

**EFFECT OF FOOTWEAR IN THE MANAGEMENT OF  
OSTEOARTHRITIS PATIENTS IN RURAL AND  
URBAN SETTING**

**M.D. (P.M. & R) THESIS**

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## **ACKNOWLEDGEMENT**

I convey my cordial thanks to the Tamil Nadu Dr. M.G.R. Medical University for providing me an opportunity to do M.D. (P.M. & R) and to present this thesis.

I am extremely glad in expressing my heartiest thanks to the virtuous hearts who are all unique pave makers to accomplish my thesis.

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# **TITLE**

## **EFFECT OF FOOTWEAR IN THE MANAGEMENT OF OSTEOARTHRITIS IN RURAL AND URBAN SETTINGS**

This study is undertaken since this disease being a common ailment of the late middle age and old age people all over the earth.

Rural and urban population have different style of living, stress and strain. Fifteen of the rural and fifteen of the urban were selected at random and detail study was conducted as follows:

### **TYPE OF STUDY**

The rural camps about 50 kms away from the city

- (1) Pullicat
- (2) Thirutani
- (3) Maduranthakam

were identified and medical team consisting of

- (1) Physiatrist
- (2) Physiotherapist
- (3) Female Nurse

went to the respective places and with the help of the Panchayat Union leader in their respective primary schools the parents and

grand parents of the school children were explained about the study and the following criteria were collected.

- (1) History of the knee pain
- (2) Whether they were known Diabetic mellitus and Hypertensive
- (3) Duration of pain
- (4) History of medications
- (5) Clinical examination of the knees:-
  - i. Swelling
  - ii. Tenderness
  - iii. Warmth
  - iv. Jointline tenderness
  - v. Range of motion
  - vi. Vas scale of pain
  - vii. X-Rays for patients who were willing to come down to City

Similarly at random fifteen patients were selected in the Out Patient of a multispeciality Hospital in City and the same (a) to (g) were taken for all patients.



**Duration:**

The study was conducted for 4 months from 1.2.2011 to 31.5.2011 with a 30 days interval and the same patients were reviewed at their respective places and all the criteria (a) to (g) were noted.

For both the group

(a) Rural patients

(b) Urban patients

the following mode of management was advocated.

- (1) Drugs - Placebo
- (2) Exercises to the painful knees taught and advised to do twice a day
  - (a) Static quadriceps exercises
  - (b) Exercises to improve the range of motion
  - (c) Mild hot water formentation

- (d) To avoid floor activities like sitting cross legged and squatting as far as possible
- (e) Chappals to both feet
  - i. With mild arch support for pes planes feet with RJ heels
  - ii. RJ heels with patients with genu valgum
  - iii. Reversed RJ heels for patients with genu varum
  - iv. Patients with Osteoarthritis knees and plantar fasciitis chappal with suitable RJ heels with scooped and cushion heels were given.
  - v. Patients with history of Diabeticmellitus were given foot wear with MCR insoles in addition to the RJ heels Medial or lateral as they needed.

At the end of four months they were reassessed for their pain and duration of walking with ease and their ability to climb stairs. Periodical visits were made by the physiotherapists at

random and visited the patients at their home to assess whether they followed the

Placebos,

Exercises

Formentation

Modified Footwear

## REVIEW OF LITERATURE

Osteoarthritis is the most common type of joint disease, affecting the aged people. It represents a heterogeneous group of conditions that result in common histopathologic and radiologic changes. It is a degenerative disorder that results from the biochemical breakdown of articular (hyaline) cartilage in the synovial joints. However, the current concept holds that osteoarthritis involves not just the articular cartilage but the entire joint organ, including the subchondral bone and synovium.

Osteoarthritis predominantly involves the weight-bearing joints, including the knees, hips, cervical and lumbosacral spine, and feet. Other commonly affected joints include the distal interphalangeal (DIP) and proximal interphalangeal (PIP) joints of the hands. This article primarily focuses on osteoarthritis of knee.

