ANALYSIS OF DIFFERENCES IN THE GAIT PARAMETERS IN INTERTROCHANTERIC FEMUR FRACTURE PATIENTS OPERATED BY PROXIMAL FEMORAL NAILING USING 3D GAIT ANALYSER- A CROSS SECTIONAL STUDY

Submitted By

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Sub: Institutional Ethical Clearance for the study.

With reference to the above, we wish to inform you that your proposed research project titled **"ANALYSIS OF DIFFERENCES IN THE GAIT PARAMETERS IN POST OPERATIVE PATIENTS WITH INTERTROCHANTERIC FRACTURES USING 3D GAIT ANALYSER"**, is ethical and justifiable. The proposed research project has been cleared by the JNMC Institutional Ethics Committee on Human Subjects Research.

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ABSTRACT

Background: Intertrochanteric fractures (ITFs) in general were observed to be quite common form of hip fractures and are predominantly reported among the elderly population especially with osteoporotic bones, and were caused typically due to low-energy trauma by falls. However, from the recent advancement in fixation surgery proved Proximal Femoral Nailing (PFN) to be effective in the ITF treatment. However not much research with regards to the postoperative assessment on the overall functional outcomes for determining the gait parameters among the treated patients. This study intends to investigate the ITF patients with the prime objective of analyzing the differences in the patients gait parameters who were treated with proximal femoral nailing using simple Helen Hayes Protocol of 3-D Gait analyzer.

Methods: The present postoperative observation study was conducted among Orthopaedics inpatients and outpatients in Jawaharlal Nehru Medical College, KAHER, Belagavi India. The study was directed between ITF patients who were examined during their 6months post-operative using 3-D Gait analyser (via employing Simple Helen Haley's protocol) for assessing the spatiotemporal parameters of the ITF. In fact, the study had been conducted within one year period that is between January 1, 2021- December 31, 2021. Simple Helen Hayes method comprised of the following parameters which were taken for consideration namely- Spatial Parameters (step width (m); stride length (m); step length (m)); Temporal Parameters (stance time (sec); cadence (steps/ min); single Support Phase (%); stride time (sec); mean Velocity (m/s); double Support Phase(%)); Gait Profile Score (Ground Reaction Force (Vertical FORCE (% body weight); Gait Profile Score (deg); Gait Deviation Index). With the help of SPSS (Version 19), data had beenanalyzed. Mann-Whitney Chi-square test and U test had been used for testing the hypothesis.

Results: In the study population, the majority of the sample population comprised of males (N-34; 56.7%) when compared to that of the female population (N-26; 43.3%). Considering the IT fracture and its severity, the sample population were classified into Type 1, Type 2, Type 3 and Type 4 fracture. From the observed findings it was presented that the majority of the respondents were presented with type 3 IT fracture followed by 18 of the respondents presented with Type 2 fracture and 10 with severe Type 4 IT fracture. Only 6 of the respondents were presented with Type 1 IT fracture. Temporal findings of the gait parameters concerned there was an increase in the single support asymmetry (43.997 ± 1.585) and double support phase (14.56 ± 0.302)

indicative of the IT fracture's impact on the limbs during gait. The observed mean velocity was reported to be 1.16 ± 0.122 m/s (i.e.) within normal ranges with no deviation despite the IT fracture's impact among the study population. The reported cadence (steps/ min) on an average estimate was reported to be decreased to a certain extent (113.35 ± 1.68). Also there was a reduced or minimal step length observed among the sample population in this case 0.63 ±0.284 m. IT fracture sample population with the estimated mean range observed was 7.76 ±.406 (whereas the normal ranges were < 7) thus presenting a deviation/ differences observed in the gait scores in the sample population so far from the report. There is an abnormal ranges in the gait deviation score was reported as 85.57 ±3.04 (< 100), thereby deviating from the normal ranges among patients reported with IT fracture.

Conclusion: 3D gait analyser of this study shows altered gait after PFN in ITF patients specifically increased single support asymmetry, increased double support phase, decreased cadence, reduced step length and abnormal gait profile score(Ground Reaction Force). Analysing the gait parameters could be employed as an effective tool in the devising a suitable management approach and treatment modality post-surgery for framing rehabilitation protocol.

Key words: Intertrochanteric Fracture, 3D gait analyser, Helen Hayes protocol, spatiotemporal parameters; Proximal Femoral Nailing

ABBREVIATION

O.A.	–	Osteoarthiritis
PFN	-	Proximal Femoral Nail
&	-	And
IT	-	Intertrochanteric
ANOVA	-	Analysis of Variance
OTA	-	Orthopedic Trauma Association
RTA	-	Road Traffic Accident
GDI	-	Gait Deviation Index
3DGA	-	3-Dimensional Gait Analyser
GPS	-	Gait Profile Score
GVS	-	Gait Variable Score
Pre-op	-	Preoperative
Post-op	-	Postoperative

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

LIST OF GRAPHS

INTRODUCTION

The clinical presentation of Intertrochanteric fractures was observed to be prevalent among the old adult groups, however it appears to be not uncommon among the younger age group. The similar type of fracture bonds easily to the line of conservative above treating as there will be no scope for technical hitches like the sequel related with OA and the avascular necrosis in the head. It is not compulsory to treat trochanteric fractures with surgical intermediations, coxa vara malformation that is malunion that result in reduction of length of limb and limp which are the common outcomes.[1]

The initial live treatment were procrastinated generally for about 3-4 weeks that lead to development of complications of the second type. There are several operative procedures that involves with different implants described as treatment modalities for the intertrochanteric fractures.

The primary goal governing with the treatment facilitates in the progress of early mobilization alongside with prevention of secondary complications, which could be achieved from the open reduction & internal fixation. Intertrochanteric femur fractures could be repaired via either with the sliding of hip screw or with the sliding of trochanteric nail. The underlying problem associated with the sliding hip screws are mainly from the collapse in the femoral neck, length reduction of leg along with leading to offset of hip loss. Even though few slipping was anticipated, lot of decrease in length can result in some damage to functioning in hip region. Thus, the bringing in of a device of the intramedullary– usage of Proximal Femoral Nail in 1996 that offers an improvement with regard to negligible invasive surgery.[2]

Across the globe, the number of patients affected by fractures near the area of hip show a significant digit. The general observations for old age people was to be intertrochanteric fractures, for trivial trauma being the main reason. The variations from one country to another can be listed for the several reasons for occurrences seen due to intertrochanteric fractures.[1]

The forecast of 2.6millions of people being impacted by hip fractures across the globe by 2025[2] , while the estimate of lifetime risk of it can be seen in individuals aging 50 in which 20% for women and 5.6% in men[3.] For medical ailments that are related with loss of bone like Diabetes, Cushing's syndrome, Hyperparathyroidism, and also Hyperthyroidism is associated to the rise in the upswing of fractures of the hip.[4]

The poor function is the result of high occurrence of varus deformity and reduction in length as outcomes. With the anticipation of improved function as the expected results, in 1950s, operations for fractures in the hip region were familiarized and lessened the complex features of constant rest on the bed.[5, 6]

Intramedullary maneuvers like PFN/ proximal femoral nail, were seen to be more stabilized with short lever arm, thus the hip joint and nail were made closer in comparison with the plate, and thus reducing the malformation factors along the implant. Specifically in a wobbly sub trochanteric and trochanteric fractures, the biomechanical help of devices in intramedullary is significant.[7, 8]

With regards to the surgical management the foremost goal in IFFs related surgical modality involved with the post-operative recovery, especially in terms of their walking ability. In order for reestablishing the patients to one's normal environment (14) in clinical findings among the older patient groups serves to be

quintessential. Perceived difficulty among the patients in terms of walking outdoors & 500 meters were assessed before fracture in general when at discharge (3.2±2.2 weeks) after surgery. Indeed, walking has been attributed as one of the most essential modalities in the human life and their functioning. When there are disturbances observed in their normal gait tend to exhibit the impacts on the patient's life quality significantly. Ultimately it could be inferred that assessment revolving around evaluation of gait parameters could be considered as a sensitive tool for assessment as well as monitoring the overall progress associated with fracture healing, as it gives the physicians with quantitative and objective data needed to frame a proper rehabilitation protocol & also determines the success of treatment modality employed for IFFs patients[9]

AIM OF THE STUDY

The aim of the present study was to analyze the differences in the spatiotemporal gait parameters in 6 months operated case of proximal femoral nailing in intertrochanteric fractures by evaluating the gait parameters using 3-D Gait analyzer.

OBJECTIVE OF THE STUDY

The present objective of the study is to determine the DIFFERENCES in GAIT PARAMETERS patients with different TYPES of INTERTROCHANTERIC FRACTURES (BOYD & GRIFFIN classification) treated with PROXIMAL FEMORAL NAILING using SIMPLE HELEN HAYES PROTOCOL OF 3-D Gait Analyser.

REVIEW OF LITERATURE

Historical Review associated with intertrochanteric femur fracture

The last seen decades of the 20th century, trochanteric fractures and their treatment was directed with conventional methods. Approaches that involved conservative treatments and schedules included general support systems like usage of splinting to the next limb or using pillows or skin traction or usage of Buck's traction as well as traction of well-leg or traction – the balanced traction of Russell by using skeletal traction on upper tibia or upper femur and plaster Spica control.

Earnest Roll[10] in 1950s, from Germany, witnessed in the first researcher to work with a sliding tool that included internal fixation as a remedy for trochanteric fractures.

A researcher named Massie (1958)[11] presented fixations to result in impactions by utilizing sliding nail plate and after that Massie in the year 1962, improved the device which included fragments impactions and also lead to an enhanced outcome for the treatment involving intertrochanteric fractures.

Furthermore, Clawson[13] stated that the treatment approaches governing with trochanteric fractures were treated with surgical modalities that involved with utilization of Jewett nail & Sliding Compression Screw.

Mulholland and Gunn[14] during 1972 reviewed around 350 intertrochanteric fractures which were treated via employing sliding hip screws. The study further then confirmed stable fractures can be satisfactorily treated via utilizing virtually of any rigid form of internal fixation device.

Ahlstrand T[15] (1974) reported from the study findings that utilized the Richards CompressionSliding Hip screw system [16, 17, 18] for treatment for 48 subjects with the complaint of intertrochanteric fractures. The researcher further then noted the system could aid in stabilizing the fracture over certain extent, thereby there is a possibility for mobilizing patient for walking with the support of full weight bearing on operated legs within the span of only few days alone.

Hunter & Krajbich[16] (1978) conducted an investigation among 80 unstable fracture cases that were treated via engaging valgus reduction, fixing using sliding compression screw or Thornton nail plate and medial displacement osteotomy. The author further then had concluded medial displacement of the osteotomy for the unstable fractures were joint together with the treating process that involved in usage of fixation of sliding compression screw.

In 1979, Richardson S, et al[17] implemented the procedure of treatment for cases involved in intertrochanteric fractures which include compression hip screw and an observation was made that taking help of rigid fixation of the interfragmentry compressions that are utilizing compression hip screw facilitated in earlier mobilization followed with an immediate outcome from the weight bearing parameters observed among the patients.

Moore GH[18], et al (1983) reported from the outcomes among 107 intertrochanteric fracture cases who were treated via employing Richard's screw. Among those patients who are suffering from unstablefractures were observed to exhibit satisfactory mobilization which was observed among the 55% cases who were treated using Jewett nail and almost 85% of them showed signs of satisfactory level of mobilization from the treatment of Richard's screw plate.

Medoff (1990)[19] modified side plates & further then designed with modular sided plate that facilitated in the collapse as well as impaction on the femoral shaft axis which is also called as Modified Sliding Plate.

From the eventual research, Davis T et al (1990) [20], evaluated reasons behind governing with power-driven motion from the sequence of 230 fracture cases of intertrochanteric which are fixed internally using a Sliding hip screw or the other option of Kuntsher Y-nail. Looking at the rates in an overall view, rates of failure due to the outcome of the power-driven failure were described with around 16.5% cases due to the sliding device followed with failures which needs to be corrected for the implant as it needs to be placed centrally within head for minimizing such complications.

Bridle SH et al[21] (1991), from the prospective study compared fixation among the 100 intertrochanteric fracture cases among the disorientated cases who underwent random utilization techniques including one new intramedullary device or two dynamic hip screw, the gamma nail. The study specified that no variation was seen in terms of the actual functioning time concerned as well as with length of the hospital stays, wound complications concerned, the blood loss involved or the movement of patient with regard to the final review. In 4 cases that noticed the need for further surgery being major, due to the fractures seen in the femur region close to the gamma nail.

A study was accomplished by Parker MJ[22] (1992) between 25 patients on the position of screw, and along with an observation of the cutout of screw that was more often when the placement of screws were posterior or superior. The actual aim from

the modality is to centrally / inferiorly screw on AP view & must be centrally screwed from the lateral view of the presentation.

O'Brien PJ et al (1995)[23] performed a compared assessment among the fracture cases that were treated using DHS & from the Gamma nail. The study showed no significant associated or differences observed between both the groups for the criteria 1) loss of blood during surgery, 2) count in days for presence witnessed in hospital, 3) after surgery, for patient in full function, the time taken for union and compatibility for all body operations to begin leading to fruitful results.

In 1995, Baumgartner MR[24], premeditated the importance for distance of tip apex and forecasting on the defects to fractures of peritrochanteric fixation of region of hip from the research done using 198 cases of fractures in AP and also including the Lateral radiographs. The study was concluded by the researcher that average distance of the tip apex needs be around 24mm. for successful fixation of peritrochanteric fractures.

Gait parameters and its significance in evaluation during post-operative recovery

In a post-operative recovery, it is pivotal for old age population to exhibit safe & efficient gait, as it regarded as the prerequisite for a good quality of life. Globally reports estimated around with 1.6 million cases of hip fractures on an annual basis25. Also concerning with the majority hip fracture cases never regained the pre-fracture function/ operations26. Gait impairment appears to be one of the key reason for this particular group to face chronic disability that affects their day-to-day functioning27 & also result in higher likelihood of fall risk28.

The underlying mechanisms associated with the decline in their gait following the hip fractures remains to be still not understood thoroughly and there are few literatures that emphasised on major gait characteristics, of which one notable parameter involves with evaluation of gait speed. Gait speed in general is recommended to be the overall measure for the health as well as overall functioning among the older adult groups29. Likewise, the posture cannot be cure considering it as a unitary concept, and we can observe various gait readings which were exhibited to differentiate and the forecasting capacity of intellectual opeartion30 , along with the downs31 recommending the underlying balancing data which can be attained from posture variables other than the speed of gait. Due to the beginning of execution of walkways that have become electronic, there have been number of factors in gait, waiting to be accounted for in a simpler manner and be estimated. This is possible even with weaker number of people especially with those with fracture at the hip. Detecting gait factors help in noting important features related to defects in the walking capability after fracture at the hip region and this can later help in upcoming studies focused on assessment of the walking style of patients in their visits before surgery and post-surgery follow-up research.

Bizzoca[32] investigated the gait analysis as the major functional assessment among the sample population within the age group above 65 years of age. This involved with determining the stability status of IFFs, wherein the minimum post-operative follow-up of 6-month period. It had been observed from the findings that among 65, 14 of the patients who had undergone intramedullary nailing with IFFs (AO/OTA 31-A) (EBA-2, Citieffe Srl, Italy). As per AO/OTA classification and the stable/unstable fractur pattern, these patients had been classified into two different groups. At the time of the follow-up appointments, the gait parameters were evaluated. During the 3-month follow-up, both the

groups exhibited significant differences in their gait patterns, when on compared to the control subjects. Also, at the 6-month follow-up, patients who are with the stable fractures exhibited comparable gait pattern, when on comparison with that of the control, whilst the patients who are with unstable fractures were still showing signs of worse gait pattern, compared to the control. This study served crucial in suggesting the necessity of utilizing gait analysis as an essential tool during the post-operative follow-up as it aids the physicians to customize their rehabilitative protocol for improving the patient's status of recovery.

Gausden et al (2018)[33] studied the associations governed with the fracture collapse that resulted in the altered gait after the intertrochanteric (IT) fracture via treatment approach that utilized trochanteric fixation nail (TFN) & the helical blade. Of the total patients, 72 were evaluated. 20.8% or 15 of which had reduced more than 8mm, 2.8% or 2 patients reduced more than 20mm, 7patients or 9.7% reduced >/= 10mm. the average reducing length was found to be 3.0mm for a constant OTA/AO31-A1 fractures, while the varying patterns (OTA/AO31-A2,31-A3) exhibited an average reduction of 5.9mm or 'P' value being 0.02. An important relation between reduced cadence P=0.008 and high shortening, increased double support time for P vale is lesser than 0.001 and higher single support asymmetry for P value being equal to 0.04 along the gait evaluation. Outcome of this research leads to the reduction after the nailing of cephallomedullary of IT fractures in hip region utilizing TFN and a helical blade is related with modified gait, especially reduced cadence, reduced step length, higher single provision time asymmetry and more of double upkeep time and higher single support time asymmetry.

