



IMMEDIATE UNRESTRICTED VERSUS GRADUATED WEIGHT BEARING AFTER PRIMARY CEMENTLESS TOTAL HIP ARTHROPLASTY

BY

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Introduction

The THA defined as surgical reconstruction of newly artificial, painless, movable, and stable artificial hip joint. It was **John Charnley 1960** who led the way in establishing total hip replacement as a useful procedure. (**Siopack and Jergesen 1995**)

Hip replacement has become one of the major surgical advances of this century, at an estimated occurrence between 500.000 and 1 million per year. (**Stanfield and Nicol, 2002**).

From the Swedish National Hip Arthroplasty Registry we learn that osteoarthritis is the primary reason for THA in 75% of patients . (**Soderman., 2000**).

The overall goals of joint replacement are pain relief, increased function, and return to normal and to provide long-term restoration of all functional mobilities **(Harkess, 1998)**.

Over the past years, we have seen a worldwide increase in the use of uncemented THAs as compared to the cemented options, and increased further in the past 10 years from 53 to 62%.

(**Canadian institute for health information 2006**).

Mechanical loading can have potent effects on skeletal form and health. Both intrinsic and extrinsic factors contribute to bone structure and function.

The definitive explanation of mechanical-loading and (or) bone-cell mechanotransductive phenomena, however, remains elusive (**Zernike et al., 2010**).

Immediate weight bearing no doubt would facilitate rehabilitation for many patients. (**Lena RPT and Nils , 2001**).

According to the Cochrane methodology, It Was found moderate to strong evidence that no adverse effects on subsidence and osseous integration of the femoral stem after cementless THA occur after immediate UWB. **(Holam, et al 2007).**

Statement of the problem

Does the immediate unrestricted weight bearing on the operated leg after cementless THA , slow down the rehabilitation progress?

Statement of the problem

In many protocols for rehabilitation following cementless THA, protected weight-bearing for 6 weeks after surgery is generally recommended **(Eng.,1986)**.

Early discharge, relatively accelerated functional recovery and independency in activities of daily living (ADL'S) are important goals of these joint recovery projects. These goals could be reached earlier and maximized if immediate postoperative unrestricted weight bearing (UWB) can be allowed on the THA (**Roos EM 2003**).

Aim of the study:

- To examine the effect of immediate UWB on minimizing the hospital stay time and shortened the rehabilitation process after primary cementless THA.
- To examine the effect of immediate UWB on accelerating gait parameters improvement and independency after primary cementless.
- To examine the effect of immediate UWB on helping avoid assisted device dependency after primary cementless THA.

Significance of the study:

It is hoped from the study to help patients of primary cementless THA to restore independency in gait and all other function mobilities and to shorten the hospital stay time and shortened the rehabilitation process without use of assistive device or even with the least assistive device.

Accelerated rehabilitation programs for THA are becoming increasingly popular to shorten hospital stay and to facilitate rapid restoration of function. The goals of these rehabilitation programs mainly based on progressive gait training could be more easily achieved if immediate UWB could be allowed after a THA. **(Holam, 2007).**

Hypotheses of the study:

There is no significant difference of immediate unrestricted versus graduated weight bearing within the first 6 and 12 weeks after primary cementless THA on :

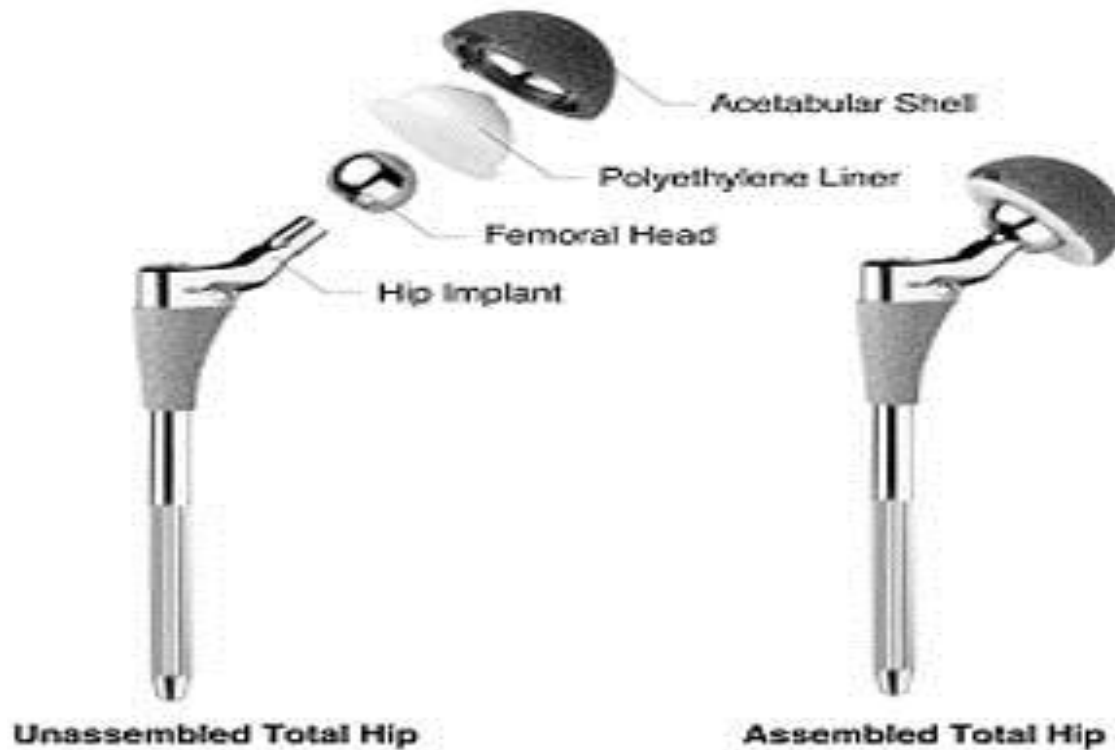
- **clinical outcome of the rehabilitation process by using Harris hip score(HHS).**
- **vertical micromigration of femoral stem (radiological assessment).**
- **lower extremity performance determined by using short physical performance battery (SPPB).**

Total Hip Arthroplasty:

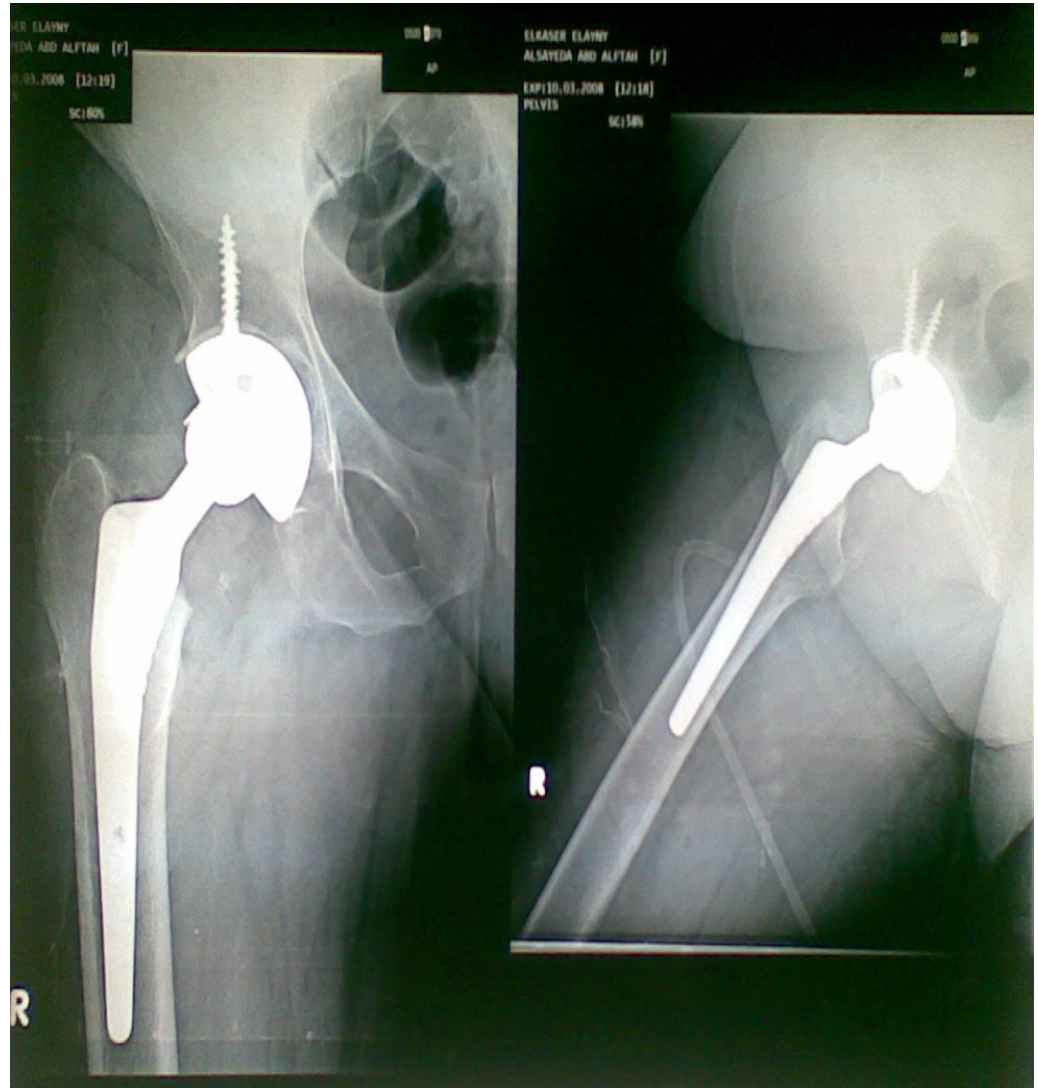
THA is an orthopedic procedure that involves the surgical excision of the head and part of the neck of the femur and removal of the acetabular cartilage down to subchondral bone. a metal femoral prosthesis, composed of a stem and head, is inserted into the femoral medullary canal. **(Siopack and Jergesen 1995).**

The aim of cementless joint replacement is to achieve better results than with cemented replacement. First-generation cementless implants were associated with a high incidence of thigh pain, aseptic loosening, stress shielding and osteolysis, **(Callaghan et al., 1988)** but the longevity of some of the components was impressive **(Teloken et al., 2002).**

Total Hip Arthroplasty:



Total Hip Arthroplasty:



Gait training

Rehabilitation program was effective in improving hip muscle strength, walking speed, and function in patients after THA, who participated in the program at least 3 times a week for 6 weeks (**Jan et al., 2004**).

The patient is encouraged to participate in Gait training or ambulation within the rehabilitation program as an activity of a basic need to move from one place to another. As such, it is one of the most common activities that people do on their daily living.(**Wessels et al., 2010**).

patients and Methods

patients :

- Twenty patients with primary cementless THA .
- randomly assigned into two groups (group A and group B).
- age range 50-65 years.
- group A started immediate unrestricted weight bearing (UWB) gait training within physical therapy program and group B started with limited weight bearing (LWB) gait training.
- Both groups were tested within the first week postoperative and at 6th & 12th week postoperative respectively.

Inclusion criteria

All patients selected for this study have had the following criteria:

- It was the first time and cementless THA.
- All patients have followed their entitled physical therapy program and precautions.
- patients of group A under UWB was allowed to use a cane or one crutch in the first week or within the hospital stay and not to relief weight from the operated leg but only for safety or balancing.

Exclusion criteria:

All patients selected for this study have been justified as follow.

- Persons with a hip implant due to rheumatoid disease, tumors or developmental dysplasia of hip have been excluded and also morbid obese subjects with body mass index (BMI) of 30 or greater have been excluded.
- patients selected did not require any special footwear or foot orthotics for walking.

Instrumentations and measurements

- Harris Hip Score.
- Short physical performance battery.
- AXIOM Luminos dRF .
- The Biodex Unweighing System .
- Weight Scale.

Harris Hip Score:

- Harris hip score (HHS) was used to assess the outcome of total hip arthroplasty.
- Harris hip score can be used by a physician or a physiotherapist to study the clinical outcome of hip arthroplasty (**Söderman et al 2001**).

Harris Hip Score

Hip ID:

Study Hip: Left Right

Examination Date (MM/DD/YY): / /

Subject Initials: | | |

Medical Record Number:

Interval: _____

Harris Hip Score

Pain (check one)

- None or ignores it (44)
- Slight, occasional, no compromise in activities (40)
- Mild pain, no effect on average activities, rarely moderate pain with unusual activity; may take aspirin (30)
- Moderate Pain, tolerable but makes concession to pain. Some limitation of ordinary activity or work. May require Occasional pain medication stronger than aspirin (20)
- Marked pain, serious limitation of activities (10)
- Total y disabled, crippled, pain in bed, bedridden (0)

Limp

- None (11)
- Slight (8)
- Moderate (5)
- Severe (0)

Support

- None (11)
- Cane for long walks (7)
- Cane most of time (5)
- One crutch (3)
- Two canes (2)
- Two crutches or not able to walk (0)

Distance Walked

- Unlimited (11)
- Six blocks (8)
- Two or three blocks (5)
- Indoors only (2)
- Bed and chair only (0)

Sitting

- Comfortably in ordinary chair for one hour (5)
- On a high chair for 30 minutes (3)
- Unable to sit comfortably in any chair (0)

Enter public transportation

- Yes (1)
- No (0)

Stairs

- Normally without using a railing (4)
- Normally using a railing (2)
- In any manner (1)
- Unable to do stairs (0)

Put on Shoes and Socks

- With ease (4)
- With difficulty (2)
- Unable (0)

Absence of Deformity (All yes = 4; Less than 4 =0)

Less than 30° fixed flexion contracture	Yes	No
Less than 10° fixed abduction	Yes	No
Less than 10° fixed internal rotation in extension	Yes	No
Limb length discrepancy less than 3.2 cm	Yes	No

Range of Motion (*indicates normal)