Although osteoarthritis is thought to be largely due to excessive wear and tear, secondary nonspecific inflammatory changes may also affect the joints. Therefore, the term

degenerative joint disease is no longer appropriate when referring to osteoarthritis.

Historically, osteoarthritis has been divided into primary and secondary forms, although this division is somewhat artificial. Secondary osteoarthritis is conceptually easier to understand. It refers to degenerative disease of the synovial joints that results from some predisposing condition, usually trauma, that has adversely altered the articular cartilage and/or subchondral bone of the affected joints. Secondary osteoarthritis often occurs in relatively young individuals.

The definition of primary osteoarthritis is more nebulous. Although primary osteoarthritis is related to the aging process and typically occurs in older individuals, in the broadest sense of the term, it is an idiopathic phenomenon, occurring in previously intact joints and having no apparent initiating factor.

As underlying causes of osteoarthritis are discovered, the term primary, or idiopathic, osteoarthritis may become obsolete. For instance, many investigators believe that most cases of

primary osteoarthritis of the hip may, in fact, be due to subtle or even unrecognizable congenital or developmental defects.

No specific laboratory abnormalities are associated with osteoarthritis; it is typically diagnosed on the basis of clinical and radiographic findings.

The goals of osteoarthritis treatment include pain alleviation and improvement of functional status; nonpharmacologic interventions are the cornerstones of osteoarthritis therapy and include patient education, weight loss, exercise, physical therapy and joint unloading in knee.

The high prevalence of osteoarthritis entails significant costs to society. Direct costs of osteoarthritis include clinician visits, medications, and surgical intervention. Indirect costs include such items as time lost from work. Costs associated with osteoarthritis can be particularly significant for elderly persons, who face potential loss of independence and who may need help with daily living activities. As the populations of developed nations age over the coming decades, the need for better

understanding of osteoarthritis and for improved therapeutic alternatives will continue to grow.

## **Anatomy**

Joints can be classified as synovial, fibrous, or combination joints, based on the presence or absence of a synovial membrane and the amount of motion that occurs in the joint. Normal synovial joints allow a significant amount of motion along their extremely smooth articular surface. These joints are composed of the following:

- Articular cartilage
- Subchondral bone
- Synovial membrane
- Synovial fluid
- Joint capsule.

The normal articular surface of synovial joints consists of articular cartilage (composed of chondrocytes) surrounded by an extracellular matrix that includes various macromolecules, most importantly proteoglycans and collagen. The cartilage protects the underlying subchondral bone by distributing large loads,

maintaining low contact stresses, and reducing friction at the joint.

Synovial fluid is formed through a serum ultrafiltration process by cells that form the synovial membrane (synoviocytes). Synovial cells also manufacture the major protein component of synovial fluid, hyaluronic acid (also known as hyaluronate). Synovial fluid supplies nutrients to the avascular articular cartilage; it also provides the viscosity needed to absorb shock from slow movements, as well as the elasticity required to absorb shock from rapid movements.

### **Pathophysiology**

Primary and secondary osteoarthritis are not separable on a pathologic basis, although bilateral symmetry is often seen in cases of primary osteoarthritis, particularly when the knees are affected.

As mentioned above, although osteoarthritis was traditionally thought to affect primarily the articular cartilage of synovial joints, pathophysiologic changes also occur in the



synovial fluid, as well as in the underlying (subchondral) bone and in the overlying joint capsule.

Even though osteoarthritis has always been classified as a noninflammatory arthritis, increasing evidence has shown that inflammation occurs as cytokines and metalloproteinases are released into the joint. These agents are involved in the excessive matrix degradation that characterizes cartilage degeneration in osteoarthritis. Therefore, as previously noted, the term degenerative joint disease is no longer appropriate when referring to osteoarthritis.

In early osteoarthritis, swelling of the cartilage usually occurs, due to the increased synthesis of proteoglycans; this reflects an effort by the chondrocytes to repair cartilage damage. This stage may last for years or decades and is characterized by hypertrophic repair of the articular cartilage.

As osteoarthritis progresses, however, the level of proteoglycans eventually drops very low, causing the cartilage to soften and lose elasticity, thereby further compromising joint surface integrity.

