by Goetz et al., [17] the authors reported greater success using the Osteonics constrained acetabular insert in recurrent THA dislocation. The constrained liner prevented instability in 54 of 56 hips (96%) after an average follow-up of 3 years. This represents a substantial improvement over the traditional methods of achieving stability.

Goetz et al., [17] also used the constrained liner in situations of neuromuscular deficiency and intraoperative instability, implanting 101 liners. In this setting, there was a failure rate of only 4%. The authors cautioned, however, that the constrained liner has the potential for long-term problems and should not be considered as a first-line treatment option. In our study, the constrained liner provided stability in 90% of patients, but because our follow-up was only 2 years, we do not have a long-term rate of dislocation.

A long follow-up study was conducted by Geotz et al., [18] to assess long-term implant loosening, osteolysis, and later recurrent instability. Fifty-five patients treated with a total of fifty-six constrained acetabular components because of recurrent dislocations of a total hip prosthesis were followed for an average of 10.2 years (range, 7 to 13.2 years) or until death. Four (7%) of the fifty-six hips had a subsequent dislocation or failure of the device. Three femoral components (5%) and two acetabular components (4%) were revised because of aseptic loosening. One hip was revised because of osteolysis. Of the twenty-six hips in the twenty-five living patients evaluated at an average of 10.4 years, fourteen (54%) were not painful and two (8%) were severely painful. Twelve patients (twelve hips) had no limp, and five patients (six hips) were unable to walk. This long-term study concluded that constrained acetabular component provides durable protection against additional dislocations without substantial deleterious effects on component fixation.

Shapiro et al., [8] conducted a study on 85 hips with an average follow-up period of 58 months. These 85 hips were evaluated at a minimum of 3 years. Overall, a 2.4% dislocation rate and an 8.2% revision rate were seen. The recurrent dislocation rate of 2.4% represents a significant improvement over other methods reported. All 49 cementless hips were fixed by bone ingrowth at the time of radiographic follow-up. The progression of radiolucent lines was less than 1mm at the most recent follow-up. Two acetabular components were revised for aseptic loosening of the shell (at 39 and 41 months). The radiolucent lines were circumferential, and the shell had changed position, necessitating a revision. Osteolysis was not present in any of these hips. But we neither documented femoral nor acetabular component loosening or osteolysis. This maybe probably because of the short-term follow-up involved in this study.

Bremner et al., [19] evaluated, at an average 10.3-year follow-up, 101 tripolar constrained components (Stryker How medic an Osteonics) used in the total hip arthroplasty construct. At the final follow-up, 6 hips had dislocated or had a failure of the constrained component, 5 of which were revised. In addition, 4 hips were revised for aseptic loosening of the acetabular component, 4 hips were revised for aseptic femoral loosening, and 1 hip was revised for acetabular osteolysis. These results were better than our study as the author is a renounced surgeon.

Levine et al., [20] stated that tripolar constructs were effective at preventing or eliminating instability in 93% of complex cases.

Leiber-Wackenheim et al., [21] evaluated the treatment of recurrent THA instability with a Dual mobility cap in a series of 59 T.H.A revision using a cementless dual mobility cup. At a mean follow-up of 8 years (range 6-11), there was one early dislocation that was treated with closed reduction with no further dislocation. The mean Harris hip score was 86.7 with 62% of patients, reporting good results and only 8% reporting acceptable or poor results. The overall survivorship of the implant was 98% and the instability recurrence rate was 1.7%. Postoperative radiographic evaluation showed no osteolysis or failure of fixation in the series. The authors suggest that their success with cementless dual mobility cups offers a preferable alternative to constrained implants for the treatment of recurrent THA instability.

Lachiewicz et al., [22] showed that the dual mobility component improves stability, range of motion, and jump distance by providing an additional articular surface. We have two cases of post-

operative infection in our study of which one had dislodgement of the constrained ring at 6 months without dislocation and the other suffered from non-union of the greater trochanter. Maybe the cause of the infection was attributed to the non-compliance of the patient, bad general health, and bad hygiene. The pros of this study include the following; one approach was used for all cases, the use of both Harris hip scoring (a clinical evaluation system) preoperatively and posts operatively which enable us to compare our results with other authors, and the use of radiological evaluation, which showed no case of early loosening.