Thingstad et al (2015)[34] found out from his research regarding the different segments of the gait and its important factors that exhibit the following segments and

moreover the research discovered on how the found-out forecasters which demonstrated the least outcomes the after effects of hip fracture along with the relation with the important factors related. From the findings both Spatial as well as the time-based walking manner factors procured during the four months after the hip fracture in total of these 249 cases via monitoring in electronic walkway (GAITRite®). The gait analyzer showcased initial sets comprising of 31 gait variables, of which 16 were selected for the following systematic procedures. Among the population, the average speed of gait was measured to be calculated from the research was 0.6 +/- 0.2m/second. Additionally, on observing the variable evaluation that showcased the 4 distinct domains in gait, and the significant factors which was the most exhibited from the segments were concluded to be initially the double support time, the next is walk ratio taken into consideration and observed variability in footstep velocity and finally the single support asymmetry. Also, some of the significant predictors are- Cognitive decline, extra capsular fracture, low grip strength, & male gender, however not pain/ age, found to be of significant predictors in respect to the impaired gait post-hip fractures. All of the core variables were in association with all the known predictors with the poor outcome post-hip fracture & is essential to warrant further assessment for as outcome variables other than gait speed.

Jeon et al., (2019)35 directed a cross-sectional study which focused on the determination of physical performance variables post operation and those that are related to the gait speed between the patients who were cured through operation along with the clinical representation of fracture in the hip. Patients those who finished the test of 10-metre walk (10MWT) to evaluate the gait speed. And the other physical exhibiting tests that added to the above were the TUG or Timed UP and Go test, MVIC or the maximum voluntary

isometric contraction, the BBS or Berg Balance Scale, of the flexors and extensors of the knee, on two sides, one is the side of surgery and the second, the other side of surgery along with the hip abductors, most of which are verified by applying weight machines that are believed to be of air-resistance and also the assessment of the walking manner aspects which are spatio-temporal, after 6 weeks of surgery of the hip. An evaluation that takes place through bivariate, concluded an important optimistic association between the TUG after surgery and 10MWT after the operation made, the swing phase timing, age & sequence of gait, addition to an important negative association between the BBS score of the post-operative and the extensors related to the knee and flexors with MVIC on the sides that did not undergo operation as well as the side that was operated.

Hollman et al., (2011)36 made an evaluation of factors on about 12 spatiotemporal gait parameters and to add to the normal sack of information related to gait factors from strong, functional personalities of women and men above the age of 70. The resulted information was taken from 294 members contributed to the findings. The outcome have been observed and drawn conclusions that 5 basic domains of gait performance of spatiotemporal : a “phase” segment was featured by temporal factors consisting of specific sectors of the gait cycle; a “rhythm” segment featured by temporal and cadence factors like the stride time; a “variability” segment consisting of gait cycle and stage wise factors of variability; a “pace” segment featured by gait speed factors , step width as well as stride length; a “base of support” segment featured by step width variability and step width. There were many domains that varied across genders and age-wise divisions. The 23 factors were given reference values and exhibited by clinicians or researchers that used for evaluating and inferring malfunctions of gait in the elderly people.

Braun et al., (2019)37 conducted an observational study that assessed the gait parameters among 22 cases with IT femur fractures. During the inpatient stays from the findings exhibited continuously were monitored via employing gait analysis insole. From the achieved primary outcome exhibited on the amount attributed to over how much did the weight-bearing reached. In regards to the short-term functional outcome observed and also their recovery to the previous condition were evaluated which were correlated with weight-bearing followed with the activity at the time of the inpatient stay. From the observed technique involving with the continuous gait data from all the patient conditions at the time of the postoperative mobilization were obtained and further were evaluated. From the achieved finding, almost 13 of the patients reached the extent of full weight-bearing. This indicated the feasibility governing with the technique and was also further then able to determine the underlying correlation that were existing between the weight-bearing as well as the outcome so, as well as between the gait activity & the other outcomes that were evaluated during the post-operative assessment. Furthermore, the study observed a significant differences observed in the gait among patients with regards to those who were able to recover to the previous living state and those who could not were seen.

Sivakumar et al (2020)38 conducted a multicenter, pragmatic, single-blinded RCT comprising of three-arm parallel group design. The participant of research consisted of 900 people on presentation with intertrochanteric fractures (A1 & A2 AO/OTA) and also it is given general and not specific cure utilizing a Stryker or Trigen Intertan nail (Smith & Nephew); proximally dynamic/ a Gamma-3 nail in a stable or dynamic conFigure uration of lag screw. The first result counted that has radiological proof of structured defects within the duration of 6 months and followed by an operation with the failure known as damage in distal locking screw or femoral nail, a modification in tip-apex distance being above 10mm

or femoral head cut-out through lag screw. The second results mention about data of surgical sector such as site of infection, patient death, reoperation, movement return duration, circumstances of home, independently being able to function, any abnormal pain and function in general. The ones who could respond to simple questions and walk on their own by using a mobility aid or no and those who could respond and go by the instructions were told to take part in 3D gait evaluation at about 6 weeks and to evaluate the biomechanics of hip at six months duration from the particular set or group. The add on to the secondary events of gait speed, motion of hip range, muscle forces and joint contact and the net activity tracking patterns can be reviewed by this subgroup.

Mangione et al (2008)39 examined in their study that focused on factors that were related with gait speed among patients after the treatment of hip fracture. A sum of 42 women and men on an average of +or- 7.5 of 79 age group who were persistent to survive a hip fracture contributed their records to this research. An analysis by linear regression was utilized to conclude a model that was statistical which gave the best analysis of gait speed which is the dependent factor. The gait speed was calculated with an electronic gait mat. The single and non-dependent factors were sex, age, height, balance confidence, time post-fracture, weight, depression, Short Form (SF-36), medical studies outcome, mental status, balance & lower extremity isometric force. In addition, the research subjects had been dispersed from physical therapy services as well as the calculations that taken to the total of 17 weeks after the fracture. About 72% of difference in the speed of gait had been enlightened through briefing up the strength of lower extremity generalized on the stepwise regression usage by body weight, balance confidence and general health (SF-36). The study concluded that Impairments (summed lower extremity strength) and risk factors (perception

of general health and balance confidence) are important predictors of gait speed in elders after hip fracture.

The experiment done by Cabell et al., (2013)[40] had a 3D gait analysis through video motion, kinetic data and platform kinematic. The condensed statistics were from areas near the rear lower parts such as right lower ankle extremity, knee and hip and also as the people used the passage in their paces needed. Information was evaluated and data was assessed as the age functions and doings staged by utilizing an analysis 2-way of variance. As predicted the outcomes lead to a conclusion which the old age category had an essentially higher, i.e., $p<0.05$ operational and limitations regarding movement concerned with joints in the lower regions when compared to the smaller age group. The noted lower limb walking capacity in regard to age was essentially seen at the ankle, while, changes in activity at the most importantly near the hip level. The least modifications was seen at the knee along with the action or age levels. The factors that affect gait are activity stages and age that may have a hand in the later improvements of a tendency to walking related defects leading to imbalances and risk of hip fractures and falling down. The professionals who view strength of an individual and conditioning factors like activity and age for the independent exercise schedules for the clients who are mostly have a sedentary lifestyle and old. The activities which are followed to prevent diseases also involve particular, restricted 3d motions of the body which may help to surpass unnecessary lower joint kinematics like postures and thus decreasing the intensity of fracture and fall.

ANATOMY PROXIMALFEMUR:[27]

The longest bone of the human body is femur. A neck, head, a greater trochanter and also a lesser trochanter in the upper end are existed.

The Head:

A little greater than ½ of the sphere is known as the head, which is positioned a little forward and medially upwards. This makes a hip joint when united with the acetabulum. Behind and below the center is fovea and also towards the head, medial convexity is present which has one of the pits that gave a hook to the head ligament of femur, ligamentum teres. Further, the entire area is head and it is intra-capsular which is also rounded by the labrum acetabulare instantly on the lateral side of the diameter. There is a sharp definition of the circumference of head other than the anterior part because it is the place of coverage of cartilage surface, along with an extension along the neck front.

The Neck:

The connection holding shaft and femur head is neck. Length=1.5 inches. Medially and upwards inclined by neck, making an angle along the shaft, is around 125^{o} in adults. To move freely by pelvis, it enables movement at joint of hip. The tilting of neck is forwards and moves upwards and shaft towards the median. Due to this neck's transverse axis, an angle is formed at the neck along the transverse axis at the femur's region at lower end, also called Angle of Anteversion, angled at about 15^{o}.

There are two surfaces and borders. Upper border has horizontal and concave forms and touches shaft near the greater trochanter. Border at lower region is oblique and straight, thus it is linking to shaft beside the lesser trochanter. It has been totally intra-capsular for

describing the anterior surface and joining the shaft near the intertrochanteric line. The convex structure of posterior surfaceis convex at downwards and above, while beside each it will form a concave structure, while it's just a bit greater than the intra-capsular medial half; along with the joining of shaft and circular crest of intertrochanteric.

The ridged neck with a factor on the anterior side that anticipates the joining of fibers of retinacular part of the hip joint capsule, that are shown on the proximal side of the capsule's distal joint. Directed along the head are several vascular foraminae, which also make a hole in the surfaces of anterior and posterior regions on the neck. Calcar femorale strengthens the neck all the way down the concavity.

The Greater Trochanter:

As the name suggests, the greater trochanter is large with a quadrangular projection, from the convex part of the junction, projects back and up, meeting the femur's neck along the shaft. Below the breadth of the tubercle of crest of the iliac is the greater trochanter's top border that has been on the level with the femoral head center.

The Gretaer Trochanter is comprised of an apex, upper border and three surfaces like lateral, medial and anterior. An apex is turned in at the upper border. At the posterior apex, elongates along the crest of intertrochanteric towards the lesser trochanter. On the greater trochanter is a medial surface along the upper border which joins piriformis fossa. A J-shaped groove is observed at the anterior part that is used to join tendon of gluteus minimus. Anteriorly, the surface of the median offers a union for the tendon that is common to gamelli and obturator internus, while at the lower level is the trochanteric fossa which is rough, attaching obturator externus. There is

an oblique strip at the lateral side, inclined forwards and downwards, offering a hold for the gluteus medius. The gluteus medius has trochanteric bursa in the forward direction of this ridge and on the behind is the gluteus maximus.

The Lesser Trochanter:

This is conical in shape on frame. From the position of shaft, it is backwards and, at the lowest region on the neck. The surface is round and provides a joint medially for the tendon psoas major. In the front of tendon is Iliacus, joined along the below bone is the lesser trochanter. Posterior surface is smooth and is enclosed by a bursa in depth to adductor magnus of upper horizontal fibers.

The Intertrochanteric Line:

The junction states a mark of the neck's anterior part along with the shaft of femur. The ridge is projected and rough, starting from proximal side of the antero-superior region - greater trochanter's tubercle and glides down and on the medial side, continuously under, in front of and line that is spiral of the lesser trochanter. This line surrounds on the surface of posterior side and under the shaft. An intertrochanteric line offers add-on below:

1. On top Iliofemoral ligament's upper band.
2. Region on hip joint & capsular ligament.
3. Under terminal of Iliofemoral ligament- below band
4. Belongs to Vastus lateralis, tallest fibers on the top most terminal.
5. Lower terminal belonging to Vastus medialis, highest fibers.

The Intertrochanteric Crest:

The region that high lightens the intersection connection to neck with shaft on the posterior surface. This is smooth, round and ridged, initiating, angle of postero-superior of the greatertrochanter and glides medially and downwards ending at lesser

trochanter. Almost half the length, the crest is projected oval, gives joint for quadrate tubercle and quadratus femoris. Gluteus maximus covers above tubercle and below is detached by two regions namely, one is quadratus femoris & second one being upper edge of the adductor magnus.

The Skeletal Anatomy:

This has a spongy bone; a thin layer of compact bone constitutes the proximal femur. The composition of spongy bone is more in trochanteric region.

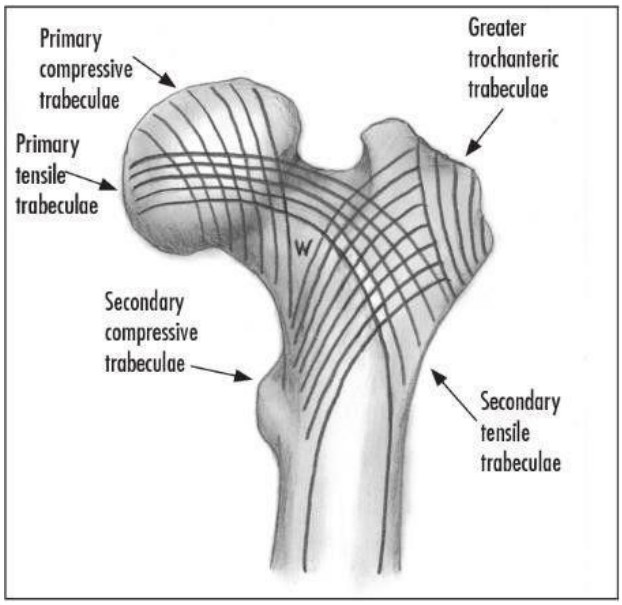


Figure 1: Trabecular System

The femoral head has an internal trabecular system which was spoken about by Ward[28] in 1838. Positioned along the lines of stress, are the trabeculae. Ward defined 5 groups of trabeculae.

Primary Compressive Trabeculae:

The strongest, goes along from base of femoral neck at medial cortex till the super medial part of head to subchondral bone.

Primary Tensile Trabeculae:

The region that starts from foveal area along inferior region and all the way to superior and head region of neck of femoral, into greater trochanter, and lateral cortex is the last part in the line.

Secondary Compressive Trabeculae:

Spread right from the greater trochanter and in lesser trochanter area along medial femoral cortex.

Secondary Tensile Trabeculae:

On the inferior side to first tensile trabeculae, these form an extension from lateral femoral cortex and along middle portion of femoral neck.

Greater Trochanteric Trabeculae:

Extension visible till base from highest border of the greater trochanter. The region flanked by tensile trabeculae and primary and secondary compressive trabeculae which are known as the Ward's Triangle.

It is further observed that a thick surface of vertical bone that has extended from the posteriormedial portion of the femoral shaft below the lesser trochanter and it has further projected laterally towards the greater trochanter, by supporting on the posteroinferior region of femoral neck. At the medial part, calcar is the thickest and as it passes laterally, it thins down. This offers to stabilize the load which is compressed in that area.

The Vascular Anatomy:

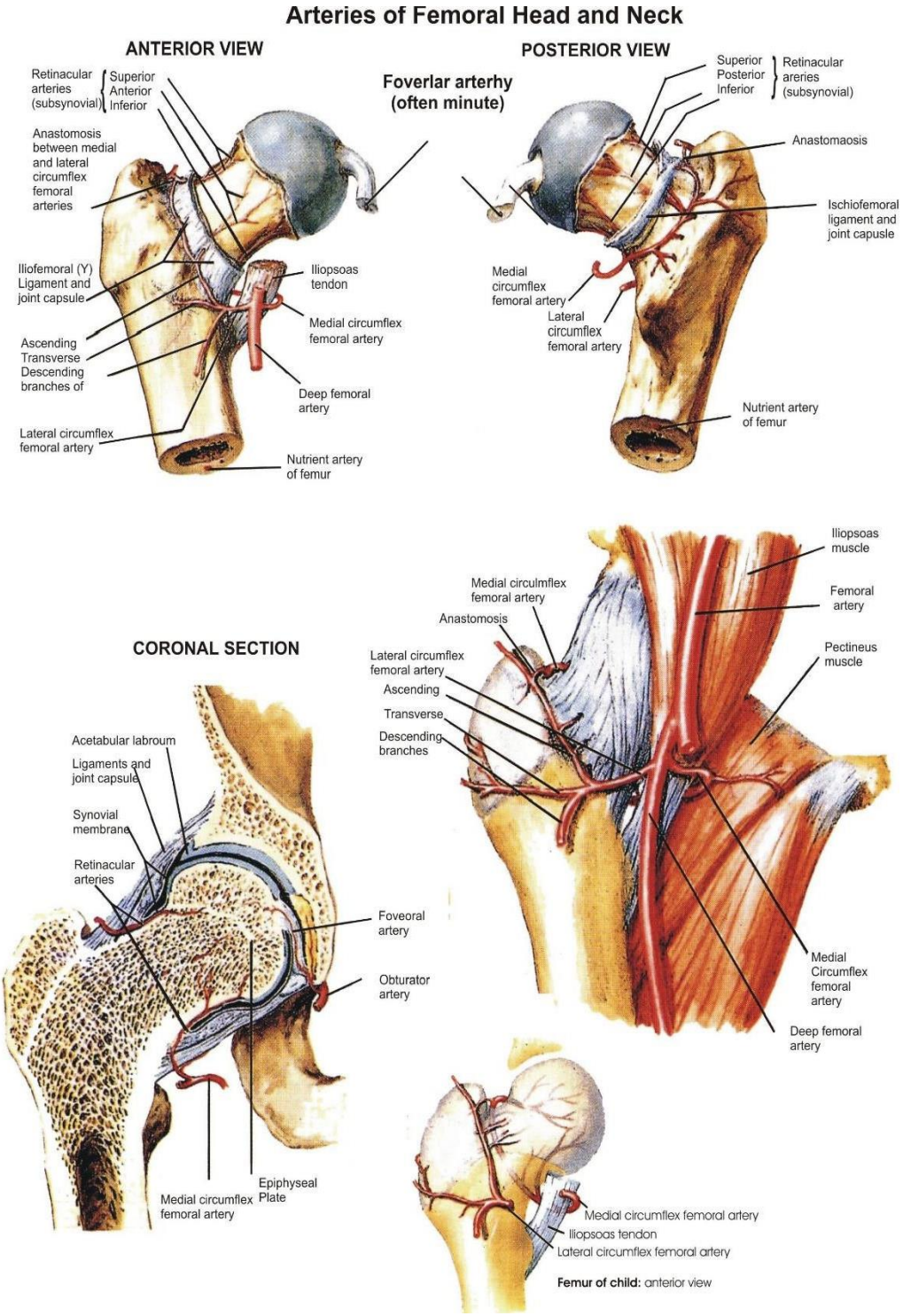


Figure 2: Blood Supply of Proximal Femur

There is arterial blood source for proximal end of femur that is researched thoroughly. Crock HV[30] has given the best description. Out of the femur arteries' proximal end that lists into three sets:

1. Arterial ring which is extra capsular and placed at base of neck of femoral.
2. From extra capsular, the cervical branches go down to capsular arterial ring located at exterior of femoral neck.
3. Round ligament & its arteries.

