# INITIAL RIGID FIXATION TECHNIQUES FOR ACETABULAR CUP IN CEMENTLESS TOTAL HIP ARTHROPLASTY

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## ABSTRACT

***Objective:*** To see the effectiveness of press fit technique to achieve initial rigid stability for Acetabular cup in cementless total hip arthroplasty (THA) done for Osteonecrosis of femoral head (ONFH) in our setting.
***Study Design:*** Case series.
***Place and Duration of Study:*** Study was conducted in UNIT 3 Orthopedic department, Combined Military Hospital Rawalpindi from Oct 2015 to Aug 2016.
***Patients and Methods:*** All cementless total hip arthroplasty (THA) patients operated for Osteonecrosis of femoral head (ONFH) in UNIT 3 were included. Total of 12 patients were included in study with age ranging from 22 years to 47 years with mean age of 35.30 years. All patients were operated in lateral decubitus position. Confirmation of adequate fit was done by visual inspection through the hole in the acetabular cup and by rocking of the pelvis after insertion of trial cup with its attached handle.
***Results:*** Out of 12 patients, line to line technique was found to be successful in 10 (83%) patients. Two (17%) patients needed press fit technique.
***Conclusion:*** Line to line technique is more successful technique for initial rigid stability in cementless total hip arthroplasty (THA) for Osteonecrosis of femoral head (ONFH) in our setting.

**Keywords:** Avascular necrosis of bone, Femur Head Necrosis, Hip Replacement Arthroplasty, Osteonecrosis.



## INTRODUCTION

Total hip arthroplasty (THA) is the most commonly done surgery for adult hip reconstruction. In the beginning, it was done to reduce the pain in osteoarthritic hips of patients above 65 years of age, who did not respond to non-surgical treatment. As the operation was remarkably successful, other disorders were also treated by this operation. Osteonecrosis of femoral head (ONFH) is one of the commonest indications for THA, after Osteoarthritis of hip. These patients of ONFH usually are 24 to 45 years old[1]. These patients are younger than those of patients suffering from osteoarthritis of hip and are expected to place increased demands on total hip arthroplasty (THA) as they are more active and have a longer life expectancy. The cemented acetabular cup in Charnley arthroplasty in young and active patients has been shown to be associated with a higher degree of polyethylene wear and osteolysis at the cement bone interface. However, cementless acetabular components have been shown to be more successful in young patients[2]. Cementless THA gets long term fixation and stability to bone by osseointegration. The surface of these implants is treated in different ways to enhance this osseointegration. They may have a layer of porous beads, titanium mesh or hydroxyapatite coating on them for this purpose. But for this osseointegration to occur, it is important to have initial mechanical stability between the bone and the implant to allow bone on- or in growth. Uncemented hips when well fixed, develop a sturdy biological fixation in bone which improves cyclically with time[3]. Two techniques are used to achieve this initial rigid implant fixation to the host bone and they are press fit technique and line-to-line technique[4]. Most of the surgical technique manuals from manufactures of cementless THA implants

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*Received: 01 Nov 2017; revised received: 09 Nov 2018; accepted: 22 Nov 2018*

suggest the press-fit fixation technique to achieve initial mechanical stability for the acetabular cup. In press fit technique, bone is prepared in a way in which a slightly oversized implant (relative to bone contour) is impacted into position. To achieve an optimal press-fit, under reaming of 1 to 2mm to the templated acetabular cup is required[5]. Initial mechanical stability cannot be achieved if the acetabular cup does not sit properly in contact with the bottom of the acetabulum and leaves a gap between the cup and the bone. This may occur when the acetabular bone is hard or when the reamed cavity is smaller than necessary. Under such circumstances, if a very strong force is used to hammer the cup to seat it, it may result in fracture around the acetabular cup. Contrariwise if the acetabular cup created by reaming is bigger than needed size, especially in older patients with osteoporosis, initial press fit fixation will not gain requisite cup stability[6]. Most common complication of the press fit technique is the fracture of the acetabulum. In line to line technique, bone is prepared in a way that the size of acetabulum is same as that of implant cup so there is minimal risk of acetabular fracture. Acetabular cup is impacted into the position and is secured with multiple screws placed into bone through the implant cup. This study draws its significance from the fact that most of the surgical technique manuals stress and advocate pressfit technique for initial rigid fixation of acetabular shell, whereas both techniques i.e. pressfit as well as line to line technique have been mentioned in the literature for this purpose. Pressfit technique may not succeed in all the cases and hence the line to line technique should be kept in mind to achieve initial rigid immobilisation, as it follows the pressfit technique in a sequence as mentioned below in methods. Failure to proceed to line to line technique may result in possible complications like fracture of the acetabulum, improperly seated acetabular cup which draws its stability only from screw fixation or abandoning the cementless procedure in favour of a cemented cup to achieve the stability. No study exists in local literature as to which type of technique is more successful in our setting and at the moment we are translating and applying the western results in our population. An awareness of this second technique of line to line insertion being available in cases where press fit technique fails to achieve the initial rigid stability without risking the above mentioned complications, will add to the arsenal of any orthopaedic surgeon in tackling these challenging cases. This study might prove to be a change agent for cementless acetabular insertion in young patients, in orthopaedic practice. Hypothesis: In majority of cases, press fit is the most appropriate technique for insertion of cementless acetabular cup in THA for Osteonecrosis of femoral head (ONFH).