The cons of this study include: A limited number of cases (20 cases) involved as compared to other studies involving a larger number of patients; A relatively short interval of follow-up of 2 years. The use of different types of acetabular liners. This was due to the market unavailability of dual mobility cups at the beginning of this study. As a result,a single articulation liner was used early on in the study. According to many studies, the Dual-mobility cup has shown excellent hip stability in both primary and revision hip arthroplasty. This is especially true in abductor deficiency, or if all other surgical attempts to restore stability have failed but we don't have long-term follow-up to conclude this issue.

Conclusion:

We concluded that the use of constrained acetabular component is an effective option in the treatment of patients with instability of the hip and further studies are recommended for a long-term follow-up results.

References

1- CROMPTON J., OSAGIE-CLOUARD L. and PATEL A.: Do hip precautions after posterior-approach total hip arthroplasty affect dislocation rates? A systematic review of 7 studies with 6,900 patients. Acta. Orthop., 91 (6): 687-92, 2020.

2- BROOKS P.J.: Dislocation following total hip replacement: causes and cures. Bone Joint J., 95-b (11 Suppl A): 67-9, 2013.

3- SHETH N.P., MELNIC C.M. and PAPROSKY W.G.: Evaluation and management of chronic total hip instability. Bone Joint J., 98-b (1 Suppl A): 44-9, 2016.

4- PADGETT D.E. and WARASHINA H.: The unstable total hip replacement. Clin. Orthop. Relat. Res., 420: 72-9, 2004.

5- PULIDO L., RESTREPO C. and PARVIZI J.: Late instability following total hip arthroplasty. Clin. Med. Res., 5 (2): 139-42, 2007.

6- WERNER B.C. and BROWN T.E.: Instability after total hip arthroplasty. World J. Orthop., 3 (8): 122-30, 2012.

7- PARVIZI J., PICINIC E. and SHARKEY P.F.: Revision total hip arthroplasty for instability: Surgical techniques and principles. J. Bone Joint Surg. Am., 90 (5): 1134-42, 2008.

8- SHAPIRO G.S., WEILAND D.E., MARKEL D.C., PADGETT D.E., SCULCO T.P. and PELLICCI P.M.: The use of a constrained acetabular component for recurrent dislocation. J Arthroplasty, 18 (3): 250-8, 2003.

9- GUYEN O., LEWALLEN D.G. and CABANELA M.E.: Modes of failure of Osteonics constrained tripolar implants: A retrospective analysis of forty-three failed implants. J. Bone Joint Surg. Am., 90 (7): 1553-60, 2008.

10- BOUCHARD S.M., STEWART K.J., PEDERSEN D.R., CALLAGHAN J.J. and BROWN T.D.: Design factors influencing performance of constrained acetabular liners: Finite element characterization. J. Biomech., 39 (5): 885-93, 2006.

11- SUNDARAM K., SIDDIQI A., KAMATH A.F. and HIGUERA-RUEDA C.A.: Trochanteric osteotomy in revision total hip arthroplasty. EFORT Open Rev., 5 (8): 477-85, 2020.

12- KHAN R.J., FICK D., ALAKESON R., HAEBICH S., DE CRUZ M., NIVBRANT B., et al.: A constrained acetabular component for recurrent dislocation. J. Bone Joint Surg. Br., 88 (7): 870-6, 2006.

13- SHRADER M.W., PARVIZI J. and LEWALLEN D.G.: The use of a constrained acetabular component to treat instability after total hip arthroplasty. J. Bone Joint Surg. Am., 85 (11): 2179-83, 2003.

14- DELLA VALLE C.J., CHANG D., SPORER S., BERGER R.A., ROSENBERG A.G. and PAPROSKY W.G.: High failure rate of a constrained acetabular liner in revision total hip arthroplasty. J. Arthroplasty, 20 (7 Suppl 3): 103-7, 2005.

15- CALLAGHAN J.J., O'ROURKE M.R., GOETZ D.D., LEWALLEN D.G., JOHNSTON R.C. and CAPELLO W.N.: Use of a constrained tripolar acetabular liner to treat intraoperative instability and postoperative dislocation after total hip arthroplasty: A review of our experience. Clin. Orthop. Relat. Res., 429: 117-23, 2004.

