

## THE EFFICACY OF BROTZMAN PHYSIOTHERAPY PROTOCOL ON PAIN AND KNEE RANGE OF MOTION IN POST SURGICAL TOTAL KNEE ARTHROPLASTY SUBJECTS WITH OBESITY

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### ABSTRACT

**Background:** To evaluate the efficacy of Brotzman physiotherapy protocol on pain and knee range of motion in post surgical T.K.A subjects with obesity and normal BMI. **Materials and Methods:** 30 subjects were divided into two groups based on BMI. The group I having normal BMI (18.5 – 24.9) and group II having BMI more than 30. Both groups received Brotzman physiotherapy protocols for duration of 30 - 45 minutes, 1 session per day, 6 days per week for a total of 6 weeks. **Results:** After 6 weeks treatment period, the subjects in the group I were compared with the subjects in the group II. Group I had shown a significant difference with outcome measures at 0.05 level. **Conclusion:** The study shows that there is a marginal significance of BROTZMAN physiotherapy protocol in TKA subjects with obesity regarding relief of pain, improvement of knee ROM and WOMAC indx.

**KEY WORDS:** BMI, BROTZMAN PHYSIOTHERAPY PROTOCOL, TKA,VAS and WOMAC .

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### INTRODUCTION

OA (osteoarthritis) is a chronic joint disorder in which there is a progressive softening and disintegration of articular cartilage accompanied by new growth of cartilage and bone at the joint margins which leads to the formation of osteophytes and capsular fibrosis. Asymmetrically distributed and often localize to only one part of joint, related to abnormal loading rather than frictional wear<sup>1,2</sup>.

It is not a purely degenerative disorder. OA is a dynamic phenomenon which shows the features of both destruction and repair.

Increase in frequency with age, it affects on cartilage, diminished cellularity, reduced proteoglycans concentration, loss of elasticity and decrease in breaking strength. Most common in both sex men 50 % age of 60 years and 70 % 70 years<sup>2,3</sup>. Risk factors are joint dysplasia such as congenital acetabular dysplasia and perthe' s disease, trauma, occupational which cause repetitive stress, decreased bone mineral density , obesity and family history<sup>2</sup>.

Symptoms occur in one or two weight bearing joints. Pain is localized and increases slowly over months or years aggravated by exertion and relieved by rest.

Stiffness is common due to inactivity. Swelling over the knee joint, presence of deformity due to capsular contracture or joint instability, local tenderness is common, osteophytes may be felt, and movement is always restricted accompanied by crepitus <sup>1</sup>.

Imaging the x ray show 4 cardinal signs. They are asymmetrical loss of cartilage, narrowing of the joint space, sclerosis of the subchondral bone under the area of cartilage loss, cysts close to the articular surface in the margins of the joint <sup>2,3,4</sup>.

OA is the commonest cause of disability in older people. With painful knee OA affects over 80 % of patients experience limitation in performing activities of daily living, such as mobility outside the home, house hold chores and work duties. <sup>4,5</sup>.

The prevalence of obesity is increasing globally <sup>6</sup>.

An estimated one billion adults worldwide are overweight, at whom at least 300 million are obese <sup>6</sup>.

In UK in 2002 studies revealed to 23 % of adult males and 25 % women are have BMI more than 30 obese <sup>7</sup>.

In 2003, 70 % of individuals aged 65- 74 were classified as obese. Increased Body mass index (BMI) is also a risk factor for osteoarthritis <sup>7</sup>.

Obesity is the Body mass index calculated by dividing the weight of our individual in kilograms (kg), by their height in meters squared <sup>8</sup>.

$$\text{BMI} = \frac{\text{Mass (Kg)}}{\text{Height (m)}^2}$$

Overweight individuals with a BMI greater than 27 kg/m<sup>2</sup> are likely to show symptoms of knee osteoarthritis. This relationship is due to the excess of amount of weight that joint is sustaining. The risk of severe osteoarthritis is almost double with an increase of 5 kg/m<sup>2</sup> <sup>9</sup>.

Increasing 1 point of BMI leads to 15 % of augmentation of knee arthrosis outcomes <sup>10</sup>.

In 2003 national health survey showed that in 254 patients, 222 are obese patients who undergone TKA which reported that 70 % of individuals aged 65 – 74 were obese <sup>7</sup>.

The cemented TKA between 2000 to 2005 was studied 9735 subjects TKA in this 18.9 % are normal weight and 3.1 % were obese subjects <sup>11</sup>.

Also, factors such as IL- 6 and C – reactive protein are derived from adipocytes and are proatabolytes for chondrocytes, causing cartilage degradation <sup>12</sup>.

OA is the most common reason for TKA accounts for most difficulty with climbing stairs and walking than any other disease <sup>1</sup>.

The concept of replacing or resurfacing the knee joint was first entertained in the late 1860 s <sup>13</sup>.

