

Functional rehabilitation after total hip arthroplasty with uncemented prosthesis

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Abstract

Arthritis is a disease that acts irreversibly on joint surfaces with significant consequences especially in the third quarter of life. About 7% of our population is affected by arthritis localized at a certain level and stage of development, and this percentage is expected to reach a much higher value in future years. *Aim:* The aim of this study is to propose a rehabilitation program for functional recovery after total hip arthroplasty and a set of recommendations for post surgery period. *Material and methods:* There were included 13 subjects (10 female and 3 male) aged between 51 and 78 years old, ready for total hip arthroplasty with uncemented prosthesis. The subjects were selected in Orthopaedics and Traumatology department of Military Clinical Emergency Hospital "Dr. Victor Popescu" Timisoara. The evaluations regarding programs' efficiency were made using 3 questionnaires (Oxford Hip Score, Harris Hip Score, Outcome Hip Score) and goniometry. The subjects were tested initially before the surgery and 3 times after (at one month, at 3 months and at 6 months). *Results:* The results showed a remarkable increase for the scores of majority, in both questionnaire and goniometry values. *Conclusions:* functional rehabilitation exercises proved to be particularly important in regaining independence, control of the prosthetic leg, pain reduction and functional and social reintegration.

Key words: total hip arthroplasty, uncemented prosthesis, rehabilitation program.

Rezumat

Artroza este o afecțiune ce acționează în sens degenertiv și ireversibil asupra suprafețelor articulare cu urmări semnificative mai ales în cel de-al treilea trimestru al vieții. Circa 7% din populația țării noastre este afectată de artroza localizată la un anumit nivel și stadiu de dezvoltare, iar acest procent este așteptat să atingă o valoare mult mai mare în anii următori. *Scop:* scopul acestui studiu este de a propune un program kinetic pentru reabilitarea funcțională a pacienților în urma artroplastiei totale de șold și a unui set de recomandări de conduită a subiecților în perioada postoperatorie. *Material și metodă:* au fost incluși în studiu 13 subiecți (10 femei și 3 bărbați) cu vârste cuprinse între 51 și 78 ani, cu indicație de artroplastie totală de șold cu proteză necimentată. Subiecții au fost selectați din compartimentul de Ortopedie și Traumatologie în cadrul Spitalului Clinic Militar de Urgență "Dr. Victor Popescu" din Timișoara. Evaluările privind eficiența programului de kinetoterapie s-au efectuat utilizând: chestionarele Oxford Hip Score, Harris Hip Score și Outcome Hip Score și bilanțul articular. Subiecții au fost evaluați o dată preoperator și de 3 ori postoperator (la o lună, la 3 luni și la 6 luni). *Rezultate:* Rezultate au indicat o creștere remarcabilă pentru scorurile majorității subiecților, atât în cazul chestionarelor aplicate, cât și a valorilor goniometriei.

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Concluzii: exercițiile programului de recuperare funcțională s-au dovedit a fi deosebit de importante în recăpătarea independenței, controlului membrului inferior protezat, diminuarea durerilor și reintegrarea socială și funcțională.

Cuvinte cheie: artroplastie totală de șold, proteză necimentată, program de recuperare.

Introduction

Osteoarthritis is a degenerative hip condition with a wide etiology, which is manifested by deterioration of articular cartilage resulting in joint deformity disabling final [1]. It can also be seen as a result of mechanical and biological events that reduce the process of synthesis of articular cartilage and leads to the formation of bone spurs.

Besides osteoarthritis there are many other disorders that can be treated through total hip arthroplasty:

- irreducible or unstable fractures and nonunion of the femoral neck in people aged between 50 and 65 years (such fractures that occur in younger patients are indicated for fixation, associated with intertrochanteric osteotomy and only after their failure it can be proceed to hip arthroplasty);
- secondary osteoarthritis (avascular necrosis of femoral head stage IV, rheumatoid arthritis, spondylitis, sequelae of juvenile osteochondrosis, sequelae after acetabular fracture or traumatic dislocation of the hip, hip dysplasia and as a special case, malignant tumors of the upper extremity femur) [2].