Extracapsular Arterial Ring: this is made at posterior side by a huge branch of artery of medial circumflex and on the anterior side by lateral femoral branches of circumflex artery. There are minor participations of inferior and superior gluteal arteries to the ring.

Ascending Cervical Branches: these arise from ring of extra capsular arterial ring. Penetration from the anterior side into hip capsule at its joint along the intertrochanteric line, and towards posterior side, they come below the orbicular capsule fibers. Passage of such branches towards the upward direction below the synovial reflections and extensions of fibers of capsules along the articular cartilage. As defined by Weitbrecht[31] these are call retinacular arteries, which send branches that are small to femoral neck's metaphysis. This neck gets more blood supply from the extra capsular arterial ring that on extra basis includes intramedullary divisions belonging to superior nutrient artery and anastomosis.

Medial, anterior, lateral and posterior are the four groups of ascending cervical arteries interacting with neck of femoral. Maximum blood source is from lateral group going to femur's head and femur's neck. The terminal part of the articular cartilage on

femoral neck exterior, a second ring is made by blood vessels called with the name Sub synovial Intra-articular Arterial Ring of Chung. In 174332, initial name given by William Hunter is Circulus Articuli Vasculosis. In 1953, Treuta & Harrison[33] stated an incomplete ring. The arterial branches entering femur head, giving rise to epiphyseal arterial branches from the sub synovial ring.

The Ligamentum Teres artery or called as medial epiphyseal artery or another name-foveolar, is a division of the medial circumflex artery (obturator). These take responsibility only for few areas of circulation in subsynovial area.

ACETABULUM:

On the lateral part of hip bone, a concave hemisphere called acetabulum is present in the center. Three elements together form the hip bone. The upper two parts of five parts is illium, pubis makes one part out of five parts and the ischium makes two parts out of 5 parts of the posterior. Has an axis that is on the lateral position and projected downwards, while the backwards direction on the femoral neck's axis. Lesser antero-inferior part for the edge of acetabulum by formation of the acetabular notch, which is joined by the transverse ligament. The acetabulum floor is portioned into articular and non-articular. Femur head has an particular area, line by hyaline cartilage, also has a horseshoe shaped surface called lunate surface. This is highly the vastest area. For the non-articular part, inner lunate surface has a margin known acetabular fossa. This has haversian fat pad which is the pad of fat, margined by synovial membrane. At the margin of the acetabulum is the fibrocartilaginous acetabular labrum by which the acetabular cavity is made deep.

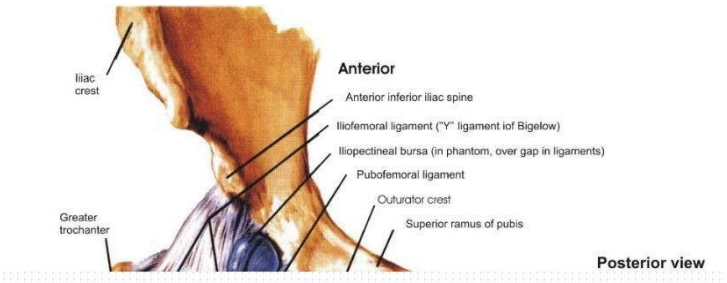


Figure 3: Ligaments of the Hip

HIP JOINT:

Synovial joint is nothing but the hip which has been multiaxial. Joint that connects ball and socket form. Makes a connection between femur head and hip acetabulum. The center is 1.2cmm under the 3rd middle inguinal ligament. A great amount of mobility and stability is given by this joint. The following features come up from:

1. Labrum acetabulare increases depth of acetabulum.
2. Muscles around ligaments, their strength.
3. The range or spread of motions can be hiked by narrow and long femur neck.

Three parts of hip bone, fuse to forms cup structured acetabulum. A hyaline cartilage covers the surface of particular region that is in the form of a C-shaped domain, observed to be the widest on the top, due to which the weight of human is transferred to be in erect posture. The round head is enclosed with hyaline cartilage of the femur. The head has a non-articulate intersecting areas that deeply spaced fovea (pit) or it is linked with ligamentum teres.

Ligaments of the Hip Joint:[34]

1. The Fibrous Capsule

A capsule is with fibers which has been highly rigid on the anterior and envelops the joint thoroughly on all sides. On the proximal end is the edge of acetabulum and traverse ligament. Personified like a sleeve, it will pass laterally. The attachment by anterior side across the whole length seen distally. The whole length by line –intertrochanteric and deep down to the bottom most part of the greater trochanter. On the posterior side, there is shortage of intertrochanteric crest, lesser than the width of a finger, while its joint is weak at the femur neck. Along these joints, the capsule fibers, are pulled behind the femur neck right till the edge of the femoral head's articular margin. The part that is reflected comprises of retinacular fibers that hold together nutrient arteries. They constitute fibrous capsules that go down in two varied paths. The most numbered, go down in an oblique direction to the femur from the acetabulum and is most viewed on the anterior part. The rest envelops the capsule which is about parallel in direction to the acetabulum margin. All these together make the zona orbicularis, which is mostly viewed posterior or inferior to the parts of fibrous capsule. For a general arthrogram, zona orbicularis has the control for hourglass compression. Three main thickenings can be seen at the fibrous membrane.

2. The Iliofemoral Ligament

Ligament of Bigelow is the name given to Iliofemoral Ligament. This is the most powerful & the densest segment of articular capsule. It has been attached with the inferior part of the anterior inferior iliac spine on the proximal end and also with the ilium surface much nearer to the spine's lateral side. On the distal side, it is wide, connected to femur's intertrochanteric line. This has edges that are dense in

comparison to the central surface and is in inverted Y shape in the middle. More than 0.5cm in thickness is iliofemoral ligament, which is known to be one among the strongest ligaments. To rupture this, need for a stress ranging from 250-750 lb. is needed. With no need for muscular activity, the ligaments of iliofemoral repels the body's capability for bending back in the similar erect position.

3. The Pubofemoral Ligament

This is joined to the obturator crest along with pubic bone's superior ramus. On the distal surface it passes deeply until the iliofemoral ligament and then mixes along the fibrous capsule. There is passage of signals between the band that has deep bursa into iliofemoral ligament and iliopsoas.

4. The Ischiofemoral Ligament

The weakest ligaments when compared to the other two. Emerges from acetabulum's border of posteroinferior surface along with the fibers and thus pass on lateral side till the capsule, upwardly swirls and joins (zona orbicularis) circular capsule fibers.

5. The Transverse Ligament of the Acetabulum

These sturdy banded fibers bridge acetabular notch. This finishes the boundary of the acetabulum and transforms mark inside the region called foramen into which the nerves and vessels get into the acetabular fossa and femur head's ligament.

6. The Labrum Acetabulare

It is joined to acetabulum rim & a fibro cartilaginous ring, as well as the transverse ligament, making a deep pit of the acetabulum and makes a little narrow at

the mouth by inwards steeping down. Femur head has labrum as a fitting that is strong and closes it at acetabulum, gives way to an essential function in keeping the head tight into acetabulum. A triangular cross section is seen as the labrum, thin free margin and thus attaching to thicker margin. The synovial membrane is surrounded with two surfaces.

7. Ligamentum Teres

Synovial membrane envelops a feeble length of connective tissue. It has an end that has been cylindrical, is narrow in width and is placed into femur head's pit; the broader and flat terminal is joined to the crosswise ligament that is flanked by borders of acetabular fossa.

As the ligament is weak, it cannot play a biomechanical role in hip joint. The assisting nature to spread synovial fluid along the femur head and provides a soft pad to regulate the acetabular volume along the motion pushed under the transverse ligament. A small blood vessel is taken along till the femur head by this.

Synovial Membrane:

Interior surface of fibrous capsule is covered by this membrane and protects femur neck laterally the margin of head's articular cartilage, while it is also joined to the articular margin. The ligament of the head and haversian fat pad is put on the sleeves and also synovial membrane has been attached to the acetabulum pit's particular borders and (fovea) on femoral head. When witnessed around 10 of 100 individuals, the hole on capsule anteriorly, flanked by iliofemoral and the pub femoral ligaments, allows signal transmission amongst iliac bursa and synovial cavity.

Blood Supply:

An anastomosis molded around the femoral neck get supply to the hip joint:

1. Arteries that ascend branches of the lateral circumflex and medial
2. Medial circumflex arteries and obturator's acetabular branches.
3. Inferior gluteal arteries and superior gluteal arteries that have branches.

Nerve Supply:

The hip joint has nerves that get supply through sources:

4. Through the nerve to rectus femoris, the femoral nerve
5. Directly, from the obturator nerve's anterior partition.
6. Nerve that leads near quadratus femoris.
7. Branches of articular starting at sciatic nerve.
8. An addition nerve of obturator.

Relations of the Hip Joint:

On the Anterior Side: To Split the capsules at psoas major tendon & femoral artery, while additional on the medial line, pectineus interferes between the femoral vein and capsule. On the lateral side is femoral nerve positioned in a groove flanked by psoas tendon and iliacus. A parted section of Iliacus is detached from capsule by bursa.

Superiorly: On the medial side is rectus femoris head and gluteus minimus has been laterally placed and very close to capsule.

On the Inferior Side: Obturator externus coiling along the rear end of femoral neck below the capsule.

On the Posterior end: Piriformis can be seen, below which, the sciatic nerve is detached by gamelli and internus tendon at the starting through the capsule.

Laterally: The capsule as well as iliotibial tract have been joined together.

Medially: A section of the lateral wall of the pelvis is presented by acetabular fossa and adjacently is the female ovary that detaches obturator internus, peritoneum, vessels and obturator nerve.

BIOMECHANICS OF THE HIP JOINT[35]

A ball and socket joint makes the hip joint. When there is pressure due to forces, the stress transfers to neck and femur head at an angle of 165^{o}-170^{o} irrespective of the pelvis position. As the powerful muscles are present along the hip, it can bear great load. The neck creates a bend in shaft when load is produced on the femoral head. Lateral tensile stress and medial compressive stress is being produced due to bending. We can observe that tensile forces are less-stronger when compared to compressive forces that is also known as bending movement. If the lever arm is longer, there is more movement of bending. Due to the implant stress, it has been one such varus deformity's essential aspects and it is also non-union fractures.

Joint of hip can be moved in different ways. 0-15^{o} extension, 0-140^{o} flexion is the range of saggital plane motion. For frontal plane motion, abduction is 0-45^{o} and 0-30 degrees adduction. External rotation of 0-40 degrees and internal 0-30 degrees for transverse plane motion. Abductors seize the proximal portion (that is, Gluteus

medius and minimus), iliopsoas activates it and short external rotators have been externally done. Abductors pull the distal fragment towards midline.

After surgery, the fixation device has been activated, even though patients have been immobile. For the hip joint, fulcrum becomes the center and the stress is due to weight and muscle tension abductor. To keep the balanced pelvis, abductors push in more force compared to body weight, as the path from trochanter to central femoral head to lesser than midline of the body.

The angle varies in neck shaft that impact relative ratio of lever arm length flanked by femoral head and midline variation along with the trochanter, thus, impact the abductor muscles potentials, and hip being in the valgus, need for short abductor lever arm to extensively pull from hip to equate pelvis.

If it is in varus position, abductors need not work hard to balance pelvis. 2.5 times of the body weight is exerted by the force at hip at the individual limb stance. When there are dynamic activities, it will need antagonist and agonist procedures which increases the stress at hip joint. For males, 4 times of the weight is the mean hip joint reaction force that happens instantly post heel strike along with the other crowning of seven times of mass near the toe. In women, the degree of forces of joint reaction diminished, for the initial highest count is about two and a half times of total weight and next one about 4 times more.

Rydell exhibited the concept when stood on a single leg, 2.5 times of weight produced at the hip. While at rest, with support of two legs, a force produced was half the weight for each hip and knee bent at 90 degrees risen to rear body weight along the hip that is flexed. The same is made 5 time more through running. 1.5 times of this force is observed with lifting leg from a flat position.

PATHOMECHANICS OF INJURY[36]

Causative mechanism of Intertrochanteric fractures

Intertrochanteric fractures happen due to slipping down either directly or indirect forces. The recommended two tools of damage are:

1. Initial mechanism occurs when fallen down, that generates a direct shock on the trochanter

2. There can be seen a rotation that is lateral for the limb with a weak bone and osteoporotic, adding to the factor in detecting early and fractures for often occurrence. Rate of osteoporosis and severity in fracture resulting in bone stock that is weak.

A mechanism that is recently recommended is cyclical loading that yields macro and micro fractures, most common in diseased bones and osteoporotic. Wang & Horn discuss about defect in bone stock that is weak to bear an unexpected twisting or strain due to bending put on it while the patient is taking the entire weight. The featured radiological results of joining on medial site is encouraged and varus deformity, on the lateral end, opening of the fracture. During process of ambulation, two forces: dynamic and static are implied to the proximal femur.

Since there can be a bloating force produced laterally of neck and by implication a force that is compressive is produced medially. The authors said if there is failure in stress competence functionality, either due to weakness in muscle or reaction time delay, specifically for osteoporotic bones. This can be a cause of etiological aspect in reasoning for fractures of interochanteric.

FRACTURE ANATOMY

The outline of fracture is inclined on muscles, which are joined to the several places of trochanteric. Push that impacts breakage and influence of bone quality on the fracture reflect the pattern of fracture. To concern with then forces of the muscle, it is overbearing that fall on this particular area.

The top part lies at exterior rotation for the stage of fracture is given at, small exterior rotators stay joined to it. Proximal fractures to joints short rotators that are exterior rotation against the part that is distally located and not at proximal, adding to this is the gravity. An angle that is forward happens in the plane of saggital because of an unbalanced action of muscle. The fracture gapes open on the posterior axis along its apex projected anteriorly and this can be viewed in the electronic rays as an opening.

FRACTURE GEOMETRY AND INSTABILITY[37]

The fracture constancy is directly proportional to fracture geometry.

The frequent sequences of randomness can be as stated:

1. Decreased trochanter communion
2. Inverse oblique fracture
3. Sub- trochanteric extension with intertrochanteric fracture.

An actual stable damage to Intertrochanteric is one that when condensed is close to cortical without an opening at the medial and posterior position. This interaction will eventually stop additional movement into retroversion and varus. The medial and posterior cortices and negligible damage movements aren’t comminuted in the steady fracture.

The lesser trochanter's prominence has been very crucial to assess the fracture's steadiness. In this assessment, the amount as well as size of the portion's transposition have been the critical factors. Up to 60%, intertrochanteric fractures is unsteady and therefore, it has been at a complicated risk.

Clinical features:

The limb is strikingly decreased in length with exterior revolution malformation. The rotation distortion is higher than visible in fractures for patients seen at femoral neck. A swelling can be seen at the hip and later some can see ecchymosis over the greater trochanter.

1. Soreness over greater trochanter
2. Test of Bitrochanteric compression being positive.
3. Shifting up of Palpatory bryands triangle
4. Greater trochanter's irregularity & broadening

Radiographic and Other Imaging Studies:

1. The hip's typical radiographic checkup comprises of
    a. Anteroposterior view- Pelvis
    b. Criss table's lateral view of the included proximal femur

To know the fracture obliquity, bone quality and enables to see diffrence of the side included along with contralateral side, the anteroposterior view is beneficial. This is to detect impacted fracture and non-displaced fracture. The view on lateral angle enables to evaluate location, size and comminution of fracture on the posterior fragment that also helps to know the steadiness of fracture.

Technetium bone scan – the occurrence of fracture at hip is a doubt and not for sure by standard radiographs, it will take about 2 or 3 days to be seen as affirmative.

MRI – least accurate for bone scanning in detecting hip fractures which can be assessed within a day of injury.

Classification:

Boyd and Griffin (1949) classification:[38]

Boyd and Griffin developed a grouping to monitor treatment with an importance on steadiness of fracture. These fractures are sorted into four types (Figure ure 4). Type 1 fractures range throughout the intertrochanteric line (2 part). Steady decrease can be attained easily and a better result may be anticipated. For the type 2 fractures, the main fracture can be viewed across the intertrochanteric line while, posteromedial comminution can be seen that settles for stability. Type 3 fractures comprises a subtrochanteric factor including the cortex located distally or simply at the lesser trochanter. They are challenging to decrease and have a high rate of complication. Type 4 fractures include regions of intertrochanteric and subtrochanteric with fracture lines seen at two planes.