- Flexion (*140°) _____
- Abduction (*40°) _____
- Adduction (*40°) _____
- External Rotation (*40°) _____
- Internal Rotation (*40°) _____

Range of Motion Scale

- 211° - 300° (5) 61° - 100 (2)
- 161° - 210° (4) 31° - 60° (1)
- 101° - 160° (3) 0° - 30° (0)

Range of Motion Score _____

Total Harris Hip Score _____

Grading for the Harris Hip Score

- The domains of HHA covered are pain, function, absence of deformity, and range of motion. There are 10 items. Response options/scale. The score has a maximum of 100 points (best possible outcome) covering pain (1 item, 0–44 points), function (7 items, 0–47 points), absence of deformity (1 item, 4 points), and range of motion (2 items, 5 points).
- **Successful result** = post operative increase in Harris Hip Score of > 20 points + radiographically stable implant + no additional femoral reconstruction.
- **Or**
 - <70 means Poor
 - 70 - 79 means Fair
 - 80-89 means Good
 - 90 -100 means Excellent

AXIOM Luminos dRF :

- The 2-in-1 Solution – Remote-Controlled Fluoroscopy and Radiography System with Flat Detector (FD)



Accuracy of migration analysis of hip arthroplasty

- Digitized photography versus radiostereometric analysis.

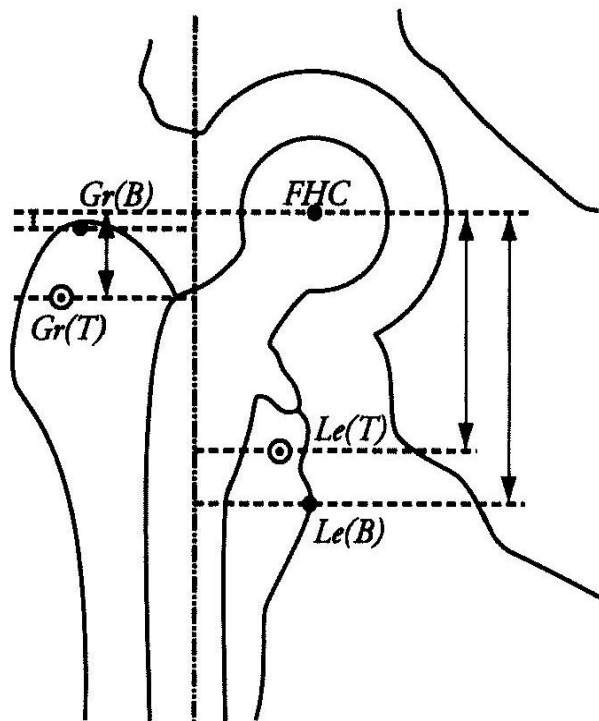


Figure 1. The femoral and femoral head center (FHC) landmarks. The 4 distances measured are shown.

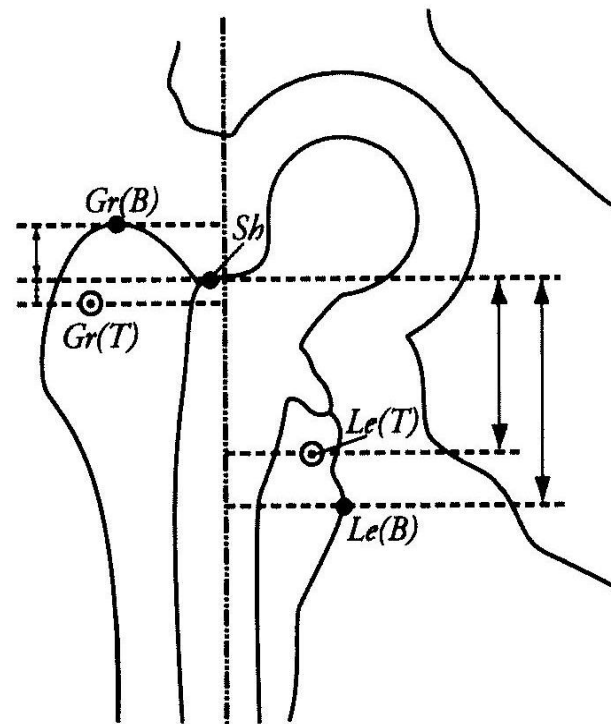
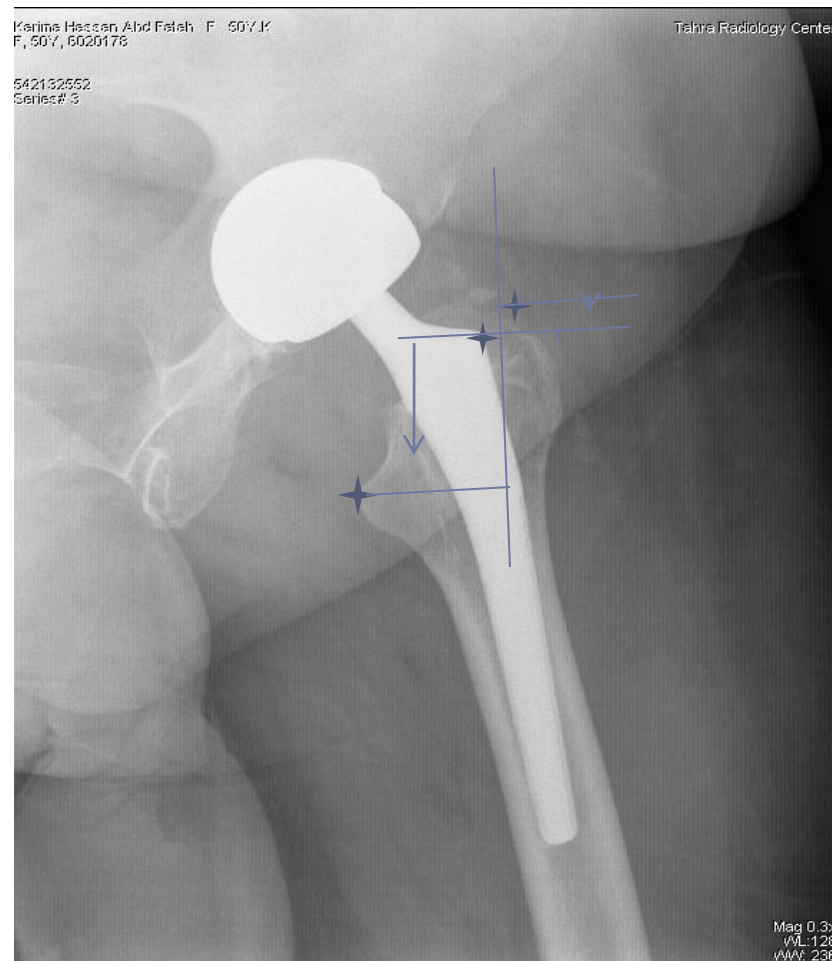
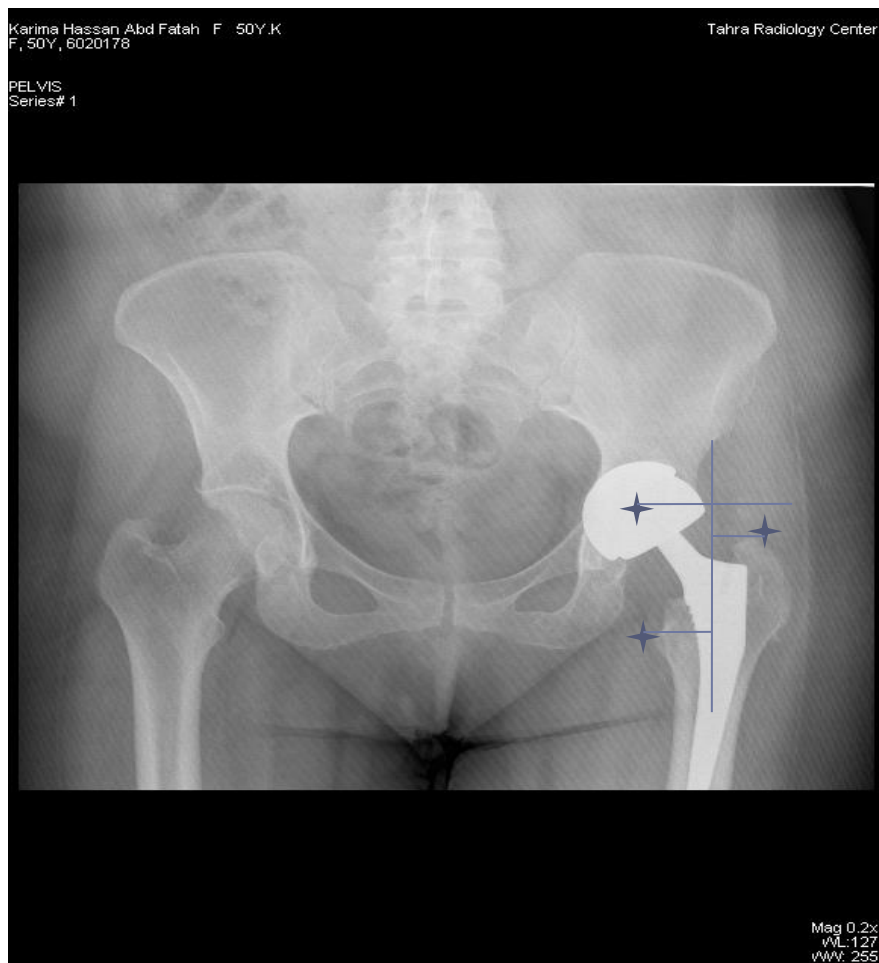