Microscopically, as flaking and fibrillations (vertical clefts) develop along the normally smooth articular cartilage on the surface of an osteoarthritic joint, the loss of cartilage results in the loss of the joint space.

In major weight-bearing joints of persons with osteoarthritis, a greater loss of joint space occurs at those areas-subjected to the greatest pressures; this effect contrasts with that of inflammatory arthritides, in which uniform joint-space narrowing is the rule. In the osteoarthritic knee, for example, one commonly observes the greatest loss of joint space in the medial femorotibial compartment, although the lateral femorotibial compartment and patellofemoral compartment may also be affected. Collapse of the medial or lateral compartments may result in varus or valgus deformities, respectively.

Erosion of the damaged cartilage in an osteoarthritic joint progresses until the underlying bone is exposed. Bone denuded of its protective cartilage continues to articulate with the opposing surface. Eventually, the increasing stresses exceed the biomechanical yield strength of the bone. The subchondral bone responds with vascular invasion and increased cellularity,

becoming thickened and dense (a process known as eburnation) at areas of pressure, traumatized subchondral bone may also undergo cystic degeneration, due to either osseous necrosis secondary to chronic impaction or to the intrusion of synovial fluid. Osteoarthritic cysts are also referred to as subchondral cysts, pseudocysts, or geodes, the preferred European term.

At nonpressure areas along the articular margin, vascularization of subchondral marrow, osseous metaplasia of synovial connective tissue, and ossifying cartilaginous protrusions lead to irregular outgrowth of new bone (osteophytes). Fragmentation of these osteophytes or of the articular cartilage itself results in the presence of intra-articular loose bodies (joint mice).

Along with the joint damage noted above, osteoarthritis may also lead to pathophysiologic changes in ligaments and the neuromuscular apparatus.

## **Pain mechanisms in osteoarthritis**

Pain, the main presenting symptom of osteoarthritis, is presumed to arise from a combination of mechanisms, including the following:

- Osteophytic periosteal elevation
- Vascular congestion of subchondral bone, leading to increased intraosseous pressure
- Synovitis with activation of synovial membrane nociceptors
- Fatigue in muscles that cross the joint
- Overall joint contracture
- Joint effusion and stretching of the joint capsule
- Torn menisci
- Inflammation of periarticular bursae
- Periarticular muscle spasm
- Psychological factors
- Crepitus (a rough or crunchy sensation)

## **Etiology**

The daily stresses applied to the joints, especially the weight-bearing joints (eg, ankle, knee, hip), play an important role in the development of osteoarthritis. Most investigators believe that degenerative alterations in osteoarthritis primarily begin in the articular cartilage, as a result of either excessive loading of a healthy joint or relatively normal loading of a previously disturbed joint. External forces accelerate the catabolic effects of the chondrocytes and disrupt the cartilaginous matrix.

Risk factors for osteoarthritis include the following:

Age

Obesity (increases mechanical stress)

Trauma

Genetics

Sex hormones

Muscle weakness

Repetitive use (ie, jobs requiring heavy labor and bending)

Infection

Crystal deposition

Acromegaly

Previous rheumatoid arthritis (ie, burnt-out rheumatoid arthritis)

Heritable metabolic causes (eg, alkaptonuria, hemochromatosis, Wilson disease)

Hemoglobinopathies (eg, sickle cell disease, thalassemia)

Disorders of bone (eg, Paget disease)

### **Advancing age**

With advancing age, cartilage volume, proteoglycan content, cartilage vascularization, and cartilage perfusion are reduced and may result in certain characteristic radiologic features, including narrowed joint space and the presence of marginal osteophytes. However, biochemical and pathophysiologic findings support the notion that age alone is an insufficient cause of osteoarthritis.

## **Obesity**

Obesity increases the mechanical stress in a weight-bearing joint. It has been strongly linked to osteoarthritis of the knees and, to a lesser extent, of the hips.

## **Trauma**

Traumatic insults to the articular cartilage, ligaments, or menisci lead to abnormal biomechanics in the joints and enhance their premature degeneration.