This includes all fractures exactly from the neck region of extra-capsular to a place which is 5cm towards the distal end near lesser trochanter.

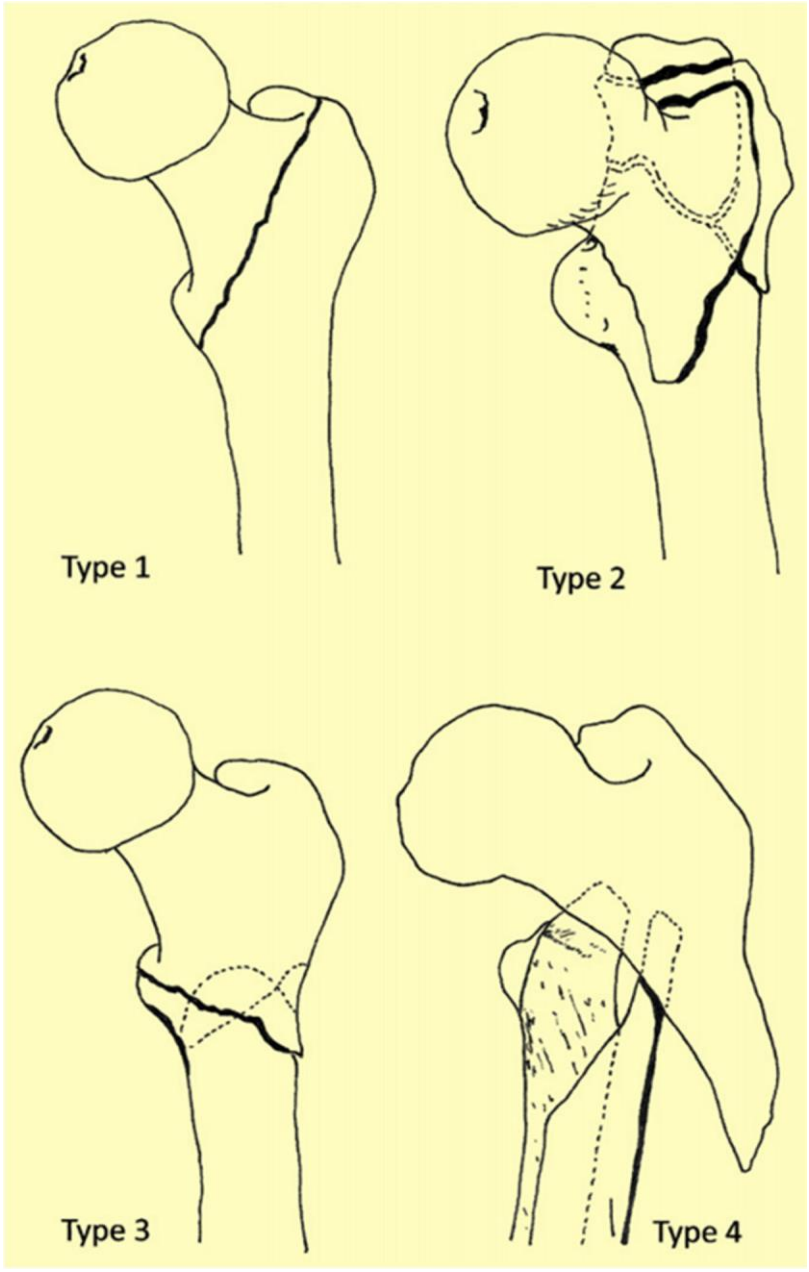


Figure 4: Types of fracture-4

Type 1 Fracture ranging over intertrochanteric surface to lesser trochanter initially from greater trochanter. Lessening of this such fractures is simple and is handled with no challenges. Satisfactory outcomes can be observed.

Type 2

Comminuted fractures, this is the chief fracture seen the total of intertrochanteric line along with the other several fractures in the cortex. Due to communication varying from extreme to slight, decreasing of such fractures can be challenging.

Type 3

Fractures are fundamentally subtrochanteric while minimum one fracture line going through the proximal fragment (i.e.) the part including lesser and greater trochanter. Variable gradations of communition is related to it. Fractures are both challenging to decrease and may lead to complications during surgery or convalescence.

Type 4

Fractures of the proximal shaft and trochanteric region, with fractures in a minimum of two planes. During internal fixation and open reduction two-plane fixation is compulsory due to the spiral oblique butterfly piece on the shaft.[31]

Singh's Classification A technique that used to detect the ailment-osteoporosis grade was familiarized by Singh M[29] through calculating the trabecular proximal femur pattern that viewed on x-rays. Osteoporosis grade is classified which starts from1 and ending with 6.

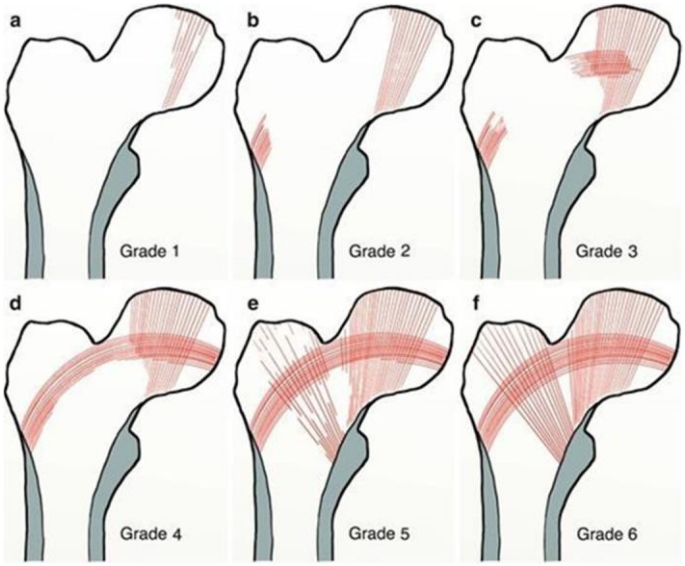


Figure 5: Singh's Index

Grade VI: Visible trabecular collectively seem normal and the terminal of upper femur is seen to be covered by cancellous bone in total.

Grade V: The principle tensile organization and compressed trabeculae are highlighted. The triangle of Ward has been seen as noticeable.

Grade IV: Trabeculae of principal tensile that are distinctly decreased but can still be drawn from the lateral cortex to the femoral neck of top part.

Grade III: Visible break in the continuous principal tensile trabeculae on the other side of the greater trochanter. At this grade, it is surely osteoporosis.

Grade II: Prominent presence of principal compressive trabeculae; while the rest can either be fully/partially resorbed.

Grade I: The principal compressive trabeculae are negligible and decreased in number or to be precise not visible.

Evans classification:[39]

There are two main types that mentioned below:

Type 1: From the lesser trochanter, the fracture line that ranged outwards as well as upwards.

Type 2: Fracture line is of upturned obliquity, while essential fracture line spreads downward and towards the outside from the lesser trochanter while it is wobbly.

An extensively utilized classification scheme on the basis of the fracture pattern steadiness as well as the capacity of transforming one of the unbalanced fracture patterns into steady reduction. An observation done by Evans which said that the crucial element to a steady decrease in is renovation of posteromedial cortical endurance.

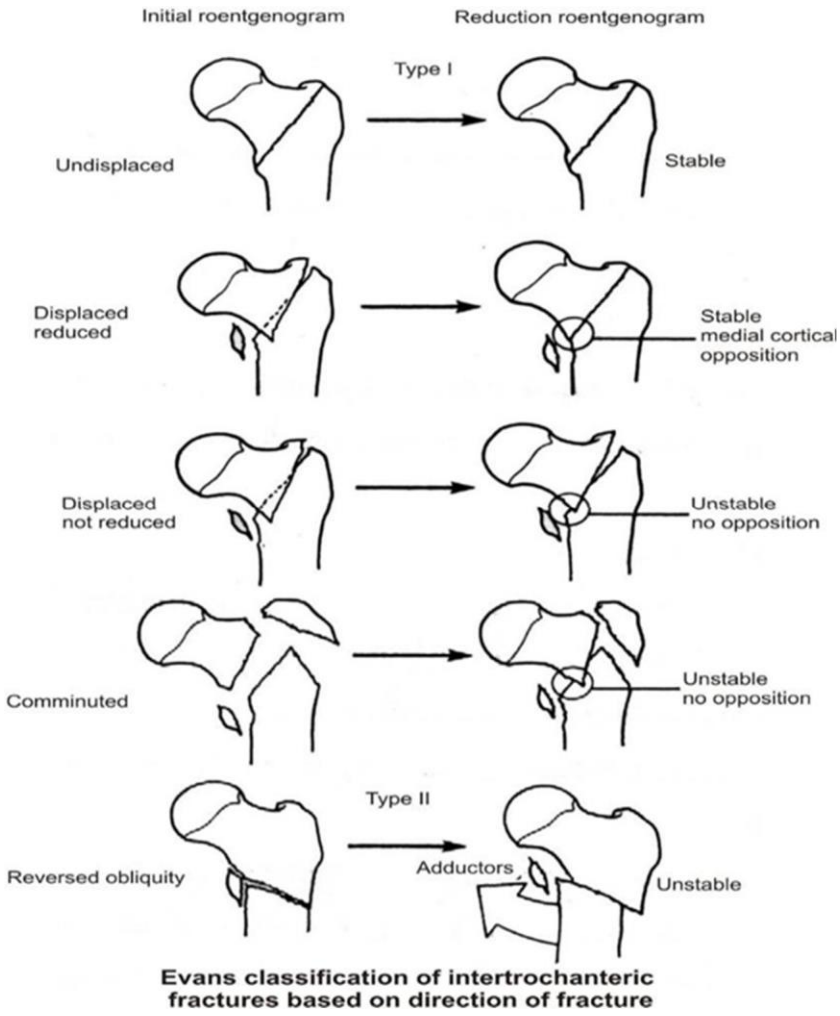


Figure 6: Singh's Index

Orthopaedic Trauma Association (OTA) Alphanumeric Fracture Classification[40]

A Proximal Trochanteric, Femur

A1 Pertrochanteric Simple

1. A1.1- Alongside intertrochanteric line
2. A1.2- Across greater trochanter
3. A1.3- Underneath lesser trochanter

A2 Pertrochanteric Multifragmentary

4. A2.1- Along with one middle fragment

5. A2.2- Consists of many intermediate fragments

6. A2.3- The extension of above 1cm under lesser trochanter

A3 Intertrochanteric

1. Simple oblique -A3.1

2. Simple transverse- A3.2

3. Multifragmentary –A3.3

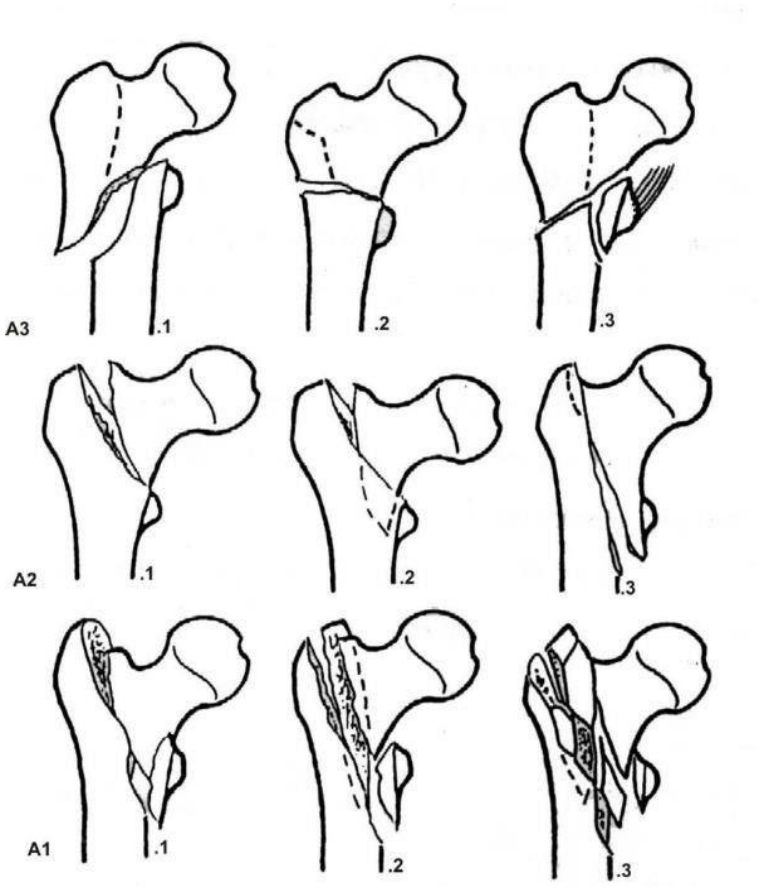


Figure 7: OTA/AO Classification

OPERATIVE MANAGEMENT:

The management selection between intertrochanteric fractures can be pronounced functional, by means of usage of few parts of internal joining. The main aim of the functioning cure is

1. Rigid & steady joining of pieces of fracture.
2. Patient will be mobilized early.
3. Earliest restoration of patient to her/his status before surgery.

Sonstegard, Kaufer and Matthews made listings on factors that estimate the fracture fragment-implant assembly's strength.[50]

The variables are –

1. Fracture Geometry.
2. Implant Placement.
3. Bone Quality.
4. Implant Design.
5. Reduction.

The fracture geometry and bone quality, are not controlled by the surgeon. Thus, what is controlled is the reduction quality, placement of implant and choice to attain a steady fixed internally and decreased steadiness of intertrochanteric fracture.

Surgical Techniques - Plate and Screw Devices:

In the intertrochanteric fractures' cure, the initial implants have been fruitful that had been a plate of Fixed Angle Nail exercises (for example, Holt nail, Jewett nail) that includes the fixed nail that had been triflanged along the plate with at angle of 130-150^{o}.

These procedures provided steadiness of the femoral neck and head portion to the femoral shaft, while no effect on impaction of fracture. The failure of the fracture fragments led to unintentional penetration of nail tip into the hip joints along the femoral head's superior part. With such devices, a few technical issues appear as challenges to gather the side plate's reasonable fit as well as femur shaft or it cannot be able for obtaining the required acquisition inside the head of femoral has cancellous bone.

Such lessons result in the change of site of fracture other than implants. Meanwhile, there was proof for osteotomies had problems, because rotation was challenging to guess, leg shortening was usual and the fraction's valgus position that has been proximally with the distal fragment's medial side displacement that had resulted in genu valgum. Sliding nail plate like tools had been developed with the elucidation given.

7. **Sliding feature** – Enabling the impaction and fracture is restructured and helps to handle the neck shaft angle and control seen while rotation.

8. **Hip nail and its Screw threads**– for enhanced acquisition in the femoral head's porotic bone.

9. **Blunt tip on the screw** – diminishing the occurrence of head projection.

10. **Tongue in groove barrel collar** – give extra rigidity, rotation control at junction of nail plate. Change at an initial stage to sliding screw of hip, greater fracture impaction that lets the proximal side of lag screw so as to minimize in the barrel plates and the plate can axially slide alongside the femoral shaft. Plate is changed on the slotted screw holes' replacement rather than Egger's plate mainly for completing the sliding in 2 different directions.

The Richard's hip screw was improved by Kulkarni GS, naming it as the Miraj Screw, while to simplify this method by improving it biomechanically. Patients with unsteady trochanteric damages, suffering from extreme bone diagnosed with osteoporotic nature, few recommended the utilization of PMMA/ Polymethylmethacrylate to supplement the fixing mechanism and enhance steadiness.[51]

PROXIMAL FEMORAL NAILING

The implant has a nail that is on proximal femoral side[52], nails of 6.4mm that can tap materials into thread with signification hip pin, 8mm of nail femoral neck lag screw, screws with distal locking of 4.9mm and an end cap. 316 litre stainless steel or a blend of titanium that occurs in the given sizes:

1. Angle series of neck shaft: 125, 130,135
2. Diameter: 9,10,11,12 mm
3. Length: standard PFN -250 mm; Long PFN- 340,360,380,400 and 420mm.

About 14 mm is the nail's proximal diameter. The stability of implant is enhanced by this. The presence of 6 mediolateral valgus angle that inhibit varus collapse fracture, while still there is a presence of medial comminution. The nail's fluting tip[55] stop concentration of focus on stress on the nail terminal that escapes fracture of shaft distally.[54, 55]

On the proximal side it has 2 holes: insertion of 8mm on the distal one performing role of a screwdriver. Near the sub-chondral bone, the screw had been placed that was optimally lesser to the center of femur head in AP view and in center & laterally. This particular screw has been framed to carry the most burden possible. Abou 6.4 mm hip is the proximal one used for avoiding rotation.

On the distal end, there are two holes of 4.9mm and 5mm in the locking screws and one static and the other is a dynamic one.