**Figure-1: Acetabular Cup insertion protocol[8].**

## PATIENTS AND METHODS

A series of 12 cases were included in case series study through Purposive sampling, which was conducted in UNIT 3 Orthopaedic Dept, CMH Rawalpindi from October 2015 to August 2016. All patients of Osteonecrosis of femoral head (ONFH) operated with cementless THA were included. All cemented THA were excluded. One hybrid THA was also excluded

from the study. PINNACLE Sector Acetabular Cup (DePuy Synthes, Joint Reconstruction companies of Johnson & Johnson ®, Leeds, UK) was used in all cases. Total of 12 patients were included in study with age ranging from 22 years to 47 years. and mean age of 35.30 years. All cases were done for FICAT stage 4 of Osteonecrosis of femoral head (ONFH). Surgical Technique: Informed consent was achieved from all the patients in whom the recommended protocol (fig-1) was explained with possible complications and outcomes. All patients were operated in lateral decubitus position with patient lying on contralateral side. Hardinge's lateral approach was used in all the cases. PINNACLE Sector Acetabular Cup (DePuy Synthes, Joint Reconstruction companies of Johnson & Johnson®, Leeds, UK) was inserted in 40-45 degrees of inclination and 20 degrees of anteversion. Confirmation of adequate fit was done by visual inspection through the hole in the acetabular cup to confirm that cup is well seated with the acetabular bone. Initial mechani-cal stability was further confirmed by rocking the trial cup after insertion through its introducing handle. A cup with initial mechanical stability would result in rocking of the pelvis instead of rotating inside the acetabulum. Same was repea-ted after insertion of definitive cup. Technique was to start with a 2mm under ream and trial, followed by 01mm under ream and trial followed by line to line reaming (fig-2)[8]. Descriptive statis-tics including mean and standard deviation were calculated for age of the patients using Statistical Package for Social Sciences (SPSS) version 17 (shown in table).

**Table: Descriptive Statistics**

| | N | Minimum | Maximum | Mean | SD |
|---|---|---|---|---|---|
| Age | 12 | 22.00 | 47.00 | 34.5000 | 6.41731 |
| Valid N (list wise) | | | | | |

## RESULTS

Out of twelve, line to line technique was found to be successful in ten patients whereas in one patient press fit technique with 2mm under ream and in one other patient press fit technique with 1mm under ream resulted in appropriate seating of acetabular cup. Thus in 83% cases line to line technique was used and in 17% cases press fit technique provided successful appropriate fit.

## DISCUSSION

We found that contrary to the literature, initial mechanical stability and most appropriate fit was achieved using line to line technique, in our setting, without exposing the patient to the risks of acetabular fracture. The difference in results from recommendations in literature can be due to the younger age group of patients included in our study. We assume, that younger patients have denser and less elastic bones which may result in loss of bone expansion in response to press fit technique as the acetabulum has to expand a bit to accommodate the fractionally larger acetabular cup[8]. We do not know the mean age of the patients in studies which form the basis of press fit technique being stated, by surgical technique manuals, as the most recommended technique to achieve initial mechanical stability. THA is more commonly done in older age group patients for conditions like OA hip and post-traumatic osteonecrosis of hip arising from fracture neck of femur with osteoporotic bones, and these conditions arise mostly in older age

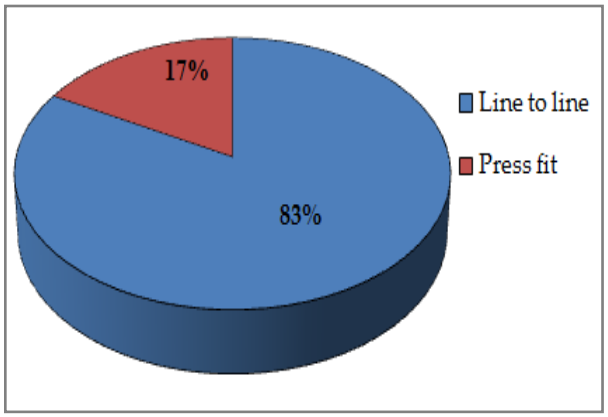


**Figure-2: Results of initial rigid fixation technique.**

group patients. In older age group the bones are likely to be softer and more accommodative for press fit technique. Average age in one of the studies studying cementless THA was 60 years ± 11[9]. We assume that the recommendations in literature favouring pressfit technique as the most indicated technique in cementless acetabular cup insertion might be based on studies in which majority of THA's were done in older age group whereas in our study mean age of patients was 35.30 years. However, this study has limitations of being carried out in a smaller number of patients over a relatively shorter period of time, as the disease is not very common amongst the masses. Also this study was conducted in a single centre. It is recommended that this study be carried out in multiple centres over a longer period of time to have clear evidence. With the emergence of Pakistan National Joint Register (PNJR), it will be worthwhile to add a column to the register, about the technique used to achieve initial rigid immobilisation in cementless acetabular cup.

## CONCLUSION

We conclude that in this initial study, the working hypothesis was found incorrect. In patients of Osteonecrosis of femoral head (ONFH) which occurs in a younger age group and have denser bones, line to line reaming technique achieved initial rigid fixation in more number of patients as compared to press fit technique, for acetabular cup in cementless total hip arthroplasty (THA). However, a bigger, longer and multicentre study should be carried out to find the correct evidence in this sub group of patients undergoing cementless total hip arthroplasty (THA).

## CONFLICT OF INTEREST

This study has no conflict of interest to be declared by any author.

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