## **Menopause**

Menopause often increases the progression of osteoarthritis; however, estrogen replacement therapy lowers the expected rate of radiographic and clinical findings in the knees and hips.

## **Muscle dysfunction**

Muscle dysfunction compromises the body's neuromuscular protective mechanisms, leading to increased joint motion and ultimately resulting in osteoarthritis. This effect

underscores the need for continued muscle toning exercises as a means to prevent muscle dysfunction.

## **Genetics**

In addition to the above factors, a hereditary component to the disease has long been recognized, particularly in generalized osteoarthritis; indeed a specific gene for osteoarthritis has been identified. One should not confuse environmental factors as causes of osteoarthritis, because these factors actually cause traumatic arthritis on a macrotraumatic or microtraumatic basis. This is especially true of individuals whose lifestyles require squatting, climbing stairs, or excessive kneeling.

## **International statistics**

Internationally, osteoarthritis is the most common articular disease. Estimates vary among different populations. The prevalence of osteoarthritis differs among different ethnic groups. The disorder is more prevalent in Native Americans than in the general population. Disease of the hip is seen less frequently in Chinese patients from Hong Kong than in age-



matched white populations. In persons older than 65 years, osteoarthritis is more common in whites than in blacks. Knee osteoarthritis appears to be more common in black women than in other groups.

### **Age- and sex-related prevalence**

Primary osteoarthritis is a common disorder of the elderly, and patients are often asymptomatic. Approximately 80-90% of individuals older than 65 years have evidence of primary osteoarthritis. Patients with symptoms usually do not notice them until after age 50 years. The prevalence of the disease increases dramatically among persons over age 50, likely because of age-related alterations in collagen and proteoglycans that decrease the tensile strength of the joint cartilage and because of a diminished nutrient supply to the cartilage.

In individuals older than age 55 years, the prevalence of osteoarthritis is higher among women than men. Women also have osteoarthritis of the knee joints more frequently than do men, with a female-to-male incidence ratio of 1.7:1. Women are

also more prone to erosive osteoarthritis, with a female-to-male ratio of about 12:1.

At age 55-64 years, 28% of men and women show signs of osteoarthritis in the knee. At age 65-74 years, 39% of men and women show signs of osteoarthritis in the knee. At age 75-79 years, approximately 100% of men and women show some signs of osteoarthritis.

### **Prognosis**

The prognosis of osteoarthritis depends on the joints involved and the severity of the condition. No proven disease/structure-modifying drugs for osteoarthritis are currently known; thus, the medication-based regimen is directed at symptom relief.

The prognosis is good for patients with osteoarthritis who have undergone joint replacement, with knee arthroplasty being generally more than 90%. However, a joint prosthesis may need revision 10-15 years after its installation, depending on the patient's activity level. Younger and more active patients will require revisions, whereas the majority of older patients will not.

## **Patient Education**

Educate patients on the natural history of and management options for osteoarthritis. Explain the differences between osteoarthritis and more rapidly progressive arthritides, such as rheumatoid arthritis.

Several Arthritis Foundation studies have demonstrated that education in osteoarthritis benefits the patient. Through education, patients can institute ways to reduce pain and increase joint function. Emphasize the need for physician follow-up visits.

For excellent patient education resources, visit eMedicine's Arthritis Center. Also, see eMedicine's patient education article Osteoarthritis.

## **Knee osteoarthritis**

From Wikipedia, the free encyclopedia

Jump to: navigation, search

Knee osteoarthritis is a degenerative disease of the knee joint. It is more common in people older than 40 years. Women have greater chance to be affected.

### **Signs and symptoms**

Some of the signs and symptoms associated with knee osteoarthritis include:

- Pain
- Stiffness
- Decreasing range of motion
- Muscle weakness and atrophy due to inactivity or stiffness
- Crepitus
- Effusion
- Deformity
- Baker's cyst (a harmless but sometimes painful collection of joint fluid behind the knee)

### **Causes**

Osteoarthritis of the knee is predominately considered a "wear and tear" process, where there is gradual degradation of

the hyaline cartilage that covers the articulating surfaces of the bones in the knee joint. In most people, the disease is either post-traumatic or hereditary.

