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## Impact of Physiotherapy on an Obese Subject with Avascular Necrosis – Case Study Report

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### Abstract

**Introduction:** The avascular necrosis of the femoral head is an increasing cause of the musculoskeletal disability, with diagnostic and therapeutic problems with global increase in prevalence of obesity and its impact on this already painful condition limiting functional activities including walking, self-care etc. are analysed in this study. **Aim and Objectives:** The aim and objectives of this case study report was (i) to analyse reduction in obesity and its influence on a subject with Avascular Necrosis. (ii) To evaluate clinical and subjective impact with exercises on this subject. **Materials and Methodology:** Treated with exercises for his obesity and orthopaedic complaints with a frequency of two sessions a week. Each session lasts for 25 – 30 minutes. The intensity of the exercises were at 70% of the maximal heart rate. **Results:** There is reduction in waist circumference ( $p < 0.01$ ) and pain level ( $p < 0.05$ ) as evidenced statistically following exercises, thereby improving cadence and range of motion. **Conclusion:** The recorded outcome of this research on the effectiveness of conservative physiotherapeutic management on an obese subject with Avascular Necrosis subject, there by delaying in undergoing surgery for the same, benefits of which can be extended on similar obese subjects and with other musculoskeletal disorders.

**Keywords:** WC – Waist circumference, VAS – Visual Analogue Scale, Avascular Necrosis, Cadence – Number of steps per unit, ROM – Range of Motion, OA – Osteoarthritis.

### Introduction

The avascular necrosis of the femoral head is an increasing cause of the musculoskeletal disability, with diagnostic and therapeutic problems. (Aiello MR et al 2011). The disease is especially common among younger population, patients are usually between 3rd and 5th decade of life, affecting mainly men (Tofferi JK et al 2012 and Mont M et al 1995). Patients are initially asymptomatic, femoral head avascular necrosis progresses to destruction of the hip joint in a relatively short time, requiring hip arthroplasty usually until the 5th decade of life they are pain free during the ischemic episode, the occult, avascular necrosis of the femoral head may be present for more than 5 years before the onset of symptoms (Lieberman JR et al, 2003).

Avascular necrosis is also known as osteonecrosis, occurs when compromised vascular supply causes ischemia and eventually necrosis of the femoral head. Blood is supplied to the femoral head via a branch of the obturator artery that is conveyed across the intra articular space on the ligamentum teres or round ligament. (Dawn Colomb Lippa, 2014).

Necrosis progresses to collapse of the femoral head, which then leads to mechanical failure of the hip. Avascular necrosis accounts for 5% to 18% of total hip arthroplasties performed in the United States annually. (Dawn Colomb Lippa, 2014)

### Prevalence of Avascular Necrosis

The prevalence of avascular necrosis of femoral head is uncertain, but each year in the USA there are between 10,000 – 20,000 new cases diagnosed with avascular necrosis of femoral head. (Levine M et al 2012, Kelly JD et al 2010, Mankin HJ et al 1992, Robinson HJ et al 1993, Babis GC et al 2011 ). The relative frequencies of the most common causes are alcohol intake (20 – 40%), corticosteroid therapy (35 – 40%), and idiopathic causes (20 – 40%) (Aiello MR et al 2011).

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A percentage between 5 – 18% of a total of 500,000 hip replacement surgeries performed in a year are performed on patients diagnosed with avascular necrosis of the femoral head, the cost is estimated to be about 1 billion dollars annually. (Aiello MR et al 2011, Tofferi JK et al 2012, Mont M et al 1995, Lieberman JR et al 2003, Levine M et al 2012, Kelly JD et al 2010, Mankin HJ et al, 1992, Robinson HJ et al 1993, Coventry MB et al 1994.)

In a study from Japan there were 2500 – 3000 new cases of avascular necrosis of femoral head every year (Tofferi JK et al 2012). The common causes incriminated in occurrence of disease were corticosteroids (34.7%), and idiopathic forms (37.1%). In a retrospective study conducted in England in 2009, the estimated incidence of disease, between 1989 and 2003, was from 1.4 to 3 cases per 100000 inhabitants. The important risk factor is trauma. (Cooper C et al 2010)

The hip abductors, gluteus medius, gluteus minimus, and tensor fascia latae provide stability of the pelvis on the hip during single – limb weight – bearing activities, such as walking and stair ambulation (Anderson FC et al 2003). Loureiro et al 2013 concluded that persons with hip OA exhibited weakness in the hip abductors compared to asymptomatic controls.

In Central India, sickle cell disease has a very high prevalence and is the most common associated condition with osteonecrosis followed by alcohol abuse and corticosteroid use. (Sudhir S Babhulkar, 2003)

**Aim and Objectives**

The aim and objectives of this case study report was to analyse reduction in obesity and its influence on a subject with Avascular Necrosis. Also to evaluate clinical and subjective impact with exercises on this subject.