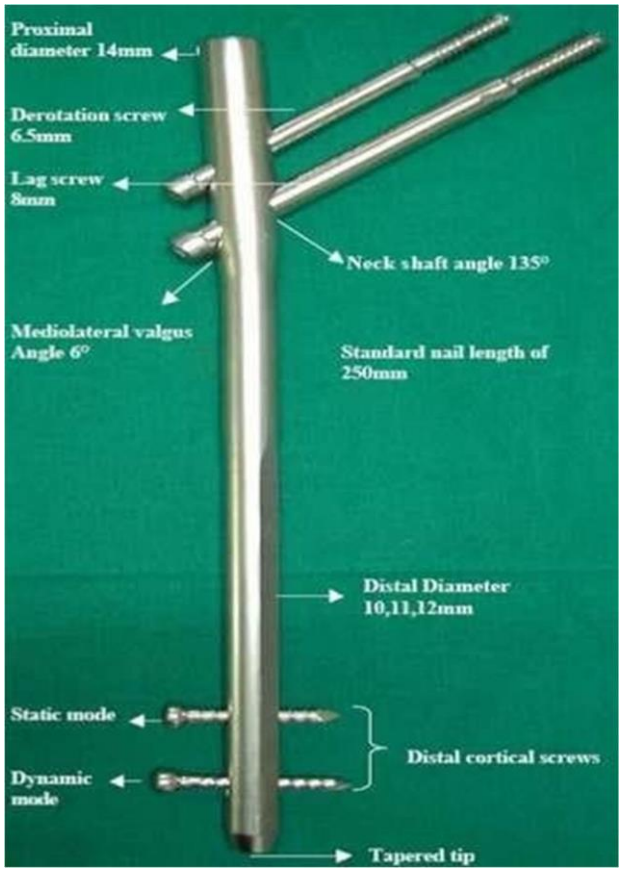


Figure 8: Proximal Femoral Nail

SURGICAL STEPS

Epidural or spinal anesthesia was given to patients and moved onto a table of radiolucent fracture positioned at the supine position. The leg that has been done surgery for, was given pull. A wide space was made between both legs for C-arm, thus other limb was placed in total abduction. Initially internal rotation was given, then reduction attained by traction and abduction or adduction as and when needed. First reduction conducted on C-arm with lateral and anterior-posterior view. Scrubbing of limb, followed by painting and finally dressed with disinfected circumstance. Above the tip of greater trochanter, a 5cm slit was done and went

deep down till the muscle of gluteus medius. Clearing of the attachment of the minimal muscle and edge of greater trochanter. Followed by fixing of PFN as given:

1. **Entry point:**

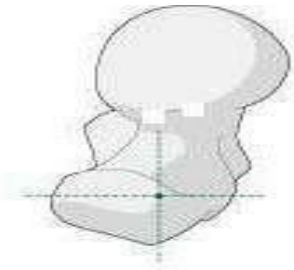


Figure .9: Insertion of guide pin

Inserting the guide pin: Placed on the greater trochanter's edge on the joint has been the surface virtual in the neck mid and laterally a line that had marked in the femoral shaft which laterally at 6º.

2. **Insertion of Guide Wire**

Figure .10: Guide Wire

Guide wire: Insertion of a 2.8mm guide wire across fracture spot at 6º of valgus into femoral shaft whose alignment is evaluated in the C-arm. Awl has made a wider entry.

3. Proximal Femur Reaming:

Reaming: The set has come with the reamer and also reaming for proximal femur is made with it.

4. Nail insertion

Nail insertion: Fixation of nail on the jig, followed by checking of alignment. Later insertion of nail into femur. Checking of hip screws holes in the C-arm for nail depth.

5. Placement the pins of guide wire

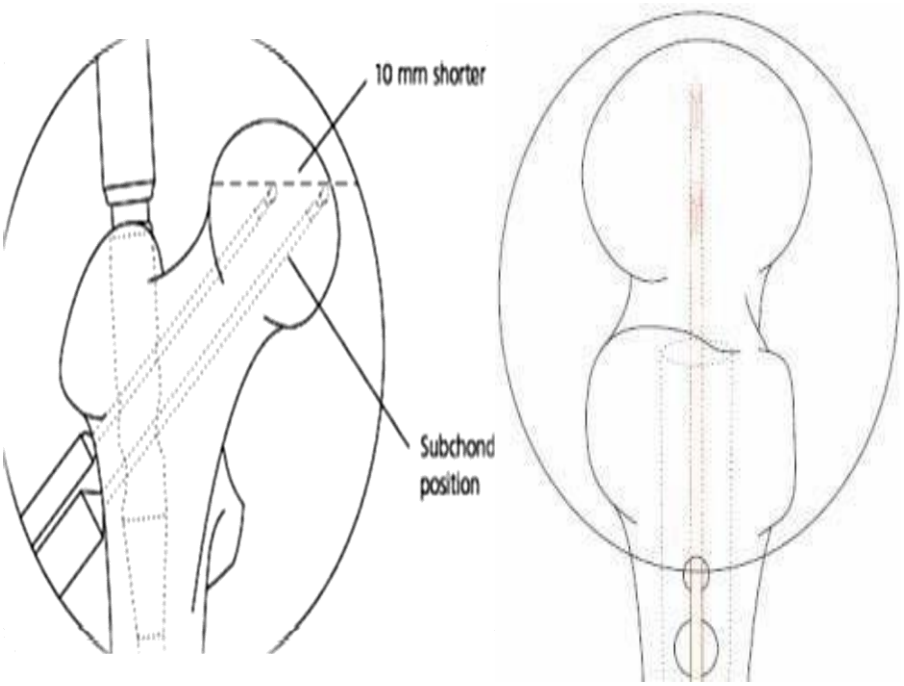


Figure 13: Guide wire insertion

Guide wire for the screws:

Through drill and jig sleeve, the guide wires concerning the screws are introduced. The best placement is parallel, when seen in AP view at the lower region of neck; along a straight line centrally at the neck when seen in the lateral views. 10mm from sub-chondral bone is the proximal cable and the distally placed wire at 5mm is situated from the sub-chondral bone.

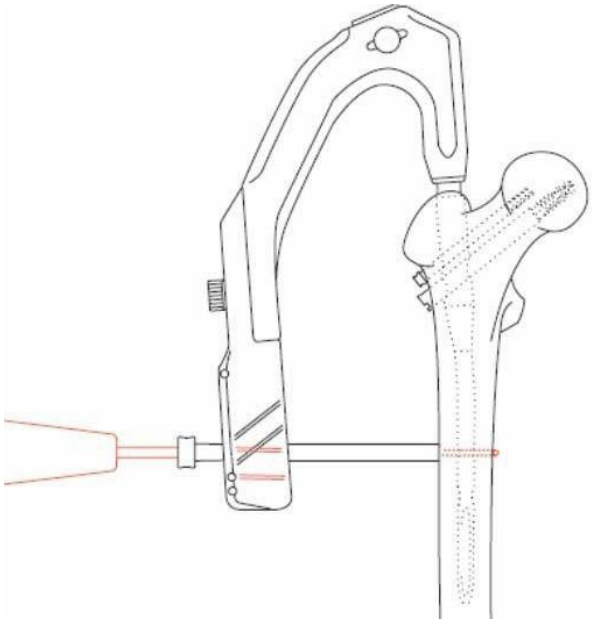


Figure 14: Insertion of screw

6. **Inserting the screws after the final setting**

Insertion of the screw:

Initially, hip screw (8mm) is introduced and then reaming on distal cable, where cervical screw of 6.5mm measurement was followed. In addition, the hip screw distance may remain 5mm away from the sub-chondralbone and the cervical screw is about 10mm away. Finally, there needs to be one straight line whether end points had been met.

Distal screws:

Either one or both 4.9mm dynamic or static interconnecting rods are implanted via the jigin distally of the nail. One can be dynamic and another a static hole. This must be done, only after taking out the traction and also constricting the proximal screws. The terminal posture checked through C-arm along both views, instead of putting the drain, leading to a closed wound around layers. Patient was given IV with single shot of cephalosporin (broad spectrum) prior to surgery, and later dose of BID

until two days depending on the wound condition and the condition of patient functionality.

POST OPERATIVE PROTOCOL[57]

1. Pts was under observation in recovery room and limbs on a high pillow till stabilized, later moved to ward.
2. Continuation of IV antibiotics for initial 48 hours and later to medicine through mouth.
3. After 48 hours, taking out of suction drainage if there was an occurrence of open reduction.
4. Static quadriceps movements commenced after four days of surgery.
5. Hip flexion exercise and active quadriceps commenced on 6th and 7th post-operative day.
6. Dressing on 2nd, 5th and 8th days after surgery.
7. 12^{th} day after surgery, stitches were taken out.
8. To avoid weight bearing walking, patients were recommended to walk on axillary crutches when tolerable, mostly post suture removal.
9. After 6 weeks, walking with little weight.
10. After total assessment of clinical and radiological union, full weight bearing walking was acceptable.

MATERIALS & METHODOLOGY

Source of Data:

Patients with 6 months post operatve intertrochanteric fractures with PFN admitted to the department of orthopedics at the KLE's Dr. Prabhakar Kore Hospital and Medical Research Centre and Charitable Hospital, Belagavi in between 1st January 2021 to 31st December 2021,over a period of one year.

Study Design: The present investigation is a 'hospital based one year observational study'.

Study Settings: Orthopaedics inpatients and outpatients in Jawaharlal Nehru Medical College, KAHER, Belagavi India.

Approximate duration of the study: one year time period starting from 1st January till 31st December 2022.

Data Collection:

The sample comprised of patients who were presented with 6 months post-operative intertrochanteric fracture operated by PFN.

Sampling

Sample size comprised of 60 PFN post-op patients. The desired sample size was achieved using the sample size formula presented below.

SAMPLE SIZE FORMULA:

In this study, scientific sample size basis was used. Using this present investigation, the minimum sample size formula was determined. This was achieved by determining the prevalence rate formula m

$$\text{Size of Sample (n)} = \frac{Z^{2}P\,(1-p)}{d^{2}}$$

P= is the percentage of prevalence

d is the percentage likely difference in the prevalence.

Zα is linked with the level of signficiance. For 5% level oof significance,

Zα= 1.96

Ref:

With P= 55.93% and d=25% of P= 13.98%, the sample size is 48. The sample size on the other hand was raised to 60 for this study.

SELECTION CRITERIA:

INCLUSION CRITERIA:

All patients who provided their willful consent to participate in this study were considered. However, there are certain key inclusion criteria were assessed before their participation. The following were:

1. Intertrochanteric fracture with postero-medial comminution
2. Intertrochanteric fracture with sub trochanteric extension
3. Intertrochanteric fracture with reverse oblique pattern.
4. Age> 18 years.
5. All AO classification Intertrochanteric fractures treated by PFN.

Exclusion criteria:

1. Open hip fractures
2. Pathological fractures
3. Peri prosthetic fractures
4. Pediatric fractures [before physical closure]
5. Poor pre-fracture walking ability
6. Associated lower limb injuries and fractures
7. Associated lower limb pathologies like Rheumatoid Arthritis/ Paralysis

Methodology:

Parameters studied GAIT parameters

Data collection

Factors related to demography of the research residents such as gender, patient's age with clinical doubt of Trochanteric fractures of femur that will be referred to the Department of Orthopaedics outpatients and inpatients in Jawaharlala Nehru Medical College, KAHER, Belagavi, India. Sampling was performed and chosen a total of **60 patients with IT fracture with PFN.**

Method:

With a position that equipped with the infrared cameras, lower limp motion is tracked by employing a motion capture system that embedded infrared cameras.

This will further facilitate in determining the position and orientation of active markers' clusters. Six phases are in Simple Helen Hayes Protocol that are in the following:

Subject Preparation: (leg length, ASIS breadth, pelvic depth, height, weight, knee diameter and malleolus width are marked that included in anthropometric measurements) and some other markers are attached on other different body parts. Nearly 15markers have been attached on sacum in Simple Helen Hayes and 2 on heel as well as on second metatarsal head. In addition, this version has been employed for evaluating the pelvis behavior as well as lower limb.

Reporting phase: includes

1. Gait variable score
2. Mean spatio-temporal parameters
3. Gait deviation index
4. Gait profile score

Acquisition Phase: a) Walking task

b) Standing task

Elaboration phase:

1. Tracking
2. Events
3. Calculation protocol selection

Finally, checking the location of marker

HALEN HAYES with medial markers

BTS SMART GAIT ANALYZER is to evaluate the main parameter after doing gait analysis by following the simple Halen Hayes protocol.

A) Temporal Parameters

1. Swing time (sec)
2. Stride time (sec)
3. Cadence (steps/ min)
4. Stance time (sec)
5. Mean Velocity (m/s)
6. Single Support Phase (%)
7. Double Support Phase (%)

B) Spatial Parameters

1. Step width (m)
2. Stride length (m)
3. Step length (m)

C) Gait Profile Score

Gait Profile Score (deg)

D) Gait Deviation Index

Gait deviation index

E) Ground Reaction Force

Vertical FORCE (% body weight)

Procedure in Brief

Surgical techniques of Proximal Femoral Nail (P.F.N):

Appropriate maintenance had been offered for one of the anatomical decreases prior to nail insertion. In skin measuring, a slit of 5cm had made about deep of 2-3 cm near greater trochanter. Passage of guide cable to grasp the decrease and it has made sure it had not been in the medullary canal. The marking of spot of entrance by taking a wire, used an awl along with a cannulated cutter. Reaming of entry point. With an

attached zig, nail was introduced. With usage of aiming tool, two guide wires were sent. Proper drills and hip pin, the neck screw was placed inside. Aiming tool was used for distal locking. Either one or two locking screws utilized to make the fracture steady. No usage of drain. In layers, the wound was closed.

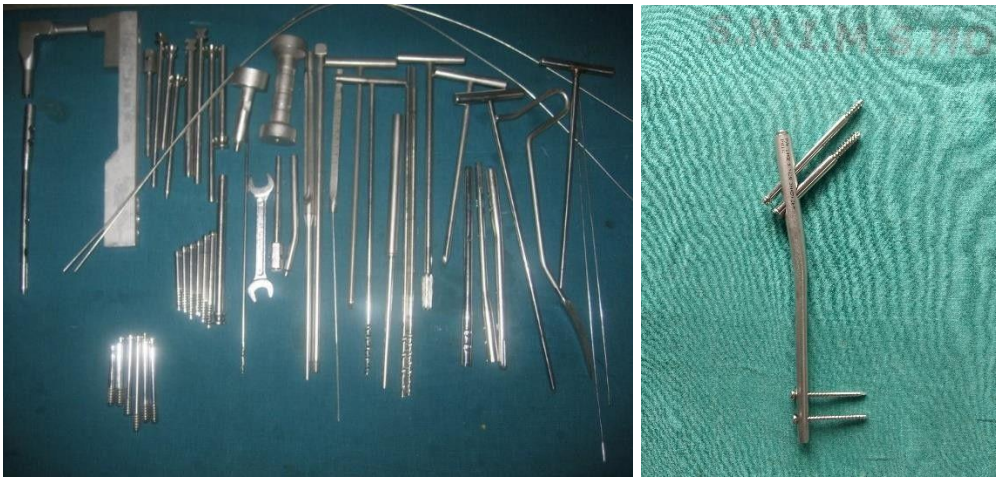


Figure 15: Surgical tools

Imaging

Every patient has to go through diagnosis using radiological tools that help in looking for Intertrochanteric fracture femur. Lying in supine posture, X-ray lateral, traction and anterioposterior views were taken to evaluate the geometry of the fracture. Boyd & Griffin Classification was used. The classification of IT fracture from the imaging studies was used. The section below is in accordance to the classification.

Boyd and Griffin (1949) classification:[38]

The factures that comprised in this sorting which has gathered from the extra capsular region at 5cm of neck on the lesser trochanter distal surface.

Type 1: The total line of intertrochanteric varying till lesser trochanter from greater trochanteric. The basic principle of reduction is normal but still difficult to maintain.

Type 2: Comminuted fractures, chief of the fractures, spreads across line related to intertrochanteric but with numerous cortical fractures. Decline of such fractures is highly thought-provoking since comminution varies till the least from the maximum.

Type 3: Fractures are primarily subtrochanteric while minimum a fracture line going through the proximal fragment (i.e.) the part including lesser and greater trochanter. Variable gradations of communition is related to it. Fractures are both challenging to decrease and may lead to complications during surgery or convalescence.

Type 4: Fractures of the proximal shaft and trochanteric region, with fractures in a minimum of two planes. During internal fixation and open reduction fixation of Two-plane is obligatory due to the presence of twisting oblique butterfly portion on the shaft.

Both Type 3rd and 4th type seem to be most challenging to manage, since it comprises of one third of the total fractures occurring to trochanteric regions.

For the following investigation, 60 patients operated by PFN were called after 6 months of post-operative period and were subjected for gait analysis to find the differences in the gait parameters using 3 D-gait analyzer using simple HALEN HAYES protocol.