Other causes or contributing factors may include:

- Trauma
- Elements injury of the knee joint
  - Tear of meniscus
  - Partial menisectomy via arthroscopy
- Recurrent patellar dislocation and patella fracture
- Interarticular fractures of the knee and knee dislocations
- Arthritis (such as rheumatoid arthritis, infectious arthritis, etc)
- Deformities of the knee joint that include:
  - Genu varum
  - Genu valgum
  - Genu recurvatum (Knee hyperextension)
  - Knee flexion deformity
- Ligamentous instability
  - Anterior cruciate ligament
  - Posterior cruciate ligament
  - Medial collateral ligament

- Lateral collateral ligament
- Obesity
- Genetics factors
- Osteochondritis dissecans disease
- Meniscal cyst
- Discoid meniscus

### **Pathophysiology**

The most important characteristic of knee osteoarthritis is degeneration of the articular cartilage in the knee joint. Osteoarthritis of the knee can involve one, two, or all three compartments of the knee:

- Medial or lateral compartments of the tibiofemoral joint  
(between the femur and the tibia)
- Patellofemoral joint (between the femur and patella)

### **Diagnosis**

- Joint space narrowing
- Osteophyte formation at the joint margins

- Subchondral Sclerosis (new subchondral bone formation in response to stress on the bone)
- Subchondral Cyst formation (joint fluid under pressure gets into cracks in the cartilage)

### **Treatment**

- Pharmacologic therapy (Tylenol; NSAIDS such as ibuprofen, naprosyn, etc.; glucosamine/chondroitin)
- Intra-articular injection (steroid or hyaluronic acid preparations such as Synvisc or Supartz)
- Weight loss (if obesity or overweight)
- Low Impact Aerobic Exercise (walking, treadmill, elliptical, bike or stationary bike, swimming or water aerobics)
- Physical therapy. Aims of physical therapy include:
  - Pain and spasm relief
  - Reducing stiffness
  - Muscles strengthening
  - Increasing range of motion
  - Increasing flexibility
  - Gait training

- Balance improvement
- Patient education
- Increasing functional activities
  
- Hydrotherapy
- Assistive devices (cane, walker)
- Surgical treatment (when nonsurgical management fails to provide relief)

## **Surgery**

Surgical operations can include the following:

- Total or partial knee replacement (Arthroplasty of the knee)
- Femoral osteotomy
- Tibial osteotomy
- Arthroscopic debridement (so-called "clean out").

Debridement may be done for these knee problems:

- Damaged cartilage
- Damaged meniscus



- The presence of loose bodies in knee joint
- Osteophytes of the joint
- Synovial hypertrophy (by synovectomy)
- Osteochondral allograft (bulk or mosaic)
- Arthrodesis (Fusion)

### Knee osteoarthritis

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- Genetics factors
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- Arthrodesis (Fusion)

## DISCUSSION

### **Genu varum**

**Genu varum** (also called **bow-leggedness**, **bandiness**, **bandy-leg**, and **tibia vara**), is a physical deformity marked by (outward bowing) of the leg in relation to the thigh, giving the appearance of an archer's bow. Usually medial angulation of both femur and tibia is involved.

Blount's disease is a specific form genu varum of affecting infants and adolescents.

### **Causes**

If a child is sickly, either with rickets or suffering from any ailment that prevents the due ossification of the bones, or is improperly fed, the bowed condition may remain persistent. Thus the chief cause of this deformity is rickets.

Skeletal problems, infection, and tumors can also affect the growth of the leg, sometimes giving rise to a one-sided bow-leggedness. The remaining causes are occupational, especially among jockeys, and from physical trauma, the condition being

very likely to supervene after accidents involving the condyles of the femur.

### **Expectations**

In most cases persisting after childhood, there is little or no effect on the ability to walk. Due to uneven stress and wear on the knees, however, even milder manifestations can see an accelerated onset of arthritis.