Figure 2. The femoral and stem shoulder (Sh) landmarks. The 4 distances measured are shown.

Digitized photography of migration analysis of hip arthroplasty



Short physical performance battery:

Short physical performance battery (SPPB) is an increasingly common test used to measure lower extremity performance in older adults. It includes a strength, balance, gait and endurance. The SPPB involves timing performance on the following items :

- five chair stands (no arms).
- 8-ft walk test .
- three hierarchical balance tests (side by side stance, modified tandem stance ,or tandem stance)

(Ostir et al., 2002).

Short Physical Performance Battery

*Short Physical Performance Battery**

1. Repeated Chair Stands

Instructions: Do you think it is safe for you to try and stand up from a chair five times without using your arms? Please stand up straight as quickly as you can five times, without stopping in between. After standing up each time, sit down and then stand up again. Keep your arms folded across your chest. Please watch while I demonstrate. I'll be timing you with a stopwatch. Are you ready? Begin.

Grading: Begin stop watch when subject begins to stand up. Count aloud each time subject arises. Stop the stopwatch when subject has straightened up completely for the fifth time. Also stop if the subject uses arms, or after 1 minute, if subject has not completed rises, and if concerned about the subject's safety. Record the number of seconds and the presence of imbalance. Then complete ordinal scoring.

Time: _____ sec (if five stands are completed)
Number of Stands Completed: 1 2 3 4 5

Chair Stand Ordinal Score: _____

- 0 = unable
- 1 = > 16.7 sec
- 2 = 16.6-13.7 sec
- 3 = 13.6-11.2 sec
- 4 = < 11.1 sec

2. Balance Testing

Begin with a semitandem stand (heel of one foot placed by the big toe of the other foot). Individuals unable to hold this position should try the side-by-side position. Those able to stand in the semitandem position should be tested in the full tandem position. Once you have completed time measures, complete ordinal scoring.

a. Semitandem Stand

Instructions: Now I want you to try to stand with the side of the heel of one foot touching the big toe of the other foot for about 10 seconds. You may put either foot in front, whichever is more comfortable for you. Please watch while I demonstrate.

Grading: Stand next to the participant to help him or her into semitandem position. Allow participant to hold onto your arms to get balance. Begin timing when participant has the feet in position and lets go.

Circle one number

- 2. held for 10 sec
- 1. held for less than 10 sec, number of seconds held _____
- 0. not attempted

Grading: Press the start button to start the stopwatch as the participant begins walking. Measure the time taken to walk 8'. Then complete ordinal scoring.

Time: _____ sec

Gait Ordinal Score: _____

- 0 = could not do
- 1 = > 5.7 sec (< 0.43 m/sec)
- 2 = 4.1-5.6 sec (0.44-0.60 m/sec)

* Reprinted from Guralnik JM, Simonsick EM, Ferrucci L, Glynn RJ, Berkman LF, Blazer DG, Scherr PA, Wallace RB. A short physical performance battery assessing lower extremity function: association with self-reported disability and prediction of mortality and nursing home admission. *J Gerontol Med Sci* 1994; 49(2):M85-M94.

b. Side-by-Side Stand

Instructions: I want you to try to stand with your feet together, side by side, for about 10 sec. Please watch while I demonstrate. You may use your arms, bend your knees, or move your body to maintain your balance, but try not to move your feet. Try to hold this position until I tell you to stop.

Grading: Stand next to the participant to help him or her into the side-by-side position. Allow participant to hold onto your arms to get balance. Begin timing when participant has feet together and lets go.

Grading

- 2. held for 10 sec
- 1. held for less than 10 sec, number of seconds held _____
- 0. Not attempted

c. Tandem Stand

Instructions: Now I want you to try to stand with the heel of one foot in front of and touching the toes of the other foot for 10 sec. You may put either foot in front, whichever is more comfortable for you. Please watch while I demonstrate.

Grading: Stand next to the participant to help him or her into the side-by-side position. Allow participant to hold onto your arms to get balance. Begin timing when participant has feet together and lets go.

Grading

- 2. held for 10 sec
- 1. held for less than 10 sec number of seconds held _____
- 0. not attempted

Balance Ordinal Score: _____

- 0 = side by side 0-9 sec or unable
- 1 = side by side 10 sec, < 10 sec semitandem
- 2 = semitandem 10 sec, tandem 0-2 sec
- 3 = semitandem 10 sec, tandem 3-9 sec
- 4 = tandem 10 sec

3. 8' Walk (2.44 meters)

Instructions: This is our walking course. If you use a cane or other walking aid when walking outside your home, please use it for this test. I want you to walk at your usual pace to the other end of this course (a distance of 8'). Walk all the way past the other end of the tape before you stop. I will walk with you. Are you ready?