In 1969, charnly s laboratory developed polymethylmethacrylate (PMMA) for use in total knee arthroplasty (TKA) <sup>14</sup>.

TKA is the removal of the old damaged cartilage and part of the bone from the lower end of the femur and upper end of tibia and introducing metal materials for good quality of life in patients who are suffering from OA <sup>2,4,15</sup>.

TKA has been shown to have 99 % 15 years survival with excellent pain relief and function post operatively .TKA is of cemented and cemented less variety <sup>16</sup>.

The BROTZMAN Physiotherapy protocol is the best protocol for the rehabilitation of total knee arthroplasty <sup>17</sup>.

The BROTZMAN protocol is widely used in the general TKA patients to give 6 weeks rehabilitation protocol. In this protocol treatment is isometric exercises, straight leg raising , quadriceps sets, weight bearing, CPM machine , knee range of motions , heel slides, wall slides, patellar mobilizations, lunges, quadriceps step ups <sup>12</sup>.

Continuous passive motion (CPM) is an external motorized device, which enables a joint to move passively throughout a present arc of motion, Robert Salter introduced the biological concept of CPM in early 1970<sup>18,19</sup>.

Knee flexion values of 95° and 105° are regarded as range of motion (ROM) benchmarks is the functional recovery of CPM while 95° of knee flexion allows normal activities in daily life function, 105° flexion provides the opportunity to ride a bicycle<sup>20,21</sup>.

## MATERIAL AND METHODS

The study samples of 30 subjects between 45 – 75 years of age were selected from post operative wards, BIRRD Hospital Tirupati, who were willing to participate in the study after obtaining the consent from the subjects and who met the inclusion criteria. study design is experimental study and type of sampling is convenience sampling with study period of 6 weeks. The subjects with BMI 18.5 - 24.9 (normal subjects) included in Group I and BMI > 30 (obese subjects) included in Group II. The subjects age with 45 – 75 years of both males and females with unilateral TKA. The materials used are Weighing machine, Inch tape, Universal Goniometer, CPM. The subjects with infections, neurological and musculoskeletal injuries, limb length discrepancy, any previous surgeries in lower limb, Post surgical complications like DVT are excluded in the study.

The treatment protocol for both Group I and II according to S.BRENT BROTZMAN physiotherapy protocol. The exercise regimen is 5 repetitions, 2 sets / session, 1 session / day, 5 days in a week, for 6 weeks. The outcome measures used are VAS, KneeROM, WOMAC.

## RESULTS

The analysis has been carried out to observe the significant difference between the pre and postoperative values of both the groups for each parameter. Another observation is to compare both the groups by considering each parameter. The statistical tools "EXCEL SPSS 16.0" used are paired samples t-test and independent sample 't'-test with p value 0.01 level.

**Table 1: Analysis of Group I with Pre and Post Intervention.**

Parameter	N	Mean	Sd	t-value	Df	p value
PRE VAS	15	7.93	0.88	24.81	14	0.01*
POST VAS	15	5	1			
PRE ROM	15	65.3	19.22	5.673	14	0.01*
POST ROM	15	85	10.35			
PRE WOMAC	15	82.2	5.4	18.85	14	0.01*
POST WOMAC	15	49.66	5.72			

\*Indicates significant at 5% level

To compare the post intervention values of the parameters of VAS, Knee ROM, and WOMAC index in Group I and Group II 't' – test for paired sample observation is used. It is observed that the post intervention values have shown significant between groups.

**TABLE – 2 Analysis of Group II with pre and post intervention.**

Parameter	N	Mean	Sd	t-value	Df	p value
PRE VAS	15	8.2	0.96	14.66	14	0.01*
POST VAS	15	6.53	1.06			
PRE ROM	15	63.66	19.86	3.25	14	0.01*
POST ROM	15	77	10.65			
PRE WOMAC	15	84.4	5.23	16.72	14	0.01*
POST WOMAC	15	64.2	7.23			

\*Indicates significant at 5% level

After 6 weeks the performance of the subjects in Group I (normal BMI) and Group II (Obese) had shown improvement with the outcome measures, but on comparing group II with group I, group I had shown a statistically significant improvement at (0.05 level) with the outcome measures i.e., VAS shows (p=0.01), Knee ROM shows (P=0.01) and WOMAC index shows (p=0.01).