Those with bowlegs and a genetic predisposition for developing arthritis will likely start having arthritic symptoms around age 30.

### **Treatment**

Generally, no treatment is required for idiopathic presentation as it is a normal anatomical variant in young children.

Treatment is indicated when it persists beyond 3 and a half years old. In the case of unilateral presentation or progressive worsening of the curvature, when caused by rickets, the most important thing is to treat the constitutional disease, at the same



time instructing the care-giver never to place the child on its feet. In many cases this is quite sufficient in itself to effect a cure, but matters can be hastened somewhat by applying splints. When the deformity arises in older patients, either from trauma or occupation, the only permanent treatment is surgery, but orthotic bracing can provide relief.

## References

- John Crawford Adams and David L.Hamblen. *Outline of Orthopaedics*. Twelfth Edition. ISBN 0 443 05149 6
- Darlene Hertling and Randolph M.Kessler. *Management of Common Musculoskeletal Disorders*. Third Edition. ISBN 0-397-55150-9

## MATERIALS & METHODS

- (1) Weighing machine
- (2) Inch Tape
- (3) Goniometer
- (4) Surface thermometer
- (5) X-rays

All patients were recorded in the following pattern:

Name

Age

Sex

Height

Weight

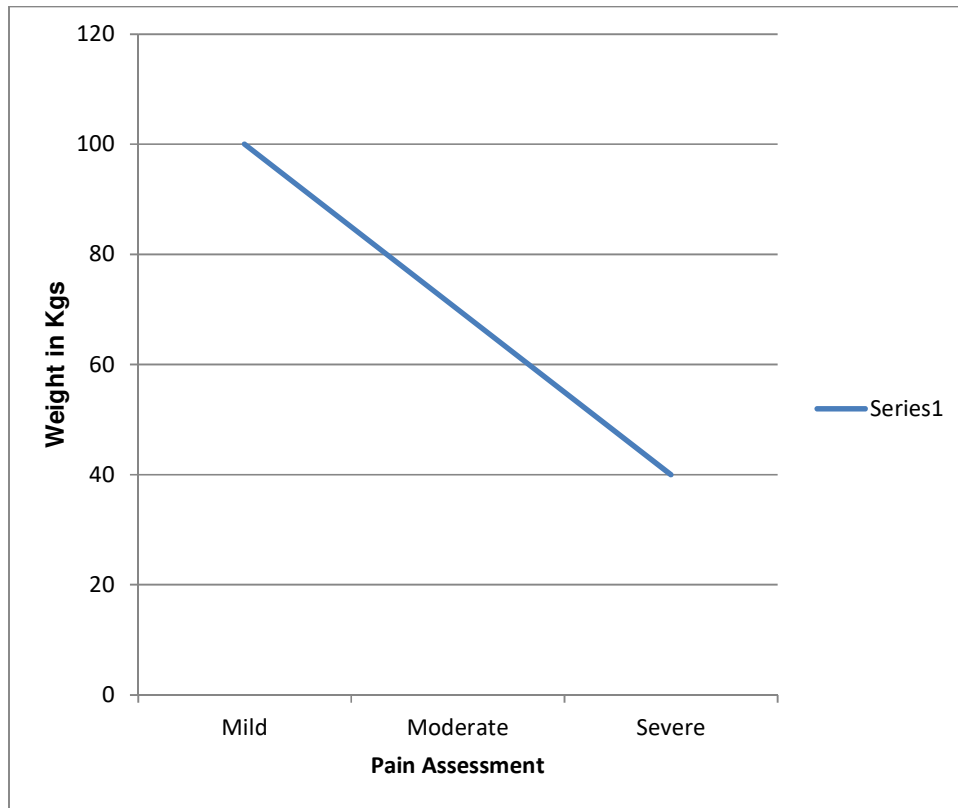
Systemic diseases

BP/DM

Built	Thin / Moderate / Obese
Knees	Circumferential measurement
	Patellar Tap
	For Patello femoral crepitations
	Joint line tenderness

Using the Goniometer Range of Motion of each knees, genu valgum, genu varum and the degree of fixed deformities of the knee were noted.