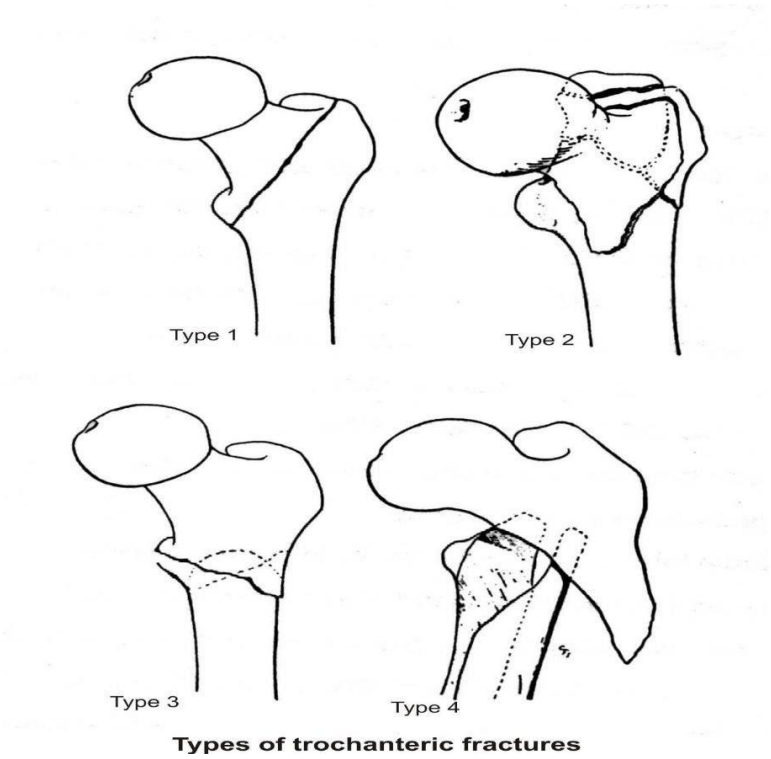


Figure 16: Types of trochanteric fractures

Boyd and Griffin classification

Gait parameters

3DGA

The study intended to assess the overall efficacy of proximal femoral nail technique via evaluating the gait parameters via performing 3D Gait Analyzer. The given evaluation utilizing 3DGA gave a huge complex and interrelated information leading to the improvement of indices. The index of gait designates the gait pattern quality utilizing an individual score[58]. The gist has calculations that are most general calculations taken into work for the purpose of research including GDI[59] or Gait Deviation Index as well as the GPS or Gait Profile Score[4], that also offer an individual score which evaluates the patient's kinematics and its worth in the pace of walking.

GDI was premeditated on the basis of space between information given by patient and the mean taken from it was calculated using reference database prevailed as a total of 15 gait factors taken from gait kinematics of pelvis, ankle, knee and hip[58].

GPS can be taken from similar kinematics of gait parallel to process of how GDI was measured and taken into calculation on factors of gait on behalf of the differences in the rms among mean from reference database and information of patient [59].

GVS or Gait Variable Score is measured by assessing the 9 gait parameters along every side of body and this can be achieved by considering the GPS score. The total GVS for pelvis that has been utilized, along with the bond on the left side metrics was taken into consideration [60, 61].

Spatiotemporal parameters comprised of measuring some of the pertinent variables namely- gait speed, step length, stride length, & width & stance, stride, swing phases duration & double stance presented in the form of raw results and were normalized in accordance to the body segments length (spatial parameters) or GC duration (temporal parameters). Step length & stride were normalized to length (LE), measured from left & right right and left anterior superior iliac spines (ASIS) to that of the medial malleolus, and step width, normalized to that of the pelvis width, which is evaluated as a measure for determining the overall distance between ASISs [62].

Ground Reaction Force- In accordance to the clinical gait analysis, ground reaction force (GRF) as one of the major **gait parameter could be validate via the state of disorder observed in patient's movement**. The purpose governing with studying the Ground Reaction Force was primarily to explore on the overall possibilities that are currently present in order for employing the derived GRF from kinematics on the center of gravity (COG) in the human gait study dynamics [63].

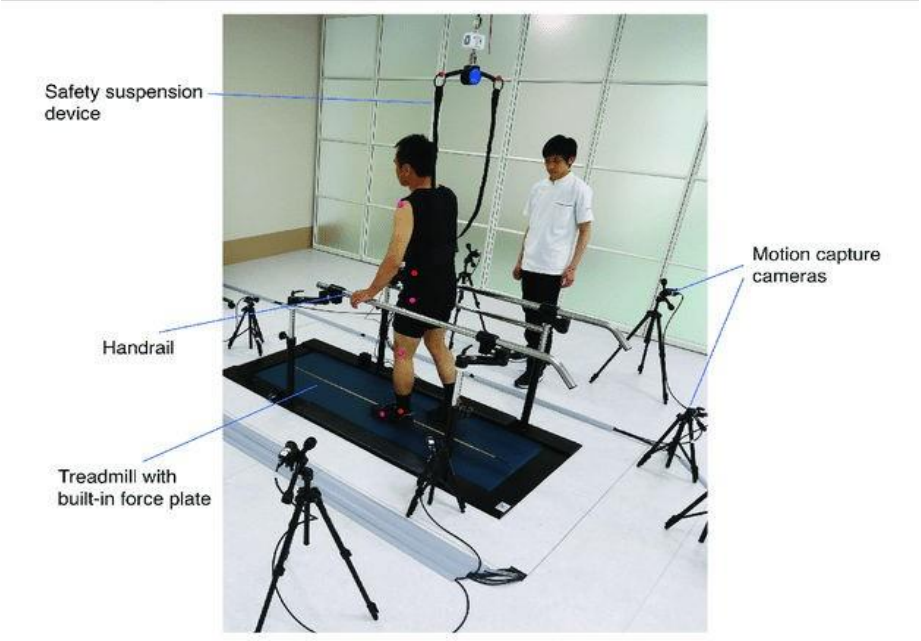


Figure 17: 3D Gait analyzer and its settings

Ethical Clearance:

1. From the institutional ethical review board, ethical clearance had been obtained.
2. The study's purpose had been explained and provided in a written informed consent and it had been an obtained consent from every participant who had taken part in the study.
3. Based on the above-mentioned exclusion & inclusion criteria, the subjected had been conducted.
4. In the course of one year, the study had been conducted. Examination and history had been recorded once the informed consent was signed by the patient according to the proforma. In the present study, we employed GAIT 3 D ANALYZER for determining the differences in the gait parameters of the post-operative patients' normal limb and the operated limb in the context with the age that matched normal individuals. All of the patients who were taking part of the study were subjected to BTS SMART GAIT 3D ANALYZER by following Simple Halen Hayes Protocol for determining the

changes observed for the gait parameters among the patients with intertrochanteric fractures.

Statistical Analysis:

The analysis plan had been performed, since the study nature had any other observational study according to the following:

For continuous quantitative variables both mean and the standard deviation was determined. In case for conducting a comparative analysis on the data which in actuality was divided under two groups based on certain qualitative characteristics, using appropriate statistics tools such as unpaired t-test students, the continuous variables had been compared. Through medium, discrete variables had been represented. Concerning with the percentages, rates and ratios, the categorical data are expressed. By employing the Fisher's exact test, Chi-square test or proportion test, the association were tested among the demographic characteristics, outcome and clinical characteristics. In case of discrete variables, non-parametric variables had been employed. Illustrations with the help of suitable graphs aided in depicting the comparisons much more effectively. The p-value is considered as significant which is less than (0.05) 5% for all the tests.

RESULTS

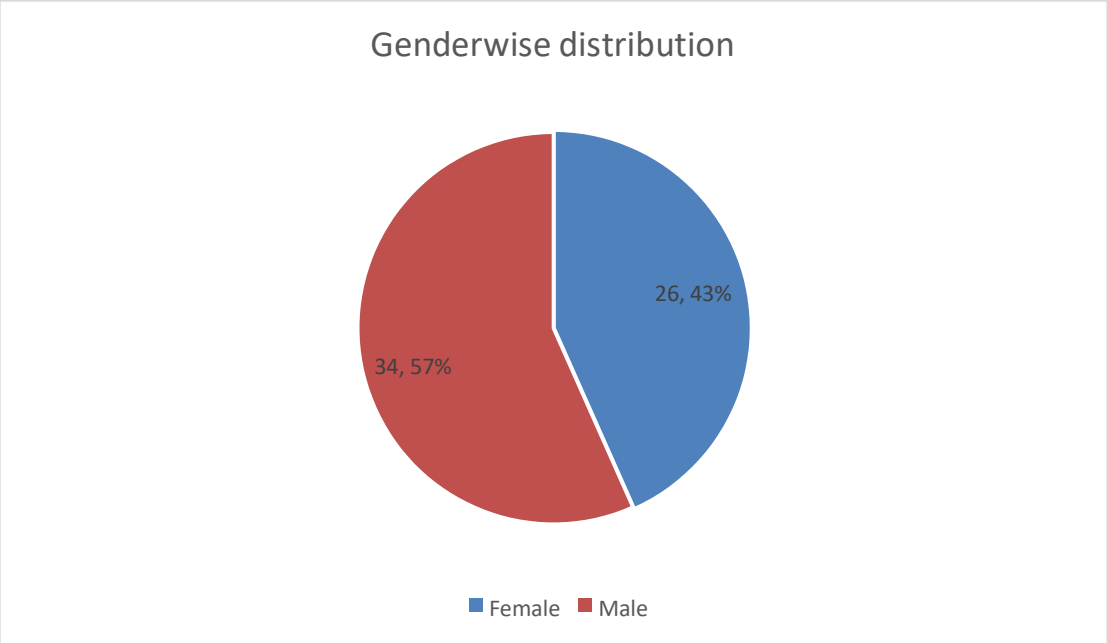
Patient's demographics

With regards to the patient demographics, the study population comprised a total of 60 respondents with the majority of the respondents were male (N-34; 56.7%) when compared to that of the female population (N-26; 43.3%). This provides an indication that the male population in general are much more prone/ susceptible to IT fracture.

Table1: Gender distribution

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Female	26	43.3	43.3	43.3
	Male	34	56.7	56.7	100.0
	Total	60	100.0	100.0	

Graph 1: Age-wise distribution of the sample respondents



Age-wise distribution of the sample respondents

Table 2: AGE DISTRIBUTION OF STUDY GROUP

AGE	No of patients	%	Mean ± SD
Below 40 years	8	13.33	60.3±15.05
41-50 years	14	23.33	
51-60 years	6	10.00	
61-70 years	18	30.00	
Above 70 years	14	23.33	
Net total	60	100.00	

Table 2 gives the patients' age distribution. On a maximum of 9 patients of total 60, were seen in the age series between 61 to 70, while above 70 years were only 7 people. Varying from 51-60 years had three cases and less than 40 years had 4 cases. In the below graph drawing, a representation using column chart is seen.

Graph 2: AGE DISTRIBUTION OF STUDY GROUP

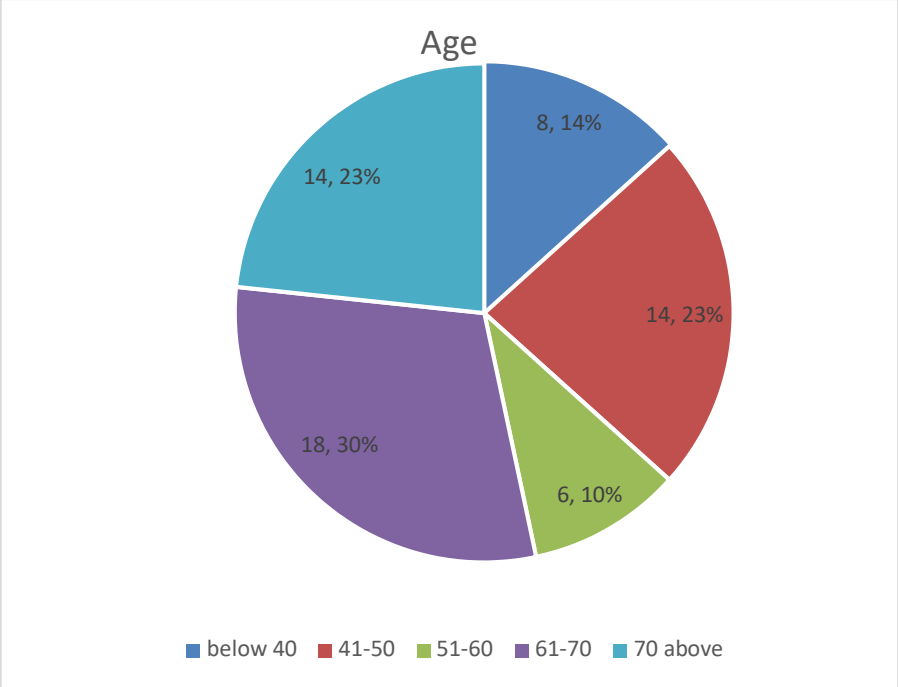
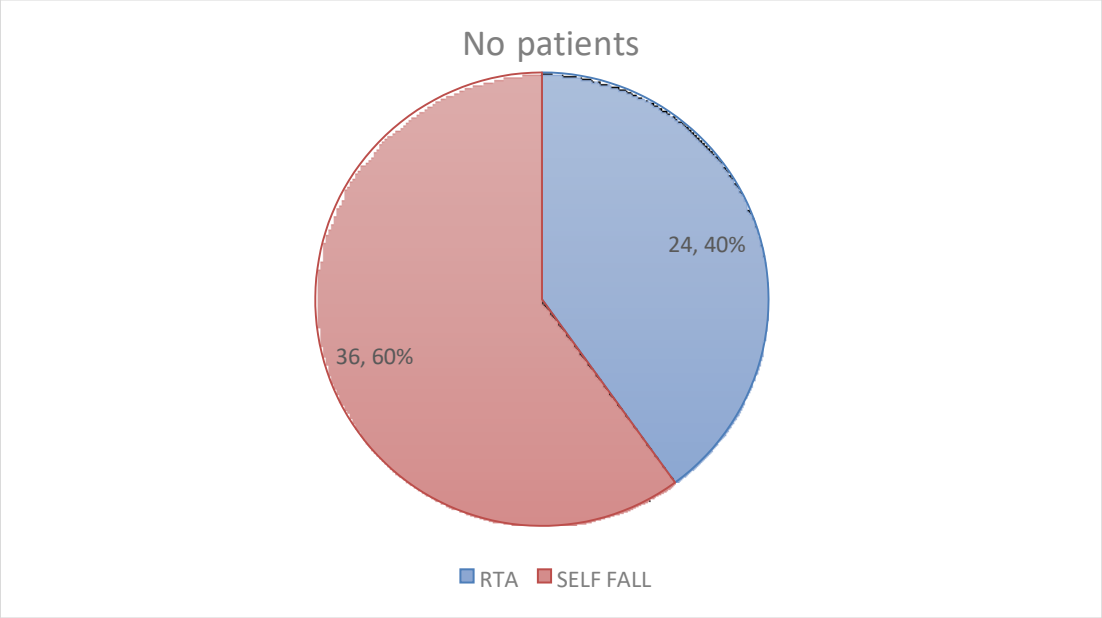


Table 3: Mode of injury

Mode of Injury	No patients	%
SELF FALL	36	60
RTA	24	40
NET TOTAL	60	100

Graph 3: Mode of injury



Diagnostic presentation of IT fracture

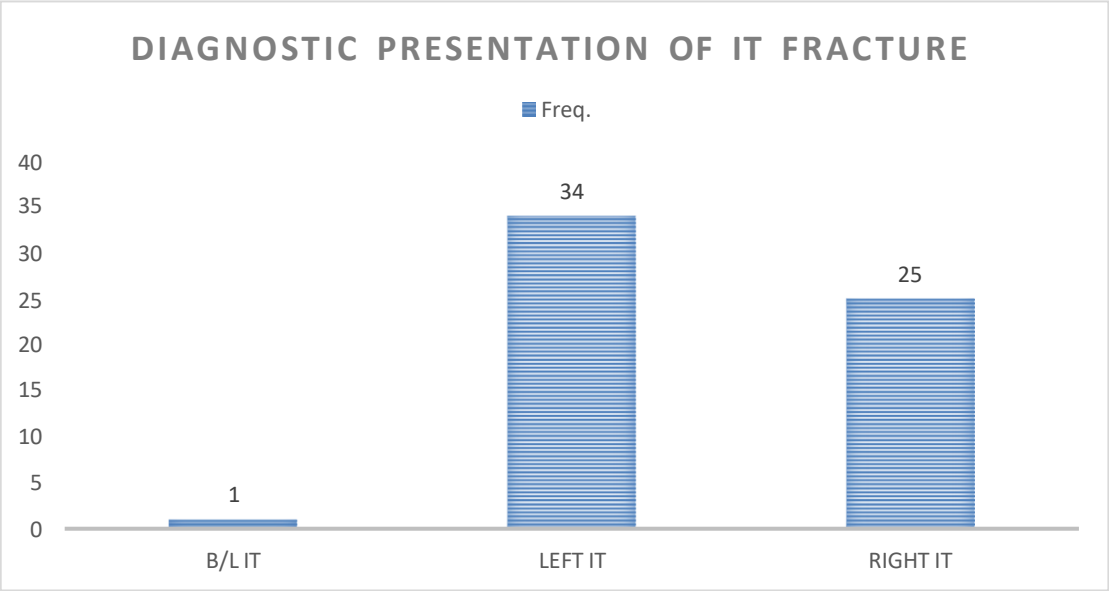
Based on the diagnostic presentation of IT fracture among the sample population showed that the majority cases were presented with left IT fracture (N-34; 56.7%) followed closely by right IT fracture among 25 respondents (41.7%). Only 1 respondent was presented with bilateral IT fracture.

Table 4: Diagnostic representation of IT fracture

DIAGNOSIS					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	B/L IT	1	1.7	1.7	1.7
	LEFT IT	34	56.7	56.7	58.3
	RIGHT IT	25	41.7	41.7	100.0
	Total	60	100.0	100.0	

The graphical illustration governing with the clinical presentation of IT fracture is provided in the below Figure 4.