(continued)

- 3 = 3.2-4.0 sec 10.61-0.77 m/sec
- 4 = < 3.1 sec 1.0-0.78 m/sec

Summary Ordinal Score: _____

Range: 0 (worst performance) to 12 (best performance).
Shown to have predictive validity showing a gradient of risk for mortality, nursing home admission, and disability

• **Chair Stand Ordinal Score: _____**

- 0 = unable
- 1 = > 16.7 sec
- 2 = 16.6-13.7 sec
- 3 = 13.6-11.2 sec
- 4 = < 11.1 sec

Gait Ordinal Score: _____

- 0 = could not do
- 1 = >5.7 sec (<0.43 m/sec)
- 2 = 4.1-6.5 sec (0.44-0.60 m/sec)
- 3 = 3.2-4.0 (0.61-0.77 m/sec)
- 4 = <3.1 sec (>0.78 m/sec)

• **Balance Ordinal Score: _____**

- 0 = side by side 0-9 sec or unable
- 1 = side by side 10, <10 sec semitandem
- 2 = semitandem 10 sec, tandem 0-2 sec
 - 3 = semitandem 10 sec, tandem 3-9 sec
 - 4 = tandem 10 sec

Grading SPPB

- Ranged from 0 (worst performance) to 12 (the best performance).
- shown to have predictive validity showing a gradient of risk for mortality.

The Biodex Unweighing System:



[Click Diagram to Enlarge](#)



Weight Scale



floor Weight scale RTZ-125 model

Preparatory procedures

patients were given a full explanation about the program, allowed to ask any question about it. they agreed to share in the study, each of them has been examined and asked about his/her dominant hand, medical history, sign the consent.

Methodology

patients was oriented to the procedures of training and assessment tools, informed for the requirements and assuring their understanding.

Every patient was assessed for weight and height to determine BMI.

BMI Categories:

- Underweight = <18.5
- Normal weight = $18.5\text{--}24.9$
- Overweight = $25\text{--}29.9$
- Obesity = BMI of 30 or greater

Assessment procedure

- **Clinical evaluations:**

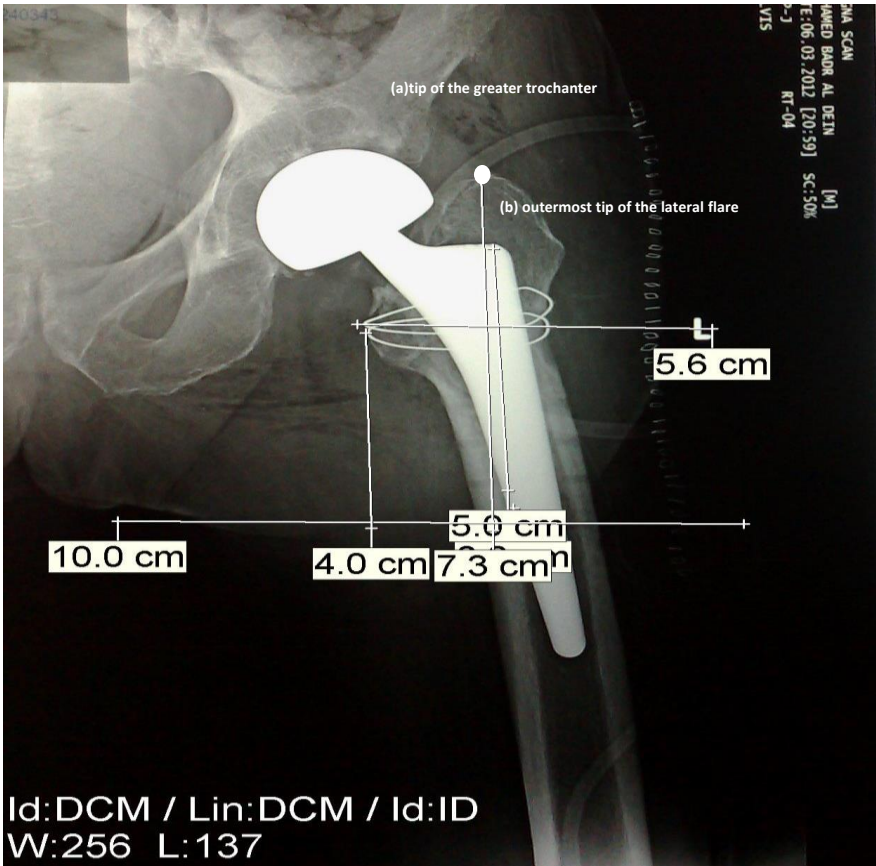
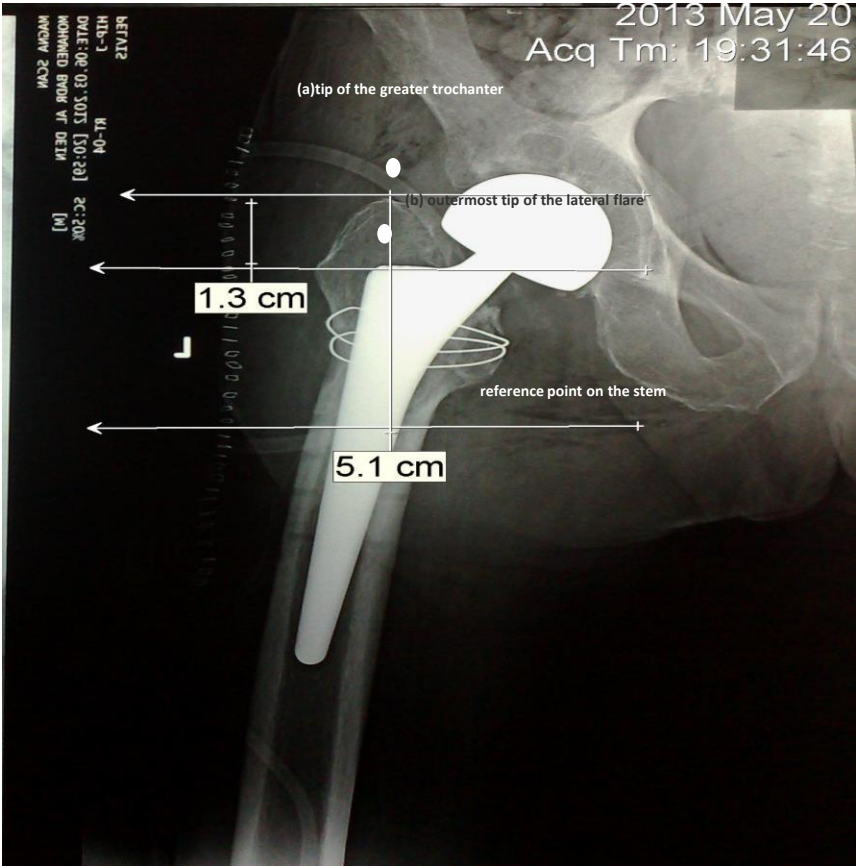
Clinical evaluations have been performed immediate (within the first week) post operative, then six weeks and finally 12 weeks after the surgery. The Harris hip score (HHS) and SPPB has been used to evaluate the outcome of the operations., Changes in harris hip score, SPPB and verical micromotion of the femoral stem has been measured and the statistcally analyzed with ANOVA test.