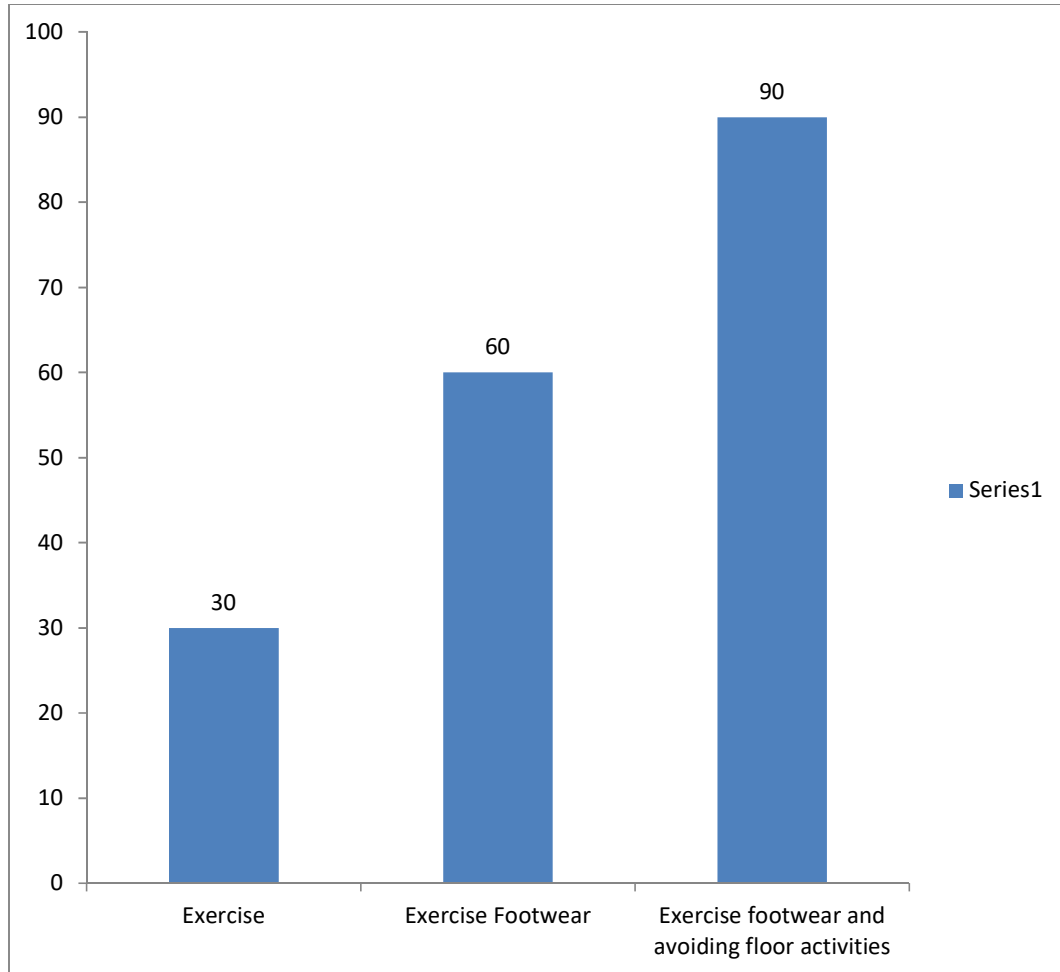
The following Table was generated



As the weight increased the intensity of pain also increased.