Graph 4: Diagnostic Presentation of IT fracture



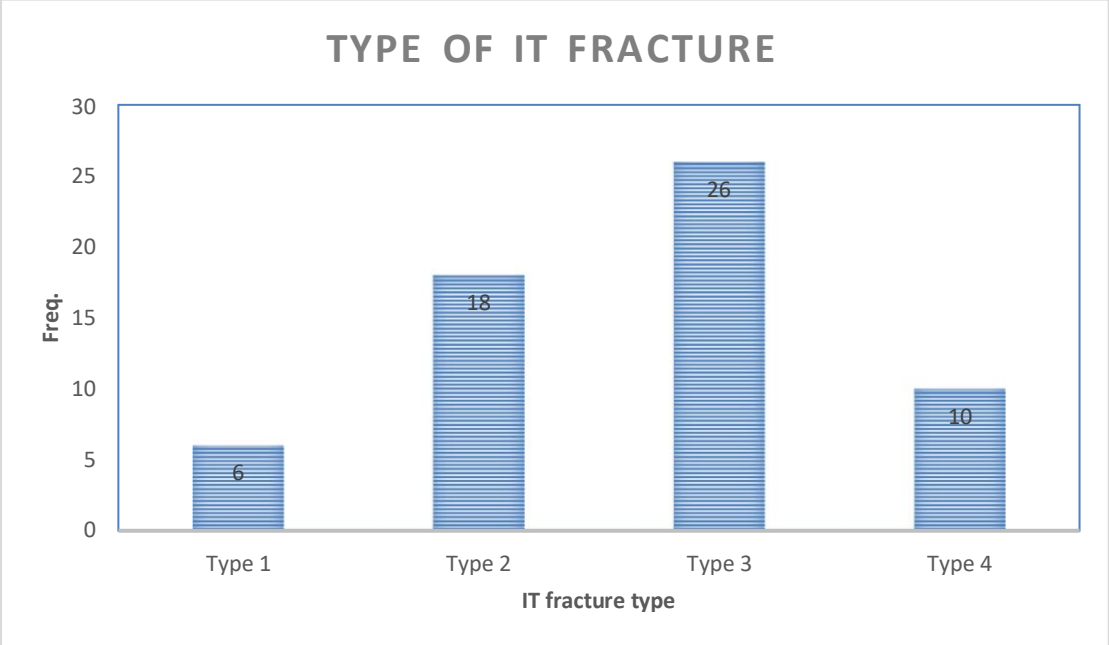
Type of IT fracture (Boyd & Griffin Classification)

Based on IT fracture and its severity, the sample population had been classified into different types of factures: Type 1, Type 2, Type 3 and Type 4. From the observed findings it was presented that the majority of the respondents were presented with type 3 IT fracture followed by 18 of the respondents presented with Type 2 fracture and 10 with severe Type 4 IT fracture. Only 6 of the respondents were presented with Type 1 IT fracture.

Table 5 :TYPE OF IT

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1	6	10.0	10.0	10.0
	2	18	30.0	30.0	40.0
	3	26	43.3	43.3	83.3
	4	10	16.7	16.7	100.0
	Total	60	100.0	100.0	

Graph 5: Type of IT Fracture



Determination of Gait parameters among the sample population

Temporal parameters

As spatiotemporal parameters are attributed as a significant and reliable approach for gait measurement, the below tabulation provides an overall observation of the temporal parameters and their measures among all the 60 respondents with their estimated mean ± standard deviation for the swing time, stride time, stance time, cadence, single & double support phase & mean velocity of the patients respectively.

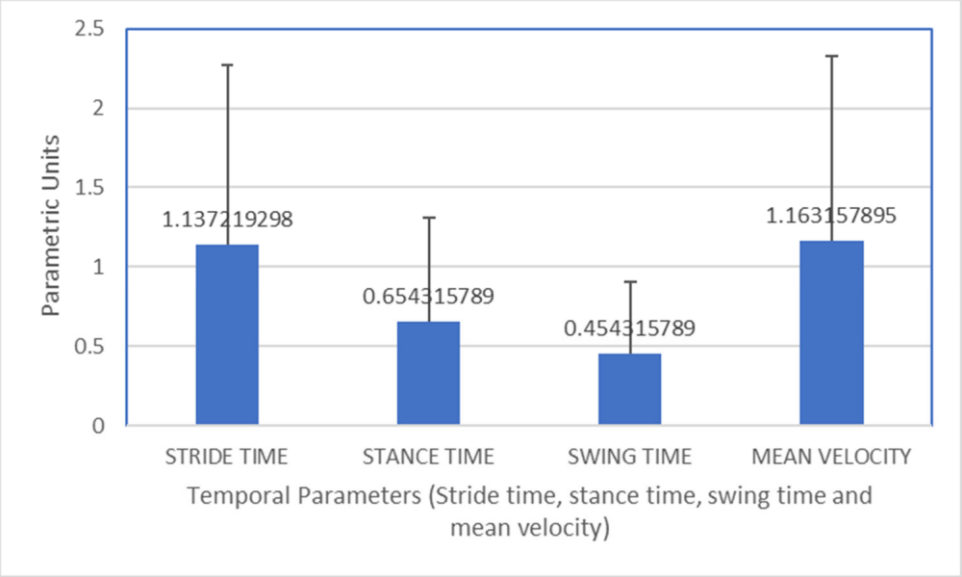
Temporal Parameters

Table 6: Descriptive Statistics-Temporal paramaters

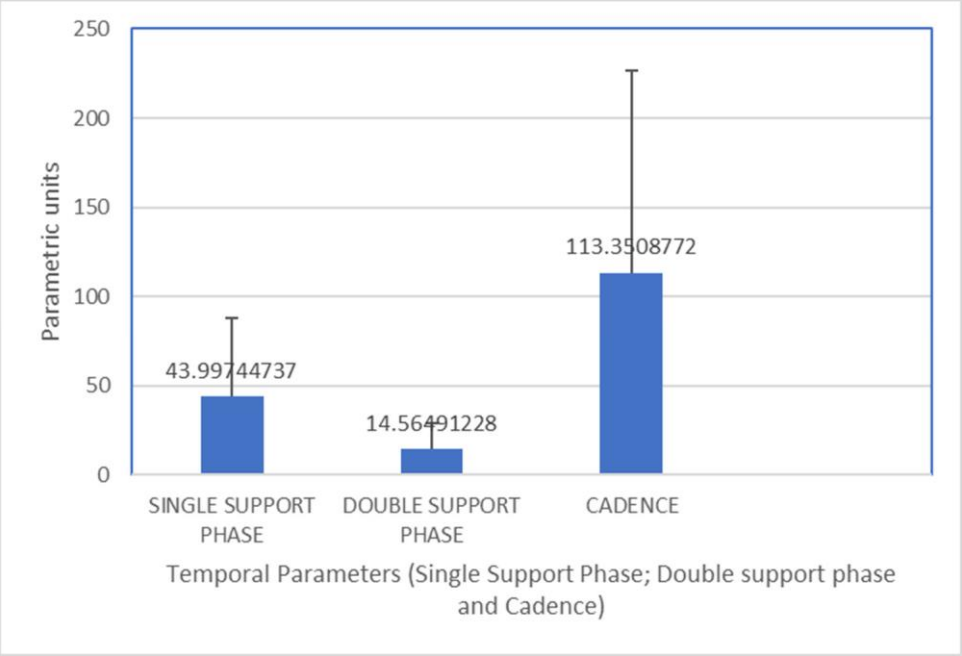
	N	Minimum	Maximum	Mean	Std. Deviation
STANCE TIME	60	1.0300000000010	1.180.690000000000100	1.137219298245714	.035202905269252
STRIDE TIME	60	.610000000000100	.690000000000100	.654315789473784	.014827996406906
SWING TIME	60	.410000000000100	.490000000000100	.454315789473784	.014827996406906
SINGLE SUPPORT PHASE	60	39.4600000000001	45.9584210526317	43.997447368421110	1.585277629010382
DOUBLE SUPPORT PHASE	60	13.2000000000001	15.3000000000001	14.564912280701856	.302802982742910
MEAN VELOCITY	60	.400000000000010	1.500000000000010	1.163157894736942	.122419847615175
CADENCE	60	111.000000000000	118.000000000000	113.35087719298257	1.682254910810818
Valid N (listwise)	60				

From the observed findings of the temporal parameters observed the mean swing time, stance time and stride time were falling within the normal ranges. However there is an increase in the single (43.997 ± 1.585) and double support phase (14.56 ± 0.302) indicative of the IT fracture's impact on the limbs during gait. The observed mean velocity was reported to be 1.16 ± 0.122 m/s. This denotes that the observed mean velocity lies within the normal ranges with no deviation despite the IT fracture's impact among the study population. Lastly, the achieved cadence (steps/ min) on an average estimate was reported to be decreased to a certain extent (113.35 ± 1.68) as a result of IT fracture when on comparison to the mean normal value ranges of the cadence.

Graph 6: Temporal parameters (stride time, stance time, swing time&mean velocity)



Graph 7: Temporal parameters (single support phase, double support phase and Cadence)



Spatial parameters

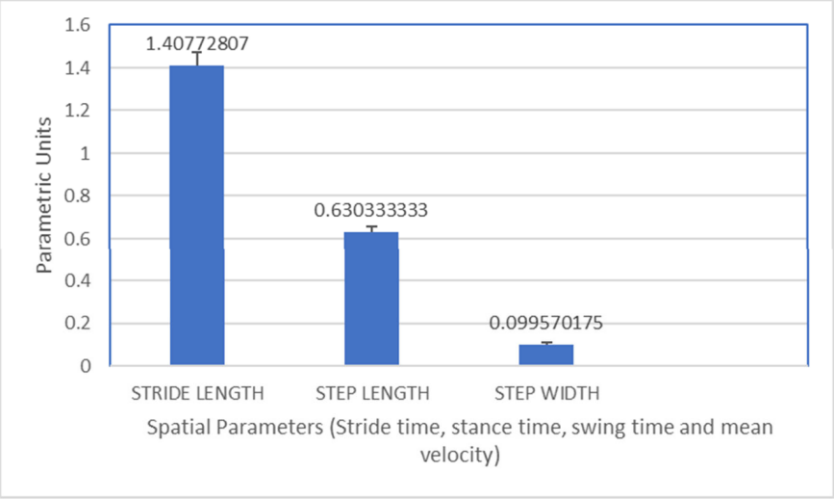
The below tabulation provides an overall observation of the spatial parameters and their measures among all the 60 respondents with their estimated mean ± standard deviation for the patient's stride length, step length and step width respectively.

Table 7: Descriptive Statistics-Spatial parameters

	N	Minimum	Maximum	Mean	Std. Deviation
STRIDE LENGTH	60	1.27000000000010	1.80000000000010	1.40772807017553981009	.06638607968100940391
STEP LENGTH	60	.50000000000100	.66035087719308333434	.63033333333434	.02844456504039177446
STEP WIDTH	60	.06000000000001000	.12000000000001000	.09957017543869700	.01390442911744600
Valid N (listwise)	60				

The findings observed from the above table on spatial parameters on IT fractures and its impact on gait parameters showed greater correlation. This was especially observed with the reduced step length 0.63 ±0.284 m and the other two parameters namely the observed stride length and step width were in normal ranges from the observed outcome

Graph 8: Spatial parameter



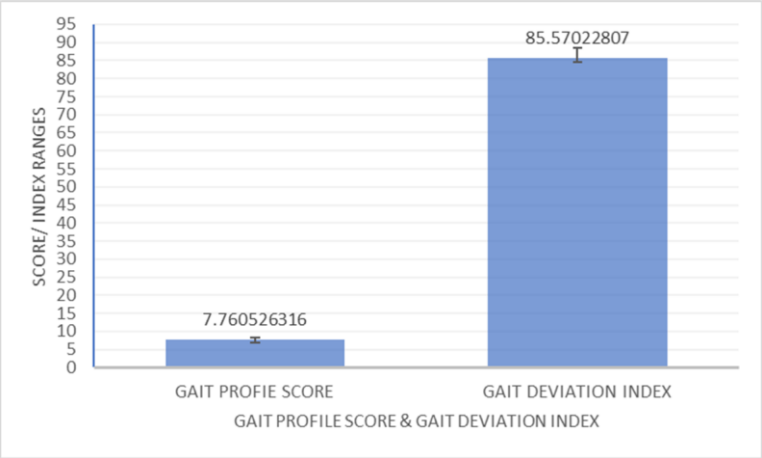
GAIT PROFILE SCORE & GAIT DEVIATION INDEX

As gait profile score and gait deviation index is considered as the mostly employed summary measures for determination of overall gait among the fractured individuals, the following table provides an overall observation of the gait profile score and gait deviation index observed among the study participants (measured in mean ±S.D.)

Table8: Gait profile score and deviation index

Descriptive Statistics					
	N	Minimum	Maximum	Mean	Std. Deviation
GAIT PROFIE SCORE	60	7.29473684210536	9.40000000000010	7.760526315789579	.406086030448177
GAIT DEVIATION INDEX	60	76.53000000000001	94.73000000000001	85.570228070175470	3.040457173053282
Valid N (listwise)	60				

From the observed tabulation, it could be determined that there is an increased Gait profile score among the IT fracture sample population with the estimated mean range observed was 7.76 ±.406 (whereas the normal ranges were < 7) thus presenting a deviation/ difference observed in the gait scores in the sample population so far from the report. There is an abnormal range in the gait deviation score was reported as 85.57 ±3.04 (< 100), thereby deviating from the normal ranges among patients reported with IT fracture.

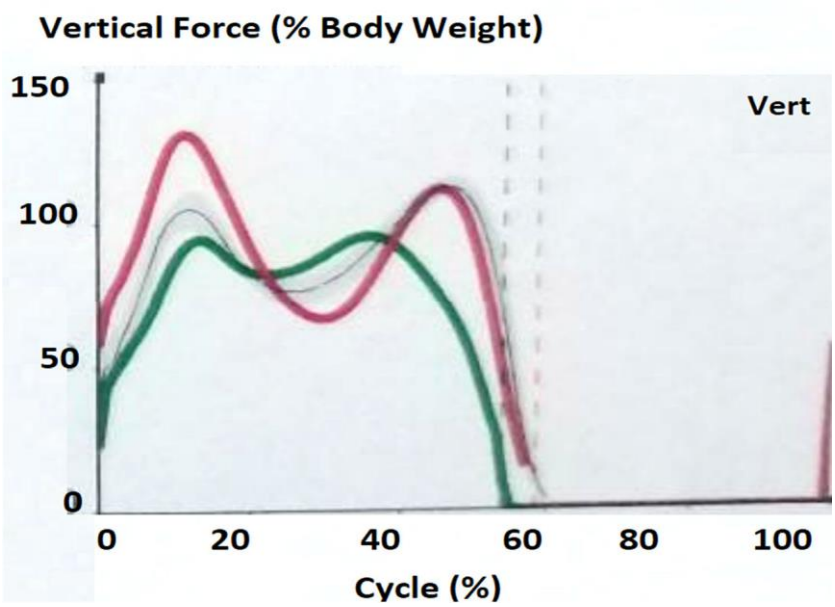


Graph 9: Gait profile score and Gait deviation index

Ground Reaction force

Also, the observed ground reaction observed in the case of the vertical force showed abnormal outcome from the current investigation upon conducting with the study participants.

Graph 10: Ground reaction force



Differences observed in the GAIT parameters concerning left versus right IT fracture

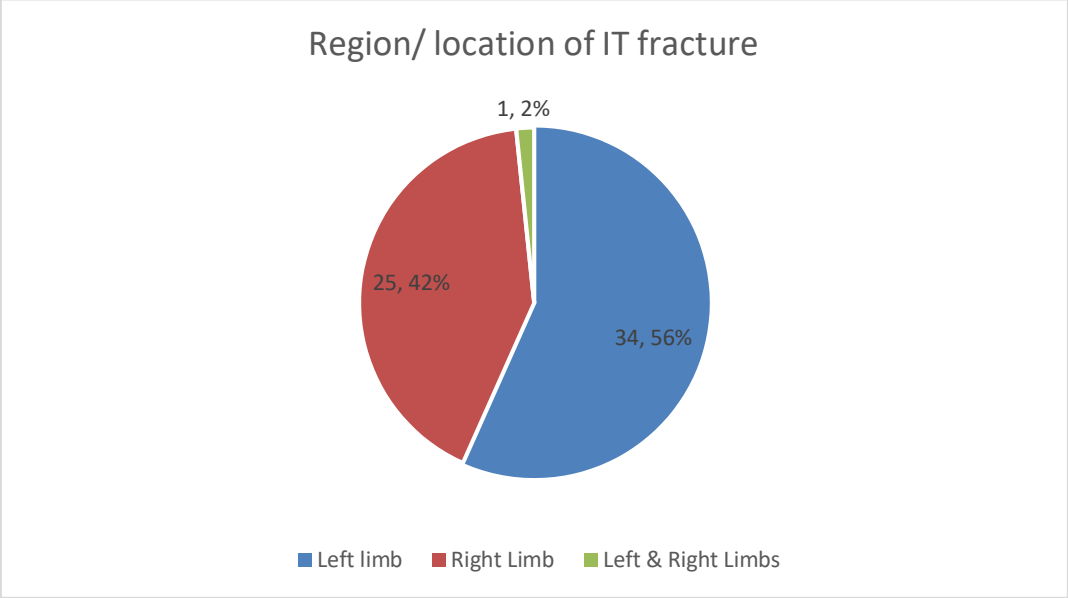
The initial findings governing with the side/ location of fracture (i.e.) left or right limb or both the left and right IT fracture was observed. It was reported with left-side dominance of IT fracture with 34 reports with IT fracture in the left limb followed by 25 of the sample respondents with right limb IT fracture and only 1 individual exhibited fracture in both left and right IT fracture.