**Materials and Methodology**

This subject treated with exercises for his obesity and orthopaedic complaints since the last 3 months with a frequency of two sessions a week.

Each session lasts for 25 – 30 minutes. The intensity of the exercises were at 70% of the maximal heart rate.

At the end of 25 sessions the following parameters were analysed with due statistical means and tabulated as shown in results.

A male patient, aged 58 years serving as a faculty in an engineering college gives a medical history of fall in 2008 and was treated with valgization osteotomy with condylar blade plate fixation. (Right) Complains of pain in the right hip with difficulty in walking since 7 years.

**On Observation**

- Limb length discrepancy.
- Atrophy of right gluteal and anterior thigh muscles.
- Ambulant with list to left.
- Right hip internally rotated and genu valgum.

**On Examination**

Limb length: Right lower extremity: 99cm, Left lower extremity: 101cm, Cadence: 52/ minute.

Circumference of Gastrocnemius: Left: 33.5cm; Right: 37.5cm.

Range of motion of RIGHT HIP Flexion: 0<sup>0</sup> – 30<sup>0</sup>, Extension: 0<sup>0</sup> - 5\*, Abduction: 0\* - 10\*

KNEE JOINT: Flexion: 0\* - 90\*

MOTOR POWER: Hip Flexors: 3+/5, Abductors: 3+/5,

Adductors: 3+/5, Extensors: 3+/5

Knee Flexors: 4/5, Extensors: 4/5

Spinal Extensors: 3/5 Flexors: 3/5

**Anthropometric Measurements**

Waist circumference: 106cm.

**Pain:** Increasing on movements of right leg, walking with VAS scale of 8/10.

**Provisional Diagnosis:** Post traumatic Avascular Necrosis of right hip.

**Treatment**

Mobilisation exercises: For spine, Hip and Knee

Strengthening exercises: For Knee, Abdomen, hip, Also on contralateral side.

Closed kinematic exercises: For knee joint.

Resisted exercises using physio ball.

**Table 1 on:** Clinical Prognosis:

|      | ROM OF HIP   | CADANCE     |
|------|--|-------------|
| PRE  | Right:<br>Flexion:0*-30*<br>Extension:0*-5*<br>Abduction:0*-10*  | 52 / Minute |
| POST | Right:<br>Flexion:0*-65*<br>Extension:0*-10*<br>Abduction:0*-15* | 60 / Minute |

**Results**

**Table 2 on:** Results of the subject pre and post exercise on waist circumference and pain.

|      | Waist Circumference     | Pain |
|------|-------------------------|------|
| Pre  | 106 cm                  | 8    |
| Post | 93 cm (12.2% reduction) | 3    |

|                    |          |          |
|--------------------|----------|----------|
| Standard Deviation | 9.19     | 3.53     |
| Standard Error     | 3.03     | 1.88     |
| 't' value          | 4.29     | 2.66     |
| p value            | p < 0.01 | p < 0.05 |

**Currently available non-invasive treatment options:**

1. Conservative management with protected weight bearing is not effective. This treatment will allow progression of their condition in one or two years. Before the onset of femoral head collapse, non - operative treatment includes the use of various electromagnetic, acoustic stimulation or pharmacologic agents. (Philippe Hernigou, 2009).
2. Leo Massari et al have analysed the effects of stimulation with Pulsed electromagnetic fields (PEMFs) on the treatment of avascular necrosis of the femoral head. Hypothesized that the effect of PEMF stimulation may be to protect the articular cartilage from the catabolic effect of inflammation and subchondral bone marrow oedema. (Philippe Hernigou, 2009).
3. Eli peled has evaluated the influence of alendronate treatment on the rat femoral head shape after 6 weeks of daily treatment, when compared with controls. Alendronate treatment prevented the distortion and destruction of the femoral head. Osteoclasts inhibition might prolong the bone creeping substitution, which

might reduce disability due to femoral head collapse. (Philippe Hernigou, 2009).

**Surgical management of avascular necrosis:**

1. Patients diagnosed in the early stages (I and II) had benefited from a surgical procedure performed in order to save and to maintain the integrity of the femoral head, respectively decompression drilling. Patients diagnosed in the third and fourth evolutionary stage have not benefitted from other therapeutic means, in addition to the reconstruction of the femoral head, respectively hip arthroplasty. (Diana Kamal et al, 2013).

PNF stretching should be completed after exercise at least two times a week to increase ROM and induce increases in muscle strength, power and athletic performance. (Nelson et al, 2005).

According to Funk et al, 2003 PNF exercises done before exercise will diminish performance for the short term (90 minutes), however the long term effects may be similar.