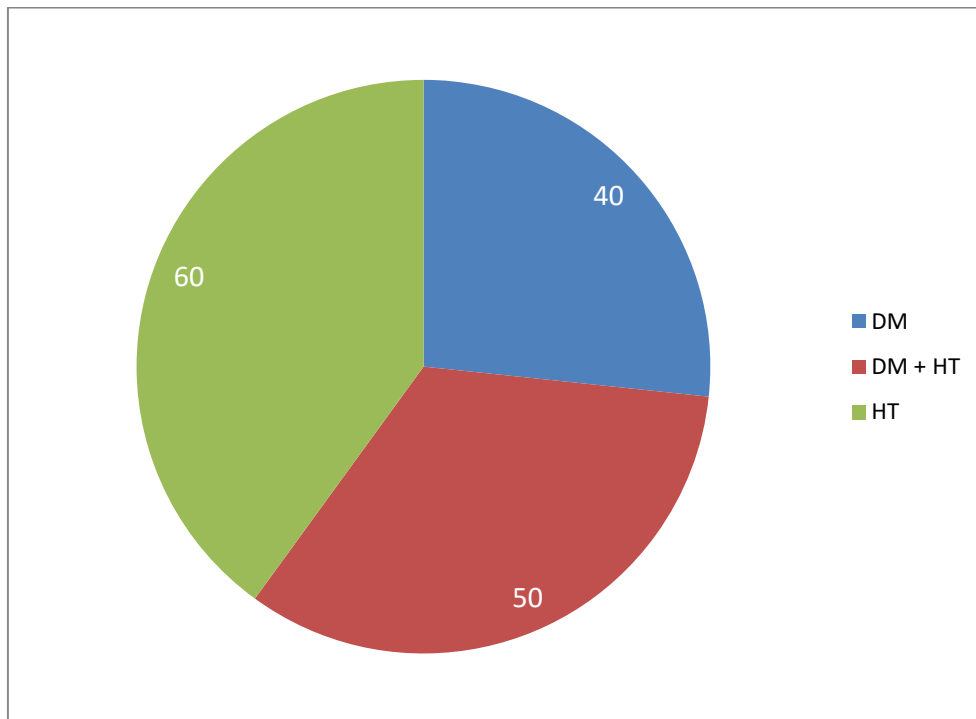
The placebo drugs were taken by 82 percentage of the patients and exercised by 74% of the patients. The footwear which was modified were worn by 100% of the patients. Hot water formentation, 98% of patients followed in the Rural

population only 10% avoided the floor activities. In the urban  
95% of the patients avoided the floor activities.



## RESULT

The rural group followed the drugs exercise and modified footwear except avoiding floor activities their relief of pain was only 60%. The urban people strictly followed all the four activities and they attained 90% of relief. The results clearly indicated that avoiding the floor activities did help in relieving the pain in the knees and the footwear modifications helped the patient to come out of pain and live with dignity. The rural people were found not changing their life style including weight reduction after 4 months.



## **FOOTWEAR EVALUATION**

The Footwear was inspected after 30 days,

60 days

90 days

120 days

The urban and rural patients were segregated and each one was assessed for pain, comfort, ADL, occupation and independent in locomotion. The physiotherapist randomly took ten patients and recorded without the patients group and collected the following information. In all the patients who wore the modified footwear the pain was reduced to a vast extent. Patients who neglected the footwear the pain relief was minimal.



## **DISCUSSION**

Osteoarthritis of knees are common in both urban and rural population and has no difference in its selection. Patients disuse are overuse the knees and abuse their knees by obesity, life style and lack of exercise and result in early Osteoarthritis. Hence educating the patients on the natural history and management options for osteoarthritis goes a long way in preparing them mentally how to get over the pain and increases their confidence. Explaining them the differences between the aging osteoarthritis and more rapidly crippling rheumatoid arthritis gets them out of the common fear nurtured in them about knee pain.

Weight reduction program, exercise and eating food rich in calcium and the necessity to seek medical attention at the earliest elivates the pain sooner.

As far as possible taking pain killers are discouraged and patients are thought Non medication techniques since pain is a long duration, self limiting diseases.

Footwear and its modifications after proper assessment of the knee helps them to overcome the pain and benefits in the long run. If pain do not subside with non invasive procedures, patients are explained the invasive procedures to come out of the pain.

Knowing about the diseases and by understand the means and methods to come out of the pain give them a psychological boost to bear the pain, to win the pain and be physically, fit for daily routine and ambulation.

## REFERENCES

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Carlos J Lozada, MD is a member of the following medical societies: American College of Physicians and American College of Rheumatology

Disclosure: Pfizer Honoraria Speaking and teaching

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