Olivera et. al [3] reported that 88% of women aged 75-101 years have pathological changes in X-ray, compared with males contained the same age range where only 68 % were suffering from osteoarthritis of the hip joint.

Purpose

This study propose the application of an individualized program of physical therapy at home for functional rehabilitation after total hip arthroplasty with uncemented prosthesis through which to obtain functional values for the hip and toning muscle groups of the operated leg and the pelvic girdle and achieve independent functionality of patient.

Material and methods

Patients were selected from the Department of Orthopaedics and Traumatology in the Emergency Military Hospital "Dr. Victor Popescu" Timisoara with a diagnosis of hip osteoarthritis (primary or secondary) and indication for total hip arthroplasty with uncemented prosthesis. The average age of the 13 patients from the study was 65.85 years (± 9.49). Distribution of subjects by age confirms that the increase age enhance the risk of developing osteoarthritis and related symptoms. The group took in the study was composed of 3 males and 10 female, all patients of the Department of Orthopedics and Traumatology in the Emergency Military Hospital "Dr. Victor Popescu" Timisoara having a body mass index between 20.76 to 34.89 kg/m² (26.81 ± 3.83).

Criteria for inclusion in study were:

- the individual has to be a patient of the Department of Orthopedics and Traumatology in the Emergency Military Hospital "Dr. Victor Popescu" from Timisoara;
- hip osteoarthritis with indication for total hip arthroplasty with uncemented prosthesis;
- personal consent to participate in the study.

Criteria for exclusion in study were:

- failure to follow the indications from the rehabilitation program;
- associated pathology that does not allowed physical exercise;
- operated hip dislocation;
- expressed desire to quit the study.

Methods

■ **Goniometry.** In this study the measurements were been focused on the hip joint. To determine the hip flexion (of the thigh on the trunk) the patient is positioned supine. Goniometer is positioned with the origin at the level of the great trochanter, the fixed arm lies on the side of the abdomen and the mobile arm on the lateral part of the thigh. The patient run active movement (with knee flexed) to the extent possible and the examiner records the value indicated by goniometer. The maximum active flexion of the hip in a healthy person is around 140°. For obtainig the degree of hip abduction motion is realized by positioning the subject in the supine position with legs extended. Goniometry origin is placed at the anterior superior iliac spine (ASIS), the arm fixed on the anterolateral aspect of the trunk and the mobile arm on the anterolateral thigh. To achieve an uncompensated movement, the examiner will stabilize the pelvis holding the opposite ASIS during the movement. Maximum

active abduction of the hip in this position in a healthy person is up to 45°.

For measuring the hip adduction, the patient is placed in the same position as preavious. The hip adduction is made by passing the mid line with the leg involved. The therapist will hold firmly the oposite part of the pelvis to obtain an uncompensated movement. The maximum value of the hip adduction measures about 30° for a healthy subject.

As well we measured the range of motion for internal rotation and external rotation of the hip. In this two cases the origin of the goniometer is placed in the middle of the heel. The fixed arm is placed vertically on the bed and the mobile arm is placed along the middle line of the sole. The maximum values vary from 40° to 45° for a healthy subject [4].

■ **Harris Hip Score** is a questionnaire with 10 items and a total of 100 points, where each question receives a number of points depending on its importance in the evaluation. Questions are grouped into categories as follows: pain, function (instruments used in locomotion and distance), functional activities (climbing stairs, put on socks, time sitting on a chair, access to public transportation vehicles). The part that is targeting hip deformity is composed of four measurements: fixed flexion below 30°, fixed abduction below 10°, extension fixed internal rotation below 10° and less than 3 cm gap between leg length. Fixed flexion below 30° means that the extension is limited or absent. The patient is positioned supine, the examiner's hand is placed in the lumbar area of the subject, the patient makes simultaneous flexion of the hips to flatten the lumbar curve, then the patient is asked to maintain healthy leg flexion and extend the tested lower limb. If the leg can not be extended and doesn't make contact with the bed, the distance to the bed determine fixed flexion deformity.

