



# CORRELATION OF GAIT SPEED AND PAIN INTENSITY IN POST OPERATIVE KNEE ARTHROPLASTY PATIENTS

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## ABSTRACT

**Background and Purpose:** Total Knee Arthroplasty is procedure done to restore the gait functions in advanced knee osteoarthritic patients although in some patient's gait speed is noted to be reduced for which pain can be responsible

**Aim:** To study the co-relation between gait speed and pain intensity in post Total Knee Arthroplasty patients.

**Materials and Methods:** A total of 50 post operative knee arthroplasty patients were selected for this research. A written consent was taken after the inclusion criteria was met. 4-meter gait speed test was conducted, and gait speed was assessed. Pain was assessed by numeric pain rating

**Results:** When gait speed and pain intensity were noted it showed that even though the pain intensity was low the patient had slow gait speed which concluded that gait speed and pain intensity are not co-related.

**Conclusion:** After comparing the obtained values of gait speed and pain intensity it showed no correlation between these two terms.

**Keywords:** Gait speed, Pain intensity, Knee Arthroplasty, Correlation

## INTRODUCTION

Total Knee Arthroplasty is procedure done to restore the gait functions in advanced knee osteoarthritic patients although in some patient's gait speed is noted to be reduced for which pain can be responsible. Thus, we are correlating pain intensity and gait speed to see whether pain affects the gait speed. Gait is a compound activity with many variables to be observed and measured<sup>1</sup>. Gait speed is distance covered in given amount of time. Gait speed is considered as important measure in comprehensive geriatric assessment<sup>2</sup>. Gait speed is used as outcome measure in rehabilitation<sup>2</sup>. Gait speed is considered as a quick and inexpensive measure of functional capacity<sup>2</sup>. In instrumental activities of daily living capacity to walk is an important element<sup>2</sup>. It is also used to predict outcome of functional dependence and survival<sup>3</sup>.

In elderly individuals gait speed is important factor for attempting the activities of daily living with minimum assistance. Slow gait speed is indication of higher risk of fall in senior citizens. Slow gait speed in elderly individuals can be significantly due to degenerative changes. In Knee Arthroplasty outcomes gait speed is a rational clinical measure<sup>4</sup>. In safe and independent community ambulation of older adults' gait speed is relevant<sup>3</sup>. Some studies view gait speed as a vital sign because of its ease of implementation in the clinical settings<sup>1</sup>.

Average gait speed of a healthy individual is 1.4 m/sec or 3 mph. Gait speed of 1.0 m/s is indicator of good health and better survival<sup>4</sup>. Patients with gait speed less than 0.8 m/s are at greater risk of mortality<sup>4</sup>. Slow gait speed is indication of higher risk of fall in senior citizens<sup>2</sup>. Slow gait speed reflects health and functional status. Research have shown that functional impairment, cognitive decline disability and mortality are associated with gait speed<sup>14</sup>. Personal factors like age and gender affect gait speed of individual. Physical factors responsible for slow gait speed are lower quadriceps strength, reduced knee range of motion and poor postural balance<sup>5</sup>. Slow gait speed in elderly individuals can be significantly due to degenerative changes.

Osteoarthritis is a non-inflammatory degenerative disorder of the joint characterized by progressive deterioration of the articular cartilage. The important contributors to the development and progression of knee OA are excessive joint loading and alteration of knee joint biomechanics<sup>7</sup>. Factors responsible for knee osteoarthritis are hormonal effects on cartilage, thinner knee cartilage, increased articular cartilage loss and progression of cartilage defects and higher preoperative body mass index<sup>19</sup>. People with osteoarthritic knee tend to walk slow<sup>8</sup>. Most common cause of disability is osteoarthritis<sup>7</sup>. Knee OA is the most common cause of difficulty in walking in older adults leading to slow gait speed<sup>8</sup>. Pain and disability interfering the daily task is seen in average osteoarthritis patients<sup>1</sup>. Thus, this condition results in chronic pain and decline in functional abilities. Pain is the prime indication of knee osteoarthritis in older adults.

According to research one in four people aged over 55 years have knee pain and by age of 65 years 30% of men and 40% of women have radiographic changes of osteoarthritic knee<sup>12</sup>. Compared with men women are at increased risk of knee osteoarthritis<sup>19</sup>. Women are 3 times more likely than men to undergo Total Knee Replacement at more advanced stage of knee osteoarthritis<sup>19</sup>.