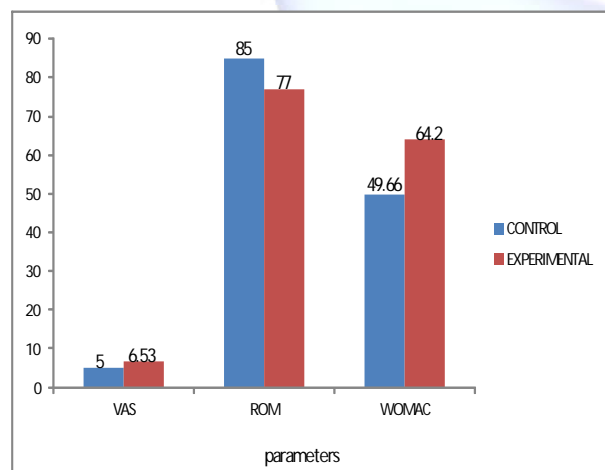
**TABLE-3: To compare the significance difference between the Brotzman physiotherapy protocols in both groups independent unpaired t-test has been used.**

Parameter	N	Mean	Sd	t-value	Df	p value
POST VAS (Group I)	15	5	1	4.07	14	0.01*
POST VAS (Group II)	15	6.53	1.06			
POST ROM (Group I)	15	85	10.351	2.09	14	0.01*
POST ROM (Group II)	15	77	10.657			
POST WOMAC (Group I)	15	49.66	5.72	6.1	14	0.01*
POST WOMAC (Group II)	15	64.2	7.23			

\*Indicates significant at 5% level

## DISCUSSION

The results of the present study show that the Brotzman physiotherapy protocol has no effect on obese patients on pain, knee range of motion and WOMAC index. The study result confirms that the Brotzman physiotherapy protocol did not have any additional effect on pain, knee range of motion and WOMAC.



To compare the post intervention values of the parameters of VAS, Knee ROM, and WOMAC index in Group I and Group II 't' – test for paired sample observation is used. It is observed that the post intervention values have shown significant between groups.

The results from this study shows that BMI

significantly influences the outcomes of rehabilitation from a TKA , with subjects with normal BMI' s rehabilitating faster than those with higher BMI's.

The impact of BMI on TKA rehabilitation is seen in studies that focus on qualitative measures like pain, knee range of motion and WOMAC scores versus qualitative measure such as quality of life.

The results suggest that obesity has a negative effect on the outcomes of TKA compared to the normal BMI subjects. Many authors believe that a high BMI will leads to less optimal TKA outcomes, because increased body weight leads to increased stress on the components and an increases load on the surrounding bone.

Pain relief during active exercise resulted due to dilatation of capillaries in the working muscles and increase in their permeability. Many capillaries that were closed when the muscles were not used, becomes open and blood flows through them, because of this there is increased blood flow and interchange of fuel and waste products between the blood and the tissue fluids is facilitated, thus reduced pain.

Exercise reduce pain from arthritis a report issue in the august 2002 journal of rheumatology report that therapeutic exercise can help reduce the pain and improves physical function in people with osteoarthritis of the knee , after TKA , accordingly to a recent literature review. As exercise decreases the stress hormones such as cortisol and increase endorphins, these are good chemicals which function as the body's natural pain killers and this will mask the pain.

As exercise increases the brain's supply of serotonin substance aids the flexibility of blood vessels and this will help to reduce the painful irritation serotonin also fights pain in the brain. It fights pain by blocking the brain's perception of pain.

Knee stability is done by several muscle groups. The two main muscle group that control knee movement and stability are the quadriceps and hamstrings. The quadriceps is a four – part powerful muscle that run along the front of thigh and attach to the front of the knee joint.

The Brotzman physiotherapy protocol is effective in improving knee range of motion and reducing pain and improving the functional outcomes with WOMAC index in normal BMI subjects.

The Brotzman physiotherapy protocol is not effective in improving knee range of motion and reducing pain and WOMAC index in OBESE subjects because of high body weight leads to pre operatively muscles weak and excessive pressure placed on the newly replaced knee. All these pain relief, reduction of stiffness, knee range of motion and western Ontario and McMaster university osteoarthritis (WOMAC) index scores are significant in normal BMI patients.

The high body weight will leads to less than optimal TKA outcomes, because increased body weight leads to increased stress on the surrounding bone. The carrying extra weight adds stress to the knee in walking, climbing and descending stairs.

The obese patients had a significantly lower preoperative total function score than normal BMI subjects. In this study the postoperative scores of the groups were significantly better than at the preoperative stage.

If woman of normal height, for every 11lb weight loss i.e. approximately 2 BMI units, the risk of knee problems dropped by 50%. So, if woman reduce weight the TKA outcomes are significant.

## CONCLUSION

The study shows that there is a marginal significance of BROTZMAN physiotherapy protocol in TKA subjects with Group II regarding

relief of pain, improvement of knee ROM and WOMAC index.

## FURTHER RECOMMENDATIONS

Further studies are required to assess the effectiveness of BROTZMAN physiotherapy protocol in subjects with different grades of Obesity and altering the treatment parameters like muscle strength and gait pattern.

Further studies can be done to know the effect of BROTZMAN physiotherapy protocol in subjects with cemented and uncemented TKA in different grade obese patients.

Further studies are needed to conduct by comparing both unilateral and bilateral TKA on pain, knee range of motion and functional outcomes in subjects with Obesity.

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