Fixed abduction deformity may be suspected if during the motion, the ASIS on tested side is lowered compared to the healthy. To determine the difference present in ASIS level, the examiner compares, bilateral, the level of iliac crest, greater trochanter, malleolus, patella and (imaginary line connecting two opposite anthropometric landmarks from those listed, must be parallel to the line connecting the two ASIS). The value of fixed abduction deformity is represented by the angle of adduction that the subject must reach (passive movement) to bring the same level ASIS sites. Most times in the presence of abduction deformity, active movement of adduction will be diminished or absent or impossible.

Internal rotation deformity in fixed extension is likely present when there is forward and inward design of ASIS on the affected site. Measurable value for this deformity is given by the angle of external rotation necessary to equalize the ASIS level.

The gap length between healthy and affected hip is determined by direct comparison. Length measurement is achieved by positioning the subject in the supine position with legs in extension and determine the distance between the navel and internal malleolus. Recorded lengths are compared to determine a possible discrepancy [5].

The scoring of this item is simple: if all answers are "yes" (below 30° in fixed flexion deformity, deformity below 10° in fixed abduction, below 10° internal rotation deformity and under 3 cm discrepancy in leg length), then 4 points are assigned, otherwise item receives 0 points.

The item on the measurement of hip range of motion is the measurement of functional hip angles obtained by active movement. The score for this item is obtained by summing the values of all movements analyzed. The score corresponding item is given based on the scoring range it is as follows:

- if the total amount of angles is between 0° – 30°, the item receives 0 points;
- if the total amount of angles is between 31° – 60°, the item receives 1 points;
- if the total amount of angles is between 61° – 100°, the item receives 2 points;
- if the total amount of angles is between 101° – 160°, the item receives 3 points;
- if the total amount of angles is between 161° – 210°, the item receives 4 points;
- if the total amount of angles is between 211° – 300°, the item receives 5 points.

Total score obtained reveals the degree of functionality of the hip:

- if the score is between 90 and 100 points indicates excellent result;
- if the score is between 80 and 90 points is considered a good result;
- if the result is between 70 and 79 points is considered average result;
- if the score is between 60 and 69 points, the hip is ranked as weak;
- any value below 60 points is considered to be a failure.

■ **Oxford Hip Score** is a questionnaire containing 12 items designed and developed in order to establish functional and pain felt in the affected/operated hip. It is a short questionnaire, valid and sensitive to important clinical changes and provides a simple scoring relevant current state of hip. The questions in the questionnaire are designed for self-scoring performance of the activities, locomotion, climbing and descending stairs, quantifying pain (usually after a sudden sitting or at night) and the degree of interference of hip pain in individual activities. Questionnaire items scoring is done by giving values between 0 and 4 points, so that severe symptoms

are scored with a small number of points, so that maximum score can be reached with 48 points.

To obtain percentage score on this questionnaire, the value obtained is divided by 48 and multiplied by 100. Percentage values between 85% and 100% indicates excellent results, those between 70% and 85% indicates a good result, poor performance is considered as percentage values of questionnaire score between 60% and 70%, and percentage scores below 60 are considered a failure.

■ **Hip Outcome Score** – with a total of 28 items divided into two categories: one for quantifying the potential of the subject in carrying out activities of daily living (ADL) and another for quantifying the potential of the subject in carrying out sports. The first category comprises 19 items aimed to score activities such as walking, climbing and descending stairs, car access, access in the bathtub, putting on shoe and socks, maintaining the position of sitting, twisting and pivoting on involved limb, light work (which involves standing and walking) and hard work (which involves pushing, pulling, climbing). In the second category are found nine items. They comprises: the race on a mile distance, jumping and landing, swinging objects like a golf club, sudden starting and stopping, sideways movement, walking in with a fast pace, the ability to perform tasks with normal technique and the ability to participate in a sport activity.