Total Knee Arthroplasty is a surgery in which the degenerated articular surfaces are replaced with all polythene or meta backed modular or non- modular components. The implant designs are improved over a period which uptakes the success rate of Total Knee Arthroplasty<sup>17</sup>. Viability of Total Knee Arthroplasty implant up to 20 years of surgery was stated as 97.8%<sup>18</sup>.

According to the degeneration Unicompartmental Knee Arthroplasty or Total Knee Arthroplasty is performed. This replacement procedure can be cemented or uncemented Unicompartmental Knee Arthroplasty had high failure rate during early period as compared to Total Knee Arthroplasty<sup>17</sup>.

The aim of this surgery is to relieve pain and restore the functional abilities of the patient. Total Knee Arthroplasty is cost effective and successful treatment option for advanced knee osteoarthritis<sup>18</sup>. With patient satisfaction Total Knee Arthroplasty is considered a successful procedure<sup>11</sup>. However, in some cases incomplete normal knee joint function is observed<sup>1</sup>. Although some articles have proved that Total Knee Arthroplasty considerably improves self-reported physical function<sup>5</sup>. Some studies have shown that Total Knee Arthroplasty reduces pain and improves the ability to perform the activities of daily living<sup>18</sup>. Total Knee Arthroplasty is considered as most successful method of functional improvement and patient satisfaction however, it is associated with incomplete recovered gait function<sup>11</sup>.

Also, primary Total Knee Arthroplasty has been reported to be less successful in restoring knee function in women than in men as women usually present later than men because of lack of social support or willingness to undergo surgery<sup>19</sup>. It may reflect women's decision to delay Total Knee Arthroplasty until a more advanced stage of knee osteoarthritis<sup>19</sup>. Women experiences greater pain before and after Total Knee Arthroplasty but gain as much benefit as men<sup>19</sup>.

Research has proved that at the age of 65 years average Total Knee Arthroplasty are performed<sup>16</sup>. But 70 is the optimal age for Total Knee Arthroplasty according to the research<sup>18</sup>. There was consensus that the mortality rate was not significantly different at 80 years but tended to increase with age<sup>18</sup>. Older patients mostly show with high mortality and morbidity<sup>18</sup>. Complications of Total Knee Arthroplasty are bleeding, acute kidney injury, post operative delirium, venous thromboembolism, pneumonia, cardiovascular complication, and infection<sup>18</sup>.

Gait speed limitation is the common issue after Total Knee Arthroplasty where pain can be significant factor<sup>1</sup>. Gait speed recovery post-Total Knee Arthroplasty can be driven by both physical and psychological factors<sup>5</sup>. Some studies showed that elderly women after Total Knee Arthroplasty showed decreases gait ability compared to healthy elderly women<sup>10</sup>. However, some studies showed there is significant improvement in functionality related to pain reduction<sup>11</sup>

## 1. Objectives

- To assess gait speed in post Total Knee Arthroplasty patients using 4-meter gait speed test.
- To assess pain intensity at knee joint in post Total Knee Arthroplasty patients using Numerical Pain Rating Scale.
- To co-relate gait speed and pain intensity in post Total Knee Arthroplasty patients