- **Radiographic evaluation:**

Radiographic evaluations initiated at the discharge day postoperatively, then followed at 6 weeks and 12 weeks after the operation. The axial migration of the stem has been measured digitally (as shown before).

The vertical distance between the two points has been measured on each film and the difference considered as a measure of the subsidence of the prosthesis. Three different sets of readings were made on each digitized film by a single observer.

Digitized photography analysis



Physical therapy program (both groups):

- **Postoperative day 1**
 - Bedside exercises are initiated (eg, ankle pumps, quadriceps sets, gluteal sets)
 - Review of hip precautions and weight-bearing status(as indicated for each group).
 - Bed mobility and transfer training (ie, bed to/from chair)
- **Postoperative day 2**
 - Gait training was initiated with use of assistive devices for group B (eg, crutches, walker) while group A started UWB unless pain intolerable so allowed to use a cane as needed.
 - Continue functional transfer training
- **Postoperative day 3-5**
 - Progression of ROM and strengthening exercises to the patient's tolerance (reaching 90° of flexion of hip & abduction 45° and progressive resistive exercises)
 - Progression of ambulation on level surfaces (ambulation from few steps to at least 20 feet)
 - Progression of ADL training .

Postoperative from discharge day to 12 weeks

- **Therapeutic ex's** : Stretching exercises to reach 90 degrees and abduction to 45 degrees , then Strengthening exercises, active assisted to active resistive e.g., seated leg extension, sidelying/ standing hip abduction, standing hip extension and hip abduction, knee bends, bridging for 10 repetition time 3 each.
- **Gait training:** Progression of ambulation has been continued using unweighing treadmill or appropriate assistive device for weight bearing precaution with group B.
- **ADL training:** Progression of independence with all ADL'S.

Gait training

Group B (GWB) used unloading treadmill initially and then appropriate assistive device for gait training while adjusting the weight bearing as permitted to start with 20% to 30% of body weight (BW) in the first three weeks to reach 60% of BW by the end of six weeks or otherwise orthopedic surgeon recommendation report., while patients continued using assistive device (AD) in the form of walker or bilateral crutches till end of the six week and then reduced the AD after the six weeks to a cane or one crutch to get rid of by the end of the twelve weeks.

Statistical analysis:

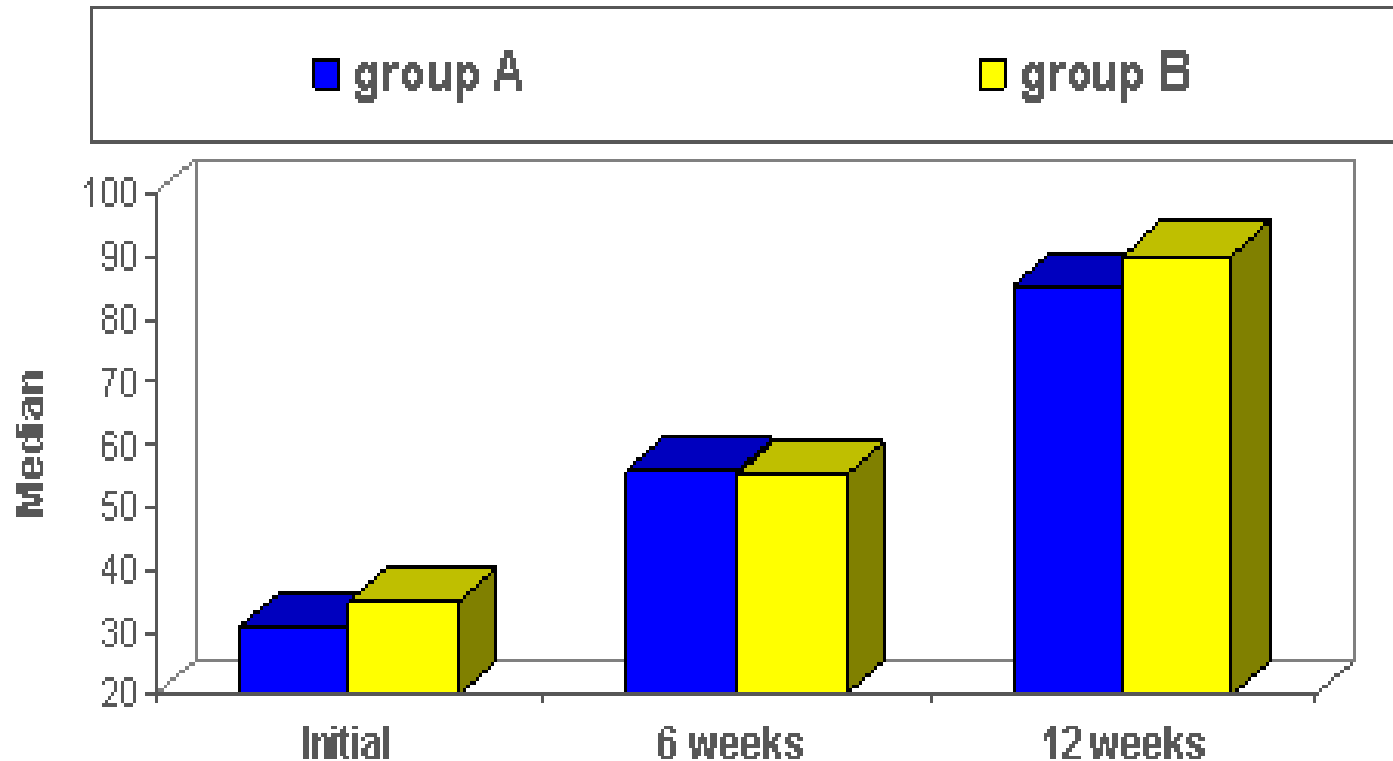
By using ANOVA to analyze data collected of the both groups and each for three specific intervals (Both groups will be tested at discharge from hospital and at 6th & 12th week postoperative respectively) .

- Mann Whitney test.
- Friedman ANOVA .
- Wilcoxon sign rank test for pair wise comparison.
- Chi square test.