Each of the 19 items with 6 answer options, of which the subject must pick only one. Current choice is adequate to present condition of the subject, and if the activity is limited by other factors than the hip (knee osteoarthritis, cardio-vascular pathology, rheumatoid arthritis, etc.) patient must check option "Not Applicable". The items are scored increasing in points from left to right, so the first option ("Unable to do") receives 0 points, and so on. If the subject

chooses the sixth version ("not applicable"), the item is not taken into account.

To obtain the total score of ADL subscale of the 19 items, each scored item is summed and the sum is divided to 76. To find the equivalent percentage of the score, divided result is multiplied by 100. For sports subscale the score values are added and the sum is divided to 36 and multiply by 100 to obtain percentage results.

Percentage values close to 0 points indicates severe/poor functional hip recovery/condition, and those greater than 50 indicates a good function of the hip, this index is improved as the rate approaches the maximum value (100% = 76 points and 36 points for the ADL for sport activities). Subjects were tested 4 times: before surgery, one month after the surgery, at 3 months after the surgery and at 6 months after the surgery. At each evaluation questionnaires were applied and measured the angles of the hip.

In processing the data from assessments we used Microsoft Office Excel 2007, and for determining the significance of the results, we used the Wilcoxon rank pair test. The Wilcoxon test of ranks pair determines the size differences of the results (eg. before and after an action), ordered by rank and is applied on the same principles as dependent t test for comparative studies between the two groups dependent (correlated) that do not qualify parametric.

The steps to compute this test are:

I. Determination of differences by subtracting the results of "pre" in "post". Some differences can be positive and others negative. If the difference is zero case is excluded from further analysis because it has no influence. It is not necessary that the difference is calculated net of the pre-test from post-test. There are situations when this is reversed depends on what the study aims.

II. Ordering the results by rank without taking in account the math sign (zero is excluded and doesn't enter in computing).

III. Assign the appropriate sign in front of each rank on the result obtained from column differences.

IV. Determination of ranks with a negative sign and their sum, result that is marked as T.

V. Testing the value of T for significance. The value of t directly consult the table.

The kinetic program contains isometric exercises for thigh and gluteal muscles, aiming to improve tonus in muscles. The program also contains exercises which use flexion, extension, abduction and adduction of hip and knee joints and balance skills, in sitting and standing position [6]. During the immediate postoperative period the exercises are carried out without resistance, but as the patient passes throughout the process of rehabilitation, is recommended the usage of various tools to increase the degree of resistance. Also, kinetic program has hip guidelines care, indications and contraindications related to the new joint [7].

Results

Interpretation of the values indicate an increase in the final assessments for most parameters except the values for internal rotation. Averages of the first evaluation (preoperative) improved up to 78.58% for the Harris Hip Score (figure 1), 113.39% for Oxford Hip Score (figure 2), 77.76% for the Hip Outcome Score questionnaire (ADL subscale) (figure 3), 65.64% Outcome Hip Score questionnaire (subscale Sport) (figure 4). In goniometry, progress was observed for hip flexion (15.15%) (figure 5), hip abduction (13.95%) (figure 7), hip adduction (32.47%) (figure 6) and external rotation (7.07%) (figure 8). The only index that showed a decline was recorded for internal rotation of the hip (-5.15%) (figure 9). It is possible that the new joint reduce the

degree of motion in this case. Thus after the rehabilitation program, patients were able to use their new joint without pain or problems, regaining their degree of independence, professional and social reintegration being also achieved.