## LITERATURE REVIEW

- **Z A maureum [2014] et al**, studied "Correlates of gait speed in Advanced Knee Osteoarthritis" in which 190 participants were included with age group of 50 years and more with advanced knee osteoarthritis and chronic pain. Data included 4-meter gait speed, quality of life, knee pain, depressive symptoms, coping strategies, self-efficacy, comorbidity, analgesic use, and pain comorbidities. This cross-sectional study of older adults with advanced knee osteoarthritis and chronic pain, it was found age, arthritis function, self-efficacy and opioid use were significantly associated with decreased gait speed.
- **H Abassi Bafghi [2012] et al**, studied " The effect of knee arthroplasty on walking speed: a meta-analysis study" in which comparison of pre and post arthroplasty gait speed of 419 patients was done. The study concluded a large effect of arthroplasty on walking speed 6–60 months post-operatively. Patients usually expect a considerable improvement of their gait speed, which may take several months to occur.
- **Yong-Hao Pua [2016] et al**, studied "Factors associated with gait speed recovery after total knee arthroplasty: A longitudinal study" in which gait speed of 1765 patients who underwent TKA at 4,8,12 & 16 weeks post-surgery which concluded that gait speed recovery post-TKA is driven by both physical and psychological factors suggesting that identifying and treating the underlying physical and cognitive causes to optimize functional recovery.
- **Nancy M Peel [2012] et al**, studied "Gait speed as a measure in Geriatric Assessment in clinical settings: A systemic review" in which gait speed was measured in persons aged 70 years and older in inpatient and outpatient setting. Gait speed data was determined by meta-analysis adjusting the setting of covariant. The results concluded that gait speed is a comprehensive geriatric assessment, and it highlights the mobility limitations experienced by older people in clinical setting and the need for ongoing rehabilitation to attain levels adequate for reintegration in the community.
- **Du Hyun Ro [2017] et al**, studied "Slow gait speed after bilateral total knee arthroplasty is associated with suboptimal improvement of knee biomechanics" which included 34 female patients with end stage knee osteoarthritis who underwent bilateral TKA. The factors like Gait speed, kinetic and kinematic changes and determinants of speed were assessed via principal component analysis and multiple regression analysis. The study concluded that despite showing improvement, the gait speed of TKA patients remained slower than that of controls.
- **Georgios I Doroses [2015] et al**, studied "Persistent post-surgical pain and neuropathic pain after total knee replacement" it included published articles which referred to pain that lasts at least 3 months after primary TKR for knee osteoarthritis, and measured pain with pain specific instruments. Some Studies that mention of pain caused by septic reasons and implant malalignment were eliminated. No resistant conclusions can be made regarding the prevalence of PPSP and NP and the allied factors due to the heterogeneity of the studies.

## MATERIALS & METHODS

### METHODOLOGY:

- Study Type: Co-relation Study
- Study Duration: 6 Months
- Sample Size: 30
- Sampling Method: convenience sampling
- Study Set Up: Joint Replacement Centers
- Study Population: Post Total Knee Arthroplasty Patients

### MATERIAL:

- Consent form
- Demographic Data
- Numeric Pain Rating scale
- Cones
- Measuring Tape
- Stopwatch

**INCLUSION CRITERIA:**

- Age group 50>
- 5 Weeks Post unilateral Total Knee Arthroplasty
- Both the genders
- Subject willing to participate

**EXCLUSION CRITERIA:**

- Bilateral Total Knee Arthroplasty
- Any fixation or surgery other than Total Knee Arthroplasty
- Patients with orthotic device.

**OUTCOME MEASURES**

- 4 Gait Speed Test
- Numeric Pain Rating Scale

**RESULT**

Table 1: Gender Distribution

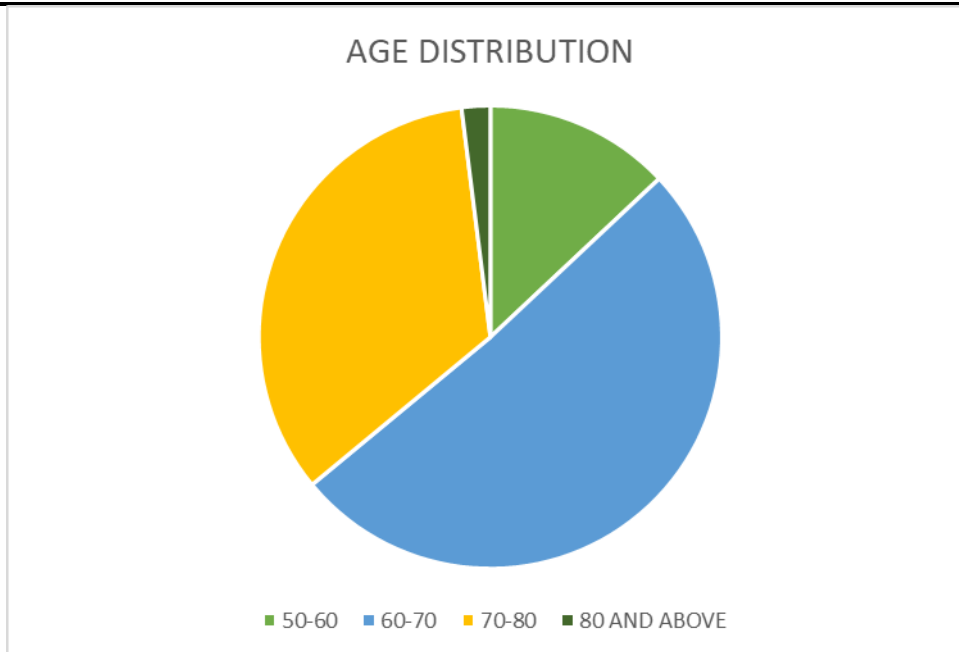
<b>GENDER</b>	<b>PERCENTAGE</b>
<b>MALE</b>	<b>50%</b>
<b>FEMALE</b>	<b>50%</b>