**Discussion**

The World Health Organization defines quality of life as “an individual’s perceptions of their position in life in the context of the culture and value systems in which they live and in relation to their goals, expectations, standards and concerns”.(Oort FJ et al 2005)

Avascular necrosis (AVN), in a recent study has been identified as one of the frequent and more debilitating complications of SCD[ Martí-Carvajal AJ et al 2014] It affects predominantly weight bearing joints (particularly the hip) and is thought to be due to the occlusion of femoral vessels by sickled cells,[ Akinyoola AL et al 2009] coupled with the reduced levels of natural inhibitors of coagulation.[Cenni E et al 2011]. Pain has long been recognized as an important factor affecting quality of life, especially with respect to social and recreational functioning, especially in adults.[Wilson BH et al 2014 ] This study subject’s pain has considerably reduced as shown in table 2 (p<0.05) as evidenced statistically has improved cadence and mobility in clinical prognosis (table 1) was a major outcome of this study.

A percentage between 5 – 18% of a total of 500,000 hip replacement surgeries performed in a year are performed on patients diagnosed with avascular necrosis of the femoral head, the cost is estimated to be about 1 billion dollars annually. (Aiello MR et al 2011, Tofferi JK et al 2012, Mont M et al 1995, Lieberman JR et al 2003, Levine M et al 2012, Kelly JD et al 2010, Mankin HJ et al, 1992, Robinson HJ et al 1993, Coventry MB et al 1994.)

Several authors have observed that there is an earlier failure of total hip replacement in osteonecrosis than in age-matched patients with other diagnosis. This is probably because of abnormal remodeling of

bones and subsidence of prosthesis because of the poor bone quality of the proximal femur. Other factors may include ongoing systemic disease, defects in mineral metabolism, use of steroids, high level of activity in young patients and increased body weight. (Horia Bogdan ORBAN et al 2009.) According to Rahim Karim et al 2004, in their study the patient had satisfactory right hip range of motion with a small trunk lurch to the right. The patient reported that his right hip pain had significantly reduced and he had returned back to work when he was followed up at the time of

discharge.

A pre surgical exercise program may be beneficial in increasing the rate of improvement in patient recovery after a total hip replacement. ( Gilbry HJ et al, 2003, Wang AW et al, 2002) Early mobilization is the gold standard in restoring functional mobility after total joint arthroplasty.(Roos EW) The goal of rehabilitation is to increase muscle strength/endurance, improve coordination, increase flexibility, increase aerobic capacity and promote tissue remodeling.( Liebensen C. 1996)

Recent studies have also demonstrated the efficacy of an exercise program in improving muscle strength, mobility, and coordination and a decrease in the amount of paracetamol taken by patients with OA of the hip or knee [M. E. van Baar, J et al, 1998]

Obesity is associated with an increased risk of osteoarthritis of the hip due to the pressure the extra weight exerts on the joint [E.W. Karlson et al, 2003, G. B. Flugsrud et al, 2002, A. C. Gelber et al, 2003]. Despite this around 81% of European orthopaedic surgeons consider obesity to be a poor prognostic factor in patients undergoing elective THR [T. Sturmer et al, 2005].

obesity was shown to have a negative impact on the five-year outcomes following THR; however, it found that the overall benefit, whilst diminished in obese patients, is still positive [NICE 2008].

A recent study found that obese patients who have bariatric surgery prior to having hip arthroplasty performed better than those who had hip arthroplasty first [A.Kulkarni et al, 2011] whereas this study subject with a reduction in obesity (p<0.01) as shown in table 2, has benefitted with specific exercises he was treated with.

**Critical Analysis of this Research were:**

1. A reduction in pain and obesity
2. An increased range of motion of hip and knee joints.
3. An improved cadence of the subject.
4. However mostly avascular Necrosis as a complication of this subject who was surgically treated for fracture neck in 2008 as evidenced by literature Arthroplasty was the treatment of choice.

But this innovative and non-pharmacological conservative means of physical exercises with moderate reduction in pain and movements has to be supported with radiological findings. Also functional impact of the clinical prognosis has to be evaluated.

**Conclusion**

Reduction in pain can influence functional activities. Also reduced obesity results in lowering of loading on weight bearing joints. But a reduction in pain and obesity are not strong enough to validate influence of Avascular Necrosis, hence further scientific studies needs to validate findings of this research, involving NMRI and radiological investigations to substantiate the results may be needed. Subjective rating scale on hip joint functioning with quality of life could form further tool to support the findings. Also this study was a case study design and for shorter duration with few variables were measured which were the short comings of this study as acknowledged by the author.

**Limitations of This Study:** Were being short term, single subject and few variables were studied.

**Further recommendations** with more radiological imaging, Functional index to be evaluated, longer duration follow up with larger sample size.

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