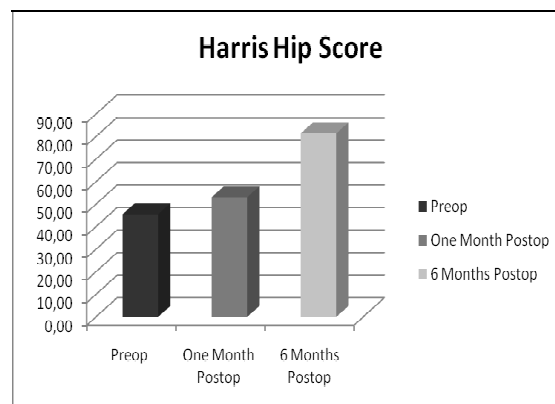


Figure 1. Mean values for Harris Hip Score

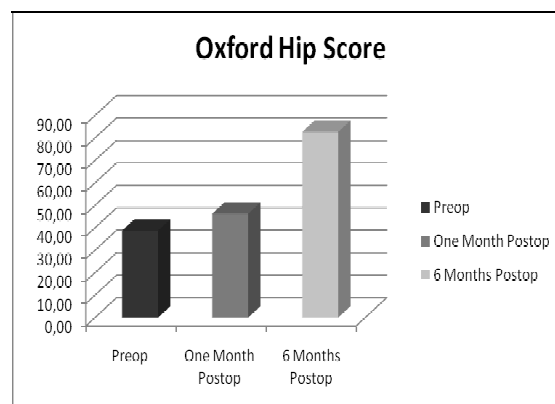


Figure 2. Mean values for Oxford Hip Score

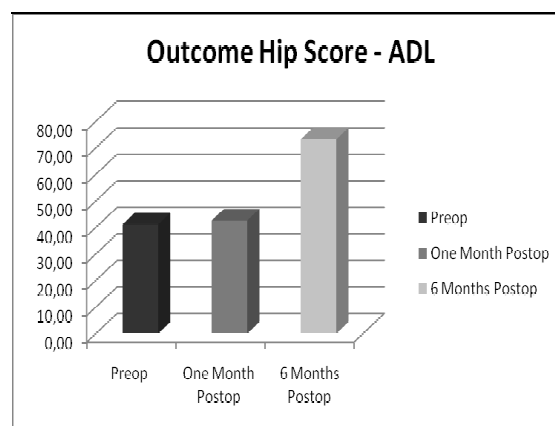


Figure 3. Mean values for Outcome Hip - Score ADL

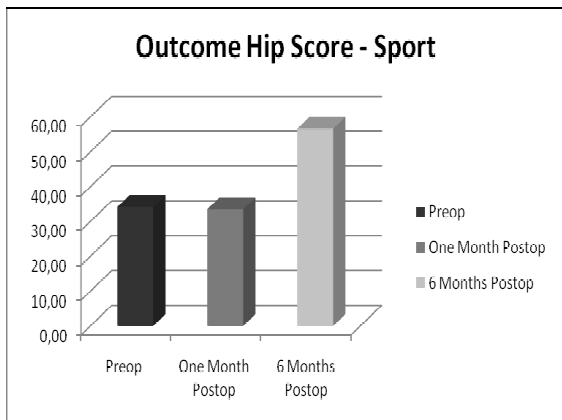


Figure 4. Mean values for Outcome Hip Score - Sport subscale

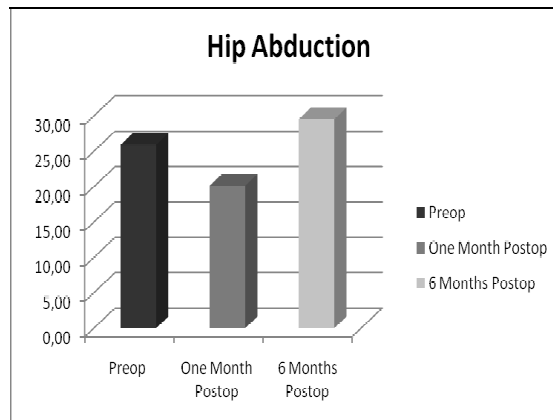


Figure 7. Mean values for hip adduction

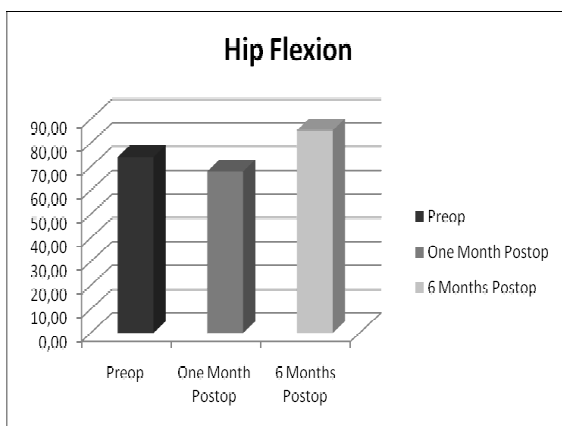


Figure 5. Mean values for hip flexion

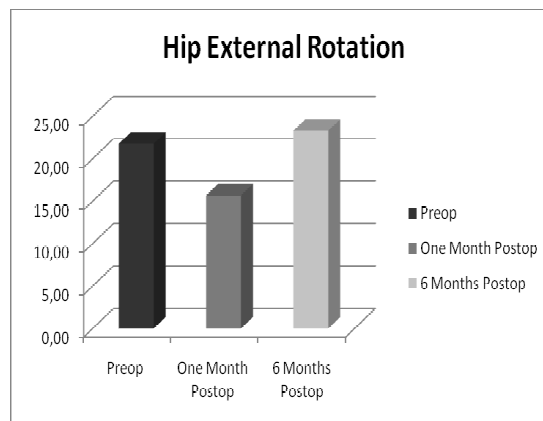


Figure 8. Mean values for hip external rotation

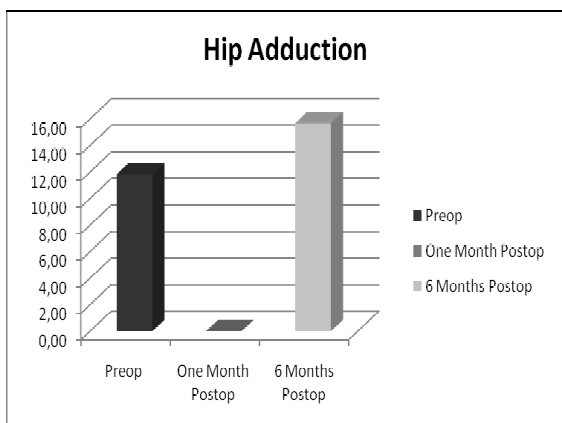


Figure 6. Mean values for hip abduction

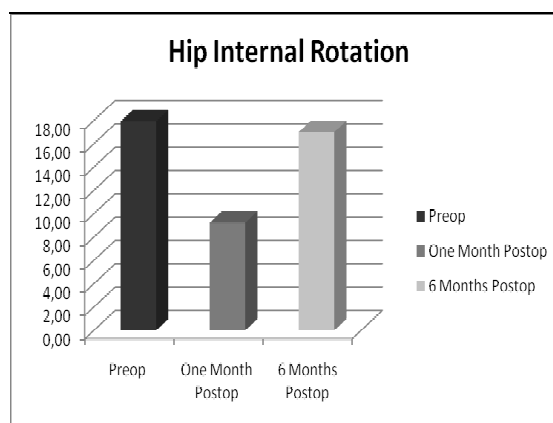


Figure 9. Mean values for Hip Internal Rotation

Conclusions

Implementing the rehabilitation program at home has lots of benefits, but it must be specified that patients have to participate conscientiously and consistently in the program, from the first postoperative day. The guidelines provided by the surgeon and physical therapist must be followed.

The success of total hip arthroplasty with uncemented prosthesis is based mainly on the high quality surgery, practicing the physical exercises from the rehabilitation program, regularly and with commitment, respecting the advices and guidelines provided by the surgeon and physical therapist mostly after the patient is discharged from hospital.

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