**Interpretation:** The above table shows 50 % male and 50 % female.

Table 2 : Age Distribution

<b>AGE</b>	<b>PERCENTAGE</b>
<b>50-60</b>	<b>13%</b>
<b>60-70</b>	<b>51%</b>
<b>70-80</b>	<b>34%</b>
<b>80 AND ABOVE</b>	<b>2%</b>

Graph 1: Age Distribution



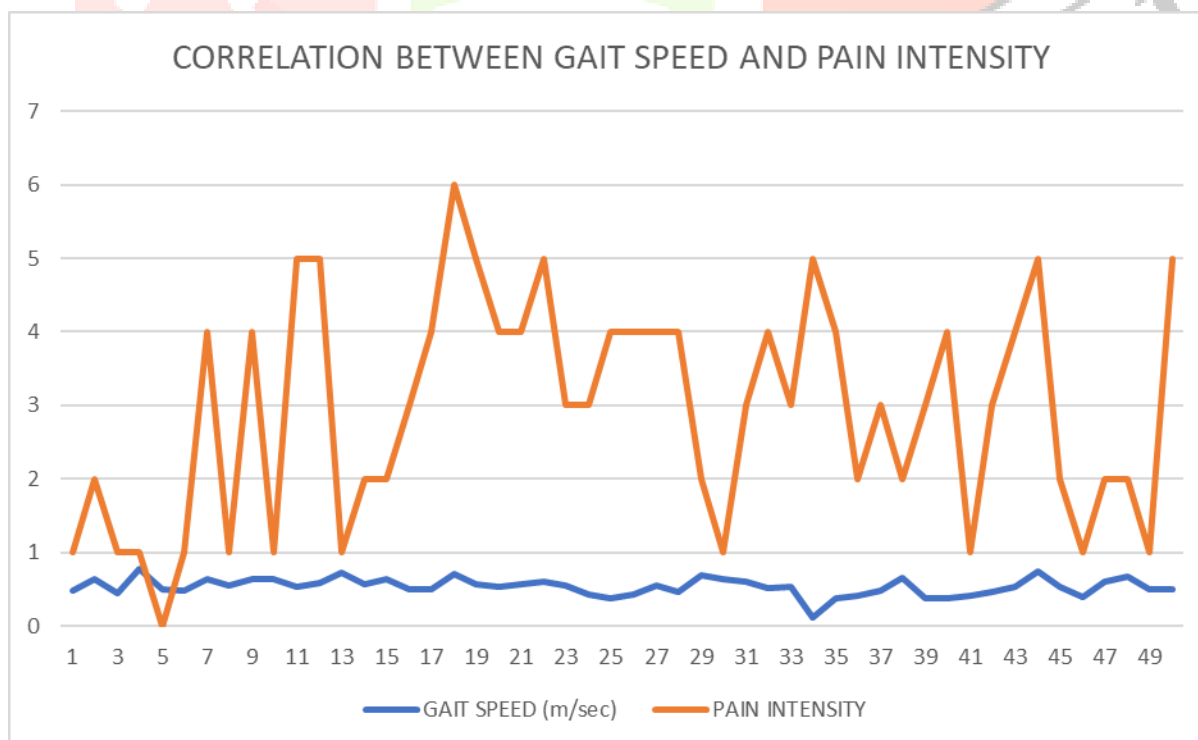
**Interpretation:** The above table shows 13% of 50-60 years age group, 51% of 60-70 age group, 34% of 70-80 age group and 2% of 80 years and above age group.

Table 3 : Type of surgery

TYPE OF SURGERY	PERCENTAGE
RIGHT TKR	46%
LEFT TKR	54%

**Interpretation:** Above table shows 46% of Right TKR and 54% of Left TKR.

Graph 2: Correlation of Gait Speed and Pain Intensity



**Interpretation:** Above graph shows correlation between gait speed and pain intensity



## DISCUSSION

Correlation study was conducted between gait speed and pain intensity. Post operative unilateral knee arthroplasty patients with no walking aids and post operative more than 5 weeks with no other lower limb surgery. 4-meter gait speed test was performed to calculate the gait speed. Numerical pain rating scale was used to record the pain intensity of the patient. Values of gait speed and pain intensity of patients were recorded to find correlation. It showed no correlation between the gait speed and pain intensity of post operative knee arthroplasty patients.