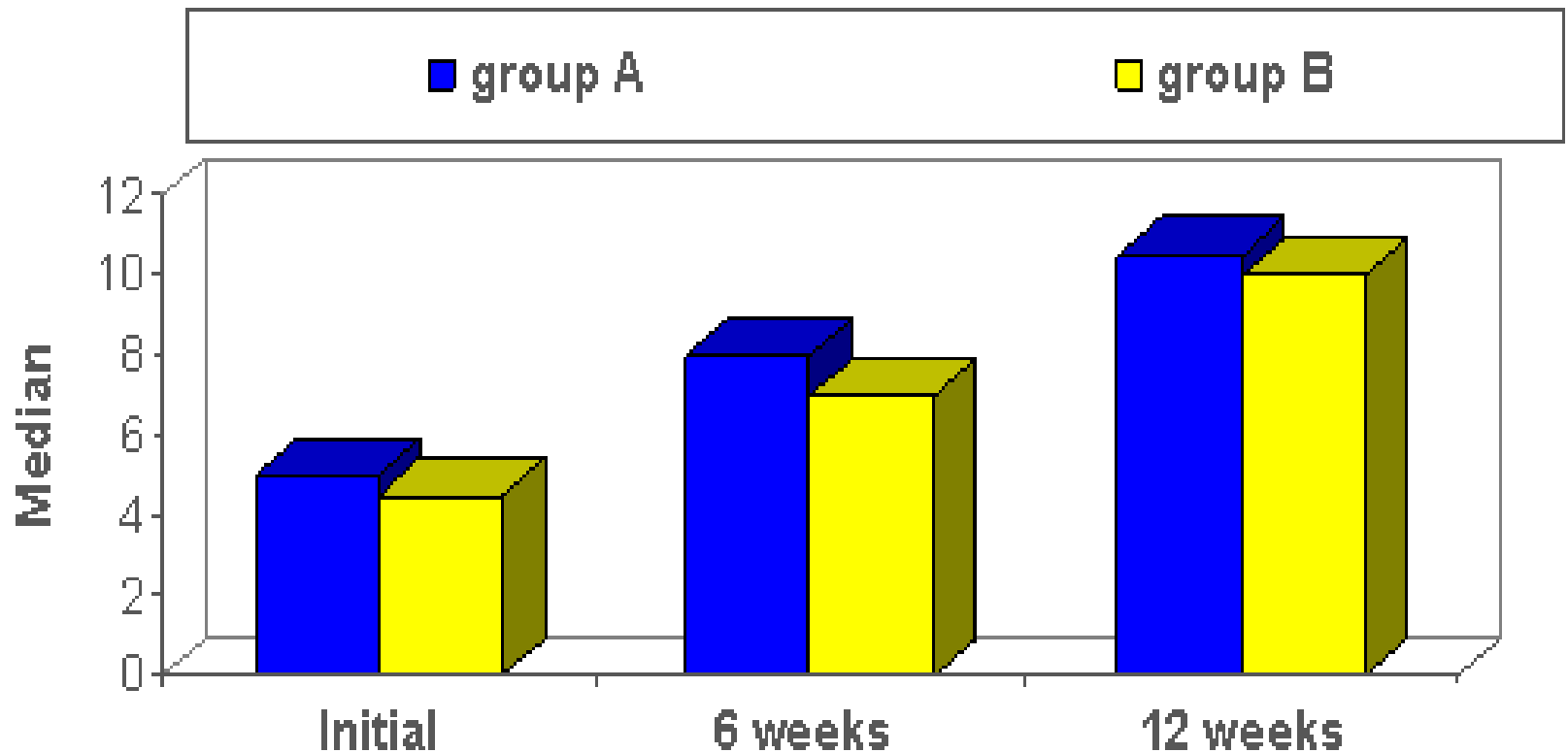
The data were considered significant if p value was ≤ 0.05 and highly significant if p value < 0.01 . Statistical analysis was performed with the aid of the SPSS computer program (version 16 windows).

Results

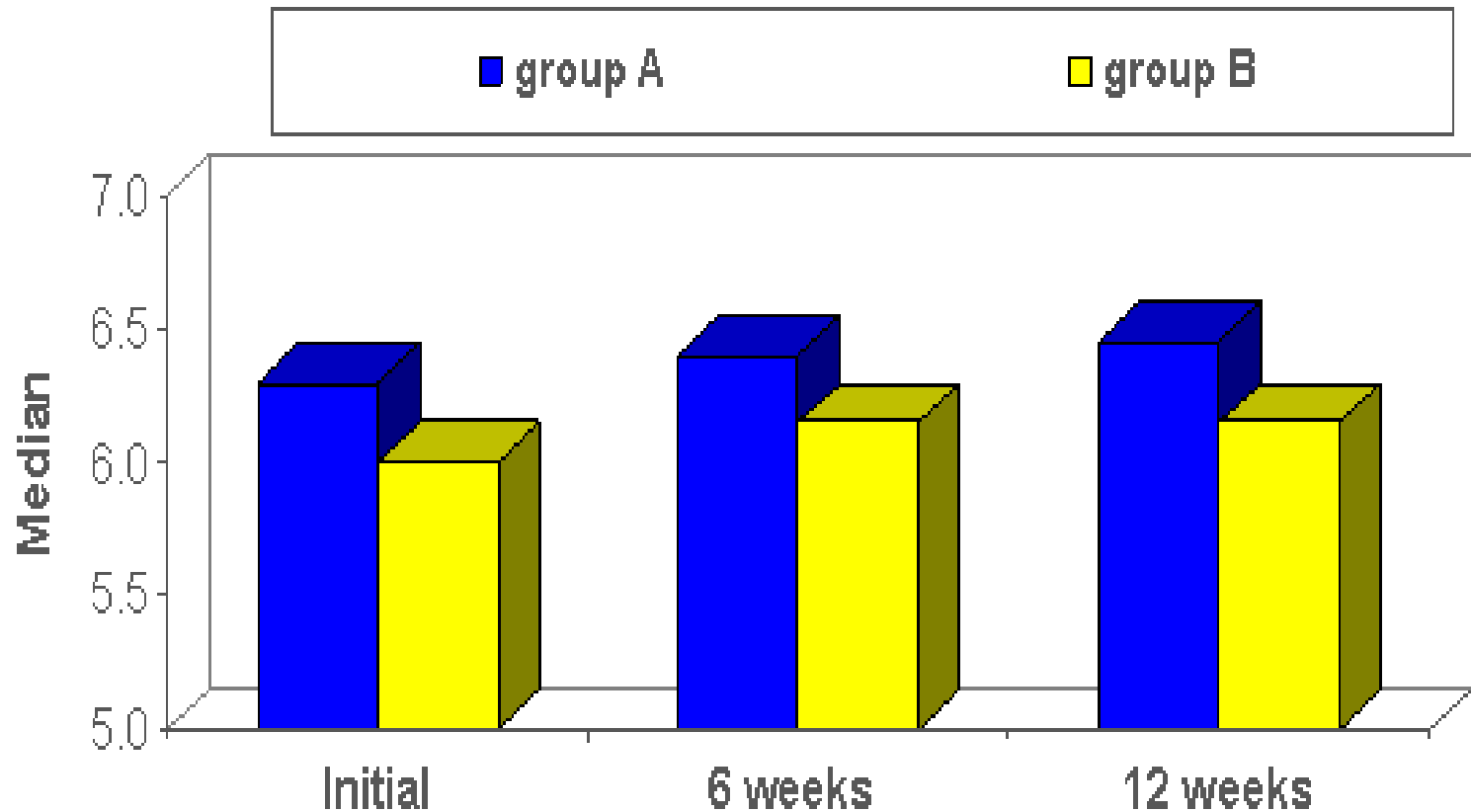
- HHS and so SPPB showed no group difference.
- There was no statistical significant difference between the HHS and SPPB measured at different times of assessment in the two studied groups.
- there was statistical significant increase in the HHS and SPPB in 6 weeks and 12 weeks when compared to initial assessment in each group.
- HHS and SPPB were significantly increased in 12 week assessment when compared to 6 week assessment.
- Radiological vertical micromigration of femoral stem assessments have revealed no statistical significant difference between group A and group B.