16- COOKE C.C., HOZACK W., LAVERNIA C., SHARKEY P., SHASTRI S. and ROTHMAN R.H.: Early failure mechanisms of constrained tripolar acetabular sockets used in revision total hip arthroplasty. J. Arthroplasty, 18 (7): 827-33, 2003.

17- GOETZ D.D., CAPELLO W.N., CALLAGHAN J.J., BROWN T.D. and JOHNSTON R.C.: Salvage of total hip instability with a constrained acetabular component. Clin. Orthop. Relat. Res., 355: 171-81, 1998.

18- GOETZ D.D., BREMNER B.R., CALLAGHAN J.J., CAPELLO W.N. and JOHNSTON R.C.: Salvage of a recurrently dislocating total hip prosthesis with use of a constrained acetabular component. A concise follow-up of a previous report. J. Bone Joint Surg. Am., 86 (11): 2419-23, 2004.

19- BREMNER B.R., GOETZ D.D., CALLAGHAN J.J., CAPELLO W.N. and JOHNSTON R.C.: Use of constrained acetabular components for hip instability: An average 10-year follow-up study. J. Arthroplasty, 18 (7 Suppl 1): 131-7, 2003.

20- LEVINE B.R., DELLA VALLE C.J., DEIRMENGIAN C.A., BREIEN K.M., WEEDEN S.H., SPORER S.M., et al.: The use of a tripolar articulation in revision total hip arthroplasty: A minimum of 24 months' follow-up. J. Arthroplasty, 23 (8): 1182-8, 2008.

21- LEIBER-WACKENHEIM F., BRUNSCHWEILER B., EHLINGER M., GABRION A. and MERTL P.: Treatment of recurrent THR dislocation using of a cementless dual-mobility cup: A 59 cases series with a mean 8 years' follow-up. Orthop. Traumatol. Surg Res., 97 (1): 8-13, 2011.

22- LACHIEWICZ P.F. and WATTERS T.S.: The use of dual-mobility components in total hip arthroplasty. J. Am. Acad. Orthop. Surg., 20 (8): 481-6, 2012.

النتائج المبكرة ما بعد تغير مفصل الورك بمفصل صناعى مقيد فى حالات جراحات مفصل الورك للغير مستقر

الحق الاسير فى جراحات مفصل الورك الصناعى يستخدم بشكل كبير فى علاج جراحات مصل الورك الغير مستقرة. وقد كان هدف البحث هو تقييم وظيفة مفصل الورك بالمقارنة ما قبل وما بعد تغير المفصل الورك بالحق الاسير.

حيث عدم الاستقرار ما بعد التغيير الكامل لمفصل الورك الصناعى يمثل أكثر المضاعفات حدوثاً، حيث تمثل عبئاً لكل من المريض والجراح، كما أنها أشهر المضاعفات التى تؤدى إلى عملية مراجعة تغيير المفصل. قد تم استخدام مفصل صناعى الحق الاسير المغلق أحادى القطب أو ثنائى القطبين، حيث إن استخدامهما ينصح به فى حالات عدم استقرار المفصل الوركى الصعبة. وتمت دراسة ٢٠ مريض وكانت فترة المتابعة من ١٢ إلى ٣٠ شهراً (المتوسط ٢٠.٤ شهراً).

ومن خلال هذه الدراسة وجد ١٥ حالة (٧٥٪) لم يوجد لديهم مضاعفات. بينما ٥ حالات سجلت مضاعفات ما بين ٢ حالة خلع ما بعد العملية وتم عمل رد مفتوح للمفصل وتغير الجزئى البلاستيكى. وحالتين التهاب بكتيرى وحالة عدم التئام للمدور الكبير لعظمة الفخذ.

توصى هذه الدراسة باستخدام مفصل صناعى وركى ذات الحق الاسير كوسيلة نهائية لإنقاذ المرضى الذين يعانون من عدم الاستقرار فى مفصل الورك، وذلك بناء على نتائج المتابعة الإكلينيكية باستخدام مقياس هاريس، والمتابعة بالاشعات. ويوصى بالمزيد من المتابعات والدراسات طويلة الامد لمزيد من التقييم الإكلينيكى للمرضى وتقييم حالة المفصل.