After Total Knee Replacement around 20% of patients experience chronic pain<sup>23</sup>. Dorases G et al, has documented that significant proportion of patients have pain of neuropathic origin for years after Total Knee Replacement<sup>21</sup>. Factors relating to persistent post operative pain after Total Knee Replacement are depression and comorbidities<sup>21</sup>. Lia Vilardo et al, stated that neuropathic pain is most common type of post operative persistent pain<sup>22</sup>. 13-20 % of post operative Total Knee Replacement patients have incidence of persistent post operative pain<sup>22</sup>.

Table 1 shows gender distribution. This study included equal number of male and female patients. 25 male and 25 female patients with unilateral knee arthroplasty were included. Jason Beng Teck Lim et al, concluded that women are at increased risk for knee osteoarthritis compared to men<sup>19</sup>. Women mostly delay the decision of TKR due to lack of social support and willingness to undergo surgery<sup>19</sup>. Thus, male TKR patients are seen more as compared to female patients<sup>19</sup>.

Table 2 shows age distribution. Age group for this study was above 50 because degenerative changes are mostly seen in individuals after the age of 50. In severe knee osteoarthritic condition Total Knee Replacement is indicated. This study included 13 % of patients of age group 50-60 years, 51% patients of age group 60-70 years, 34% patients of age group 70-80 years and 2% of age group 80 years and above. 60-70 age group shows highest no of knee arthroplasty patients. Age group of 80 and more shows only 2% of knee arthroplasty patients. Seung Hong Lee et al, concluded that mortality rate tends to increase with age after 80 years thus least no of patients undergo TKR surgery after age of 80<sup>18</sup>.

Table 3 shows right and left TKR distribution. Right or left TKR are performed according to the pain and degenerative changes of patient. Study included 54 % of left TKR and 46 % of right TKR. Right or Left side TKR depends on the level of degenerative changes in respective joint. It also depends on type of work the patient used to do which leads to grade 4 osteoarthritic changes of the knee joint. In Indian population average work type and household chores involves squatting. These speeds up the degenerative changes leading to osteoarthritis.

Factors responsible for slow gait speed after Total Knee Replacement are lower operative quadriceps strength and knee flexion range of motion, older age greater body mass, preoperative use of walking aid, poor postural balance, and female sex<sup>5</sup>. Also, in other surgery like Total Hip Replacement or Hip fracture slow gait speed has been noted post operatively<sup>24</sup>. Factors responsible for slow gait speed after hip replacement are lowered lower extremity strength, body weight and lower confidence<sup>24</sup>. Young Tae Joen et al, stated that the gait speed after surgically treating hip fracture of his cohort study was much slower than that of same aged healthy individual

Graph 2 shows correlation of gait speed and pain intensity. Numerical Pain Rating Scale was used to record the pain. It ranges pain from 1-10. Pain marked between 1-5 shows low to moderate pain intensity, 5 shows moderate pain intensity and 5-10 shows moderate to high pain intensity. Graph 1 shows pain intensity ranging from 1 to 6 which shows low to moderate and moderate to high pain intensity. 4-meter Gait Speed Test was used to calculate the gait speed. The gait speed in the graph ranges from 0.12 m/sec to 0.77 m/sec.

After comparing the values of gait speed with pain intensity it did not show any correlation between them. Patient with slow gait speed has low pain intensity as well as patient with same gait speed has moderate to high pain intensity. This concludes that pain does not affects the gait speed in post operative knee arthroplasty patients. Other factors like weight, age, lower strength, comorbidities can be responsible for slow gait speed

## CONCLUSION

After comparing the obtained values of gait speed and pain intensity it showed no correlation between these two terms.

## LIMITATIONS AND FUTURE SCOPE OF THE STUDY

## LIMITATIONS:

- Only unilateral total knee replacement patients were included in the study.
- Other factors associated with pain has not been considered.

## FUTURE SCOPE:

- Bilateral total knee replacement patients can also be considered for this study.
- Similar study can be done on Total Hip Replacement patients

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