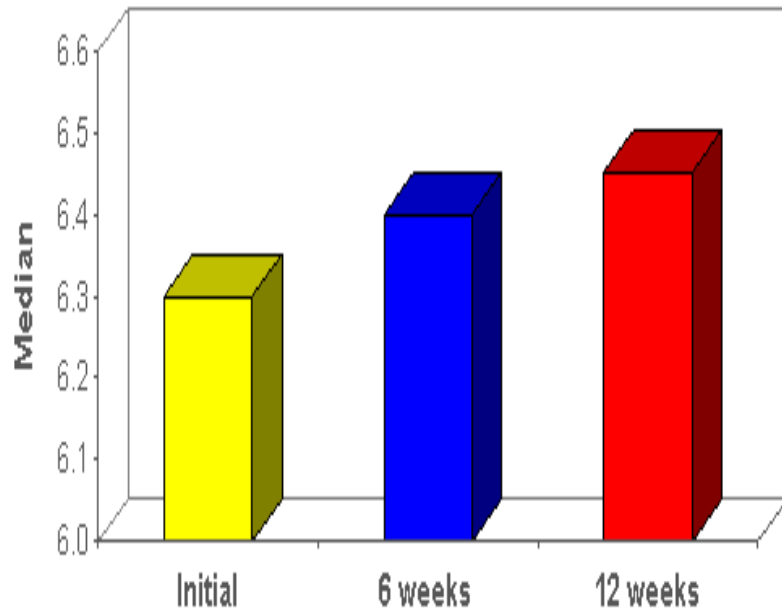
Comparison between the median values of the Harris hip score measured at different times of treatment in the two studied groups.



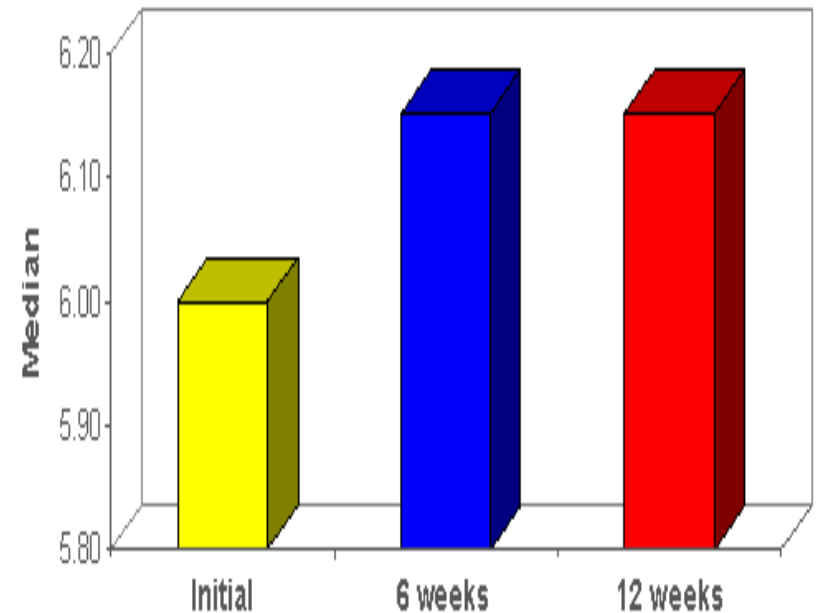
Comparison between the median values of the short physical performance battery in the two studied groups measured at different times of assessment.



Comparison between the median values of the radiological vertical micromigration of femoral stem in the two studied groups measured at different times of assessment.



Comparison between the median values of the radiological vertical micromigration of femoral stem measured at different times of assessment in the group A.



Comparison between the median values of the radiological vertical micromigration of femoral stem measured at different times of assessment in group B.

Discussion

- The clinical results of the study comply with most of the previous researches conclusions regarding the changes of the functional improvements assessed by HHS and SPPB and also regarding the vertical micromotion of the femoral stem. , the results have revealed no significant different between both research groups (A and B).

SUMMARY

- This study was conducted to assess the efficacy of immediate unrestricted weight bearing gait training program in the treatment of primary cementless total hip arthroplasty patients.
- Twenty patients with primary cementless THA have participated in this study, with age range 50-65 years.
- Assigned into two groups (group A and group B), group A started immediate unrestricted weight bearing (UWB) gait training within rehabilitation program and group B started with graduated weight bearing (GWB) gait training.
- the collected data has been analyzed using unpaired t-test, and ANOVA.
- comparison between the data collected from both groups regarding vertical migration of the prosthetic stem revealed nonsignificant subsidence (Femoral component subsidence was defined as a change of more than 4 mm) .

CONCLUSION

Bending on the presented data, it is possible to conclude that immediate unrestricted weight bearing gait training program has no adverse effect in the treatment of primary cementless total hip arthroplasty.

RECOMMENDATIONS

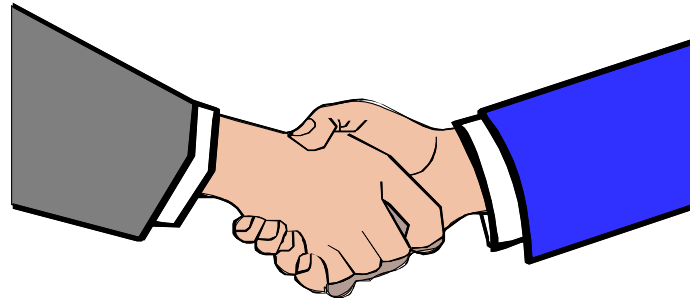
- **The results of the present study have stimulated concerns regarding the following:**
 - Further research needs to be conducted to assess life time expectations for cementless THA using different types of weight bearing precaution .
 - Research regarding the immediate unrestricted weight bearing gait training with using bigger sample would be encouraged.
 - Research the effect of balance training program accompanied with UWB on gait parameter deviations after cementless total hip arthroplasty.

بِسْمِ اللَّهِ الرَّحْمَنِ الرَّحِيمِ

يَرْفَعُ اللَّهُ الَّذِينَ آمَنُوا مِنْكُمْ وَالَّذِينَ أُوتُوا الْعِلْمَ
دَرَجَاتٍ وَاللَّهُ بِمَا تَعْمَلُونَ خَبِيرٌ.

المجادلة ١١

الْحَمْدُ لِلَّهِ الَّذِي بِنِعْمَتِهِ
تَتِمُّ الصَّالِحَاتُ



Thank You