Table 9: Temporal Parameters (Left Versus Right IT fracture)

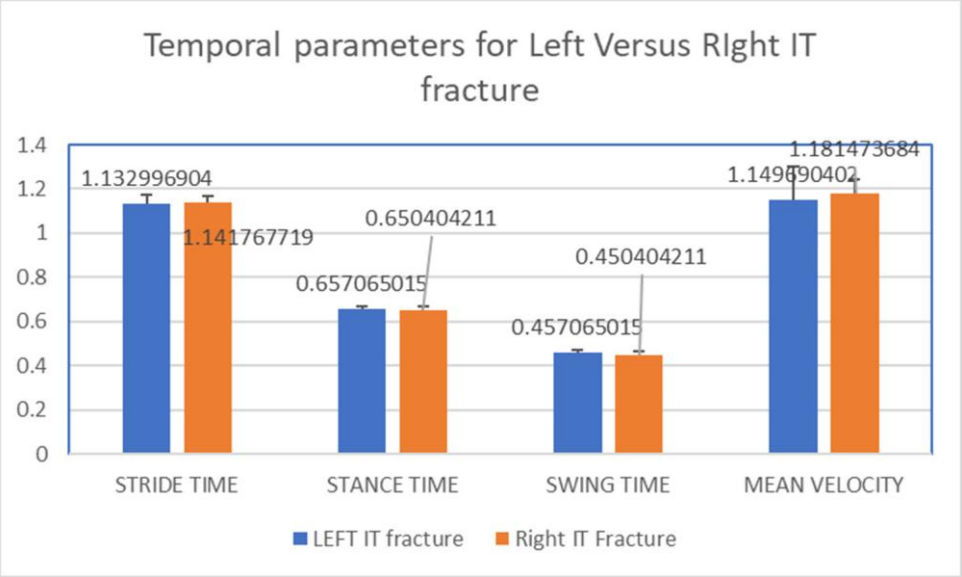
Descriptive Statistics						
DIAGNOSIS		N	Minimum	Maximum	Mean	Std. Deviation
Both Left & Right	STRIDE TIME	1	1.16707017543870	1.16707017543870	1.167070175438700	.
	STANCE TIME	1	.658631578947468	.658631578947468	.6586315789474 68	.
	SWING TIME	1	.458631578947468	.458631578947468	.4586315789474 68	.
	SINGLE SUPPORT PHASE	1	45.3601578947369	45.3601578947369	45.36015789473 6900	.
	DOUBLE SUPPORT PHASE	1	14.7087719298247	14.7087719298247	14.70877192982 4700	.
	MEAN VELOCITY	1	1.16315789473694	1.16315789473694	1.163157894736 940	.
	CADENCE	1	111.912280701754	111.912280701754	111.9122807017 5410	.
	Valid N (listwise)	1				
Left	STRIDE TIME	34	1.03000000000010	1.18017543859659	1.132996904024868	.040968335295453
	STANCE TIME	34	.620000000000100	.690000000000100	.6570650154799 76	.013640533035742
	SWING TIME	34	.420000000000100	.490000000000100	.4570650154799 76	.013640533035742
	SINGLE SUPPORT PHASE	34	39.4600000000001	45.9584210526317	44.02722600619 2060	1.721143329262345
	DOUBLE SUPPORT PHASE	34	13.2000000000001	15.3000000000001	14.54226006191 9600	.361012926874048
	MEAN VELOCITY	34	.400000000000 10	1.500000000010	1.149690402476879	.153129535712232

	CADENCE	34	111.280701754386	117.000000000000	113.489164086687 40	1.559815359350766
	Valid N (listwise)	34				
Right	STRIDE TIME	25	1.060000000000010	1.177263157894 84	1.141767719298 346	.025587780584501
	STANCE TIME	25	.610000000000100	.670000000000100	.650404210526416	.016039099271812
	SWING TIME	25	.410000000000100	.470000000000100	.450404210526416	.016039099271812
	SINGLE SUPPORT PHASE	25	39.780000000001	45.825473684 2106	43.902440000000 90	1.420143486865828
	DOUBLE SUPPORT PHASE	25	13.800000000001	14.800000000001	14.589964912280804	.209658004656709
	MEAN VELOCITY	25	1.100000000000010	1.400000000000010	1.181473684210625	.063196625551400
	CADENCE	25	111.000000000000	118.000000000000	113.220350877193 07	1.865625946528725
	Valid N (listwise)	25				

Graph 11:Region/location of IT fracture



Graph 12: Temporal paramaters for Left vs.Right IT fracture(1)



There was no reported significant deviation in the ranges observed in regards to the temporal parameters so far in the case of left and right IT fracture in the following investigation.

Graph 13: Temporal paramaters for Left vs.Right IT fracture (2)

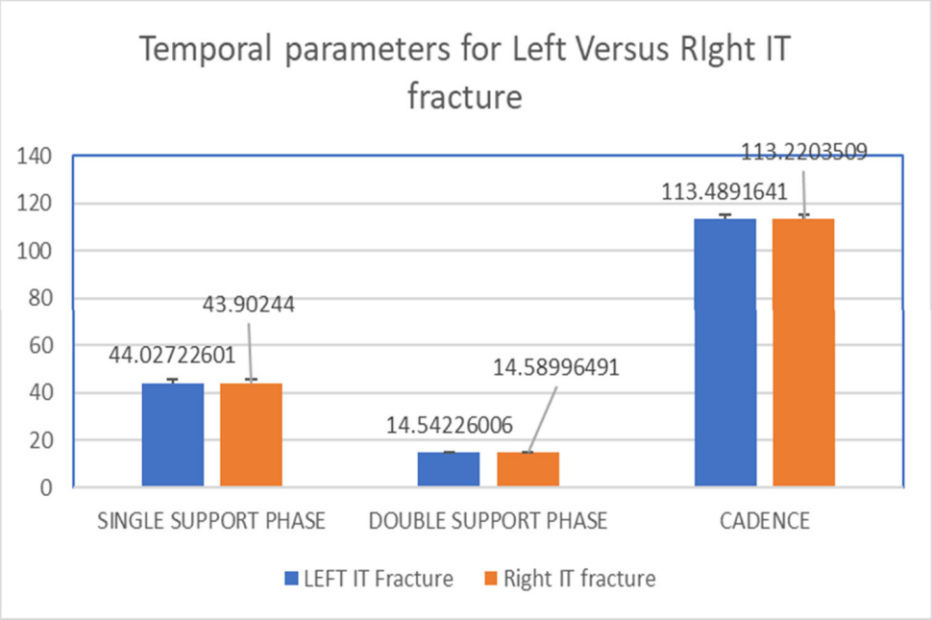


Table 10: Spatial parameters

Descriptive Statistics						
DIAGNOSIS		N	Minimum	Maximum	Mean	Std. Deviation
Both Left & Right	STRIDE LENGTH	1	1.429666666666777	1.429666666666777	1.429666666666770	.
	STEP LENGTH	1	.651192982456240	.651192982456240	.651192982456240	.
	STEP WIDTH	1	.110719298245714 0	.110719298245714 0	.11071929824571 4	.
	Valid N (listwise)	1				
Left	STRIDE LENGTH	34	1.2700	1.800000000000010	1.408532507740039	.083486950370124
	STEP LENGTH	34	.5000	.660	.632238390092979	.029648702883243
	STEP WIDTH	34	.060000000000100	.115614035087819 0	.098160990712174	.014426917159172
	Valid N (listwise)	34				
Right	STRIDE LENGTH	25	1.300000000000010	1.440000000000010	1.405756491228170	.035004024567551
	STEP LENGTH	25	.570000000000100	.658315789473784	.626908070175539	.027291764215104
	STEP WIDTH	25	.070000000000100 00	.120000000000100 00	.101040701754486	.013373307575042
	Valid N (listwise)	25				

Similar to the temporal parameters spatio parameters were reported to be within the similar ranges with not much significance observed among both the left and right IT fractured individuals.

Graph 14: Spatial parameters observed among patients

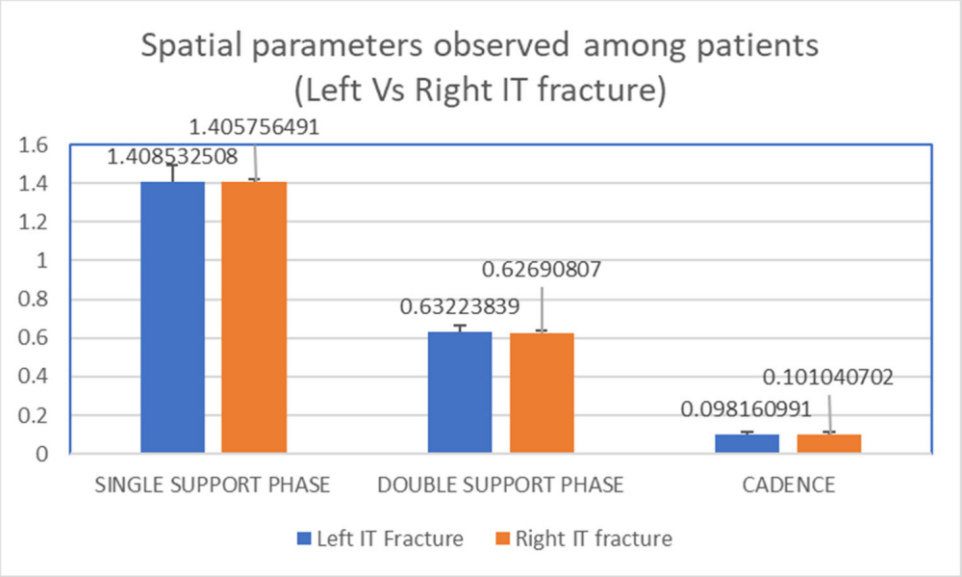
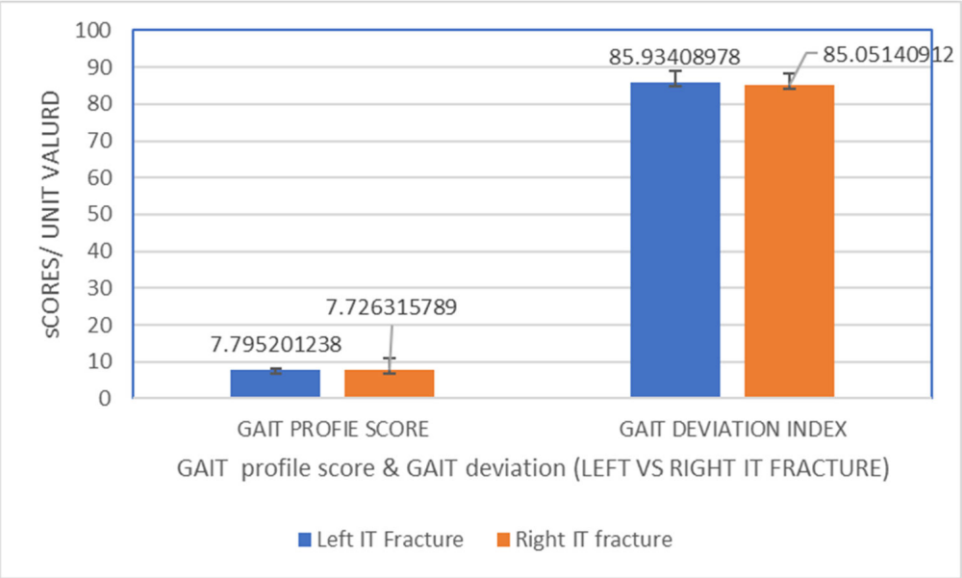


Table 11: GAIT PROFILE SCORE & GAIT DEVIATION INDEX

Descriptive Statistics						
DIAGNOSIS		N	Minimum	Maximum	Mean	Std. Deviation
Both Left & Right	GAIT PROFIE SCORE	1	7.43684210526326	7.43684210526326	7.4368421052632 61	.
	GAIT DEVIATION INDEX	1	86.1694035087720	86.1694035087720	86.169403508771 990	.
	Valid N (listwise)	1				
Left	GAIT PROFIE SCORE	34	7.29473684210536	9.40000000000010	7.7952012383901 95	.4533771679898 35
	GAIT DEVIATION INDEX	34	79.2200000000001	94.7300000000001	85.934089783281 800	2.990020867651 969
	Valid N (listwise)	34				
Right	GAIT PROFIE SCORE	25	7.32631578947379	8.70000000000010	7.7263157894737 86	.3398135114001 17
	GAIT DEVIATION INDEX	25	76.5300000000001	91.5400000000001	85.051409122807 120	3.154370056824 341
	Valid N (listwise)	25				

Graph 15: Gait profile score and Gait deviation index



The study showed an increased gait profile score followed by a decreased gait deviation score which was reported to be abnormal in the case of both the left Vs right IT fracture with not much significance observed between both the groups.

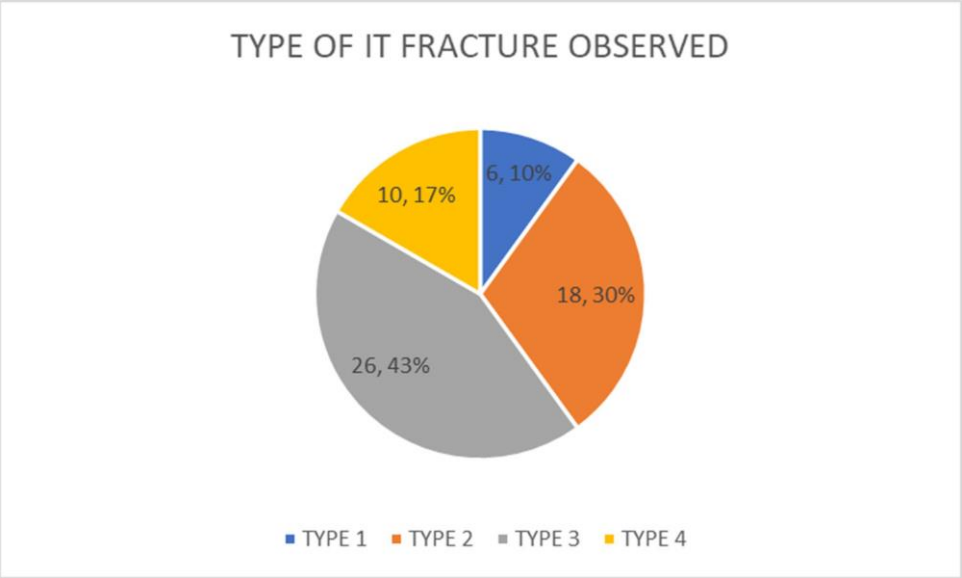
Table 12: Temporal Parameters

Descriptives									
		N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
						Lower Bound	Upper Bound		
STRIDE TIME	1	6	1.136540935672615	.033282024068509	.013587329429205	1.101613593447640	1.171468277897589	1.080000000000010	1.172894736684221
	2	18	1.141391812865597	.038709188597155	.009123843250502	1.122142186246189	1.160641439485004	1.040000000000010	1.180175438659659
	3	26	1.138958839406308	.030080553775178	.005899281949285	1.126809040798402	1.151108638014215	1.060000000000010	1.178719298824571
	4	10	1.125592982456241	.044392967881037	.014038289059946	1.093836166306079	1.157349798606403	1.030000000000010	1.171438596649133
	Total	60	1.137219298245714	.035202905269252	.004544675528285	1.128125423518907	1.146313172972521	1.030000000000010	1.180175438659659
STANCE TIME	1	6	.656543859649223	.003159590188237	.001289897292973	.653228073098353	.659859646200092	.652315789473784	.660000000000100
	2	18	.659076023391913	.010163695583407	.002395606023057	.654021736486326	.664130310297499	.640000000000100	.690000000000100
	3	26	.647360323886740	.016982465732132	.003330535544583	.640500957531562	.654219690241917	.610000000000100	.670000000000100
	4	10	.662494736842205	.013298759421734	.004205436982799	.652981377449097	.672008096235314	.650000000000100	.690000000000100

	Total	60	.654315789473784	.014827996406906	.001914286104806	.650485311825929	.658146267121639	.610000000000100	.690000000000100
SWING TIME	1	6	.456543859649223	.003159590188237	.001289897292973	.453228073098354	.459859646200092	.452315789473784	.460000000000100
	2	18	.459076023391913	.010163695583407	.002395606023057	.454021736486326	.464130310297499	.440000000000100	.490000000000100
	3	26	.447360323886740	.016982465732132	.003330535544583	.440500957531563	.454219690241917	.410000000000100	.470000000000100
	4	10	.462494736842205	.013298759421734	.004205436982799	.452981377449097	.472008096235314	.450000000000100	.490000000000100
	Total	60	.454315789473784	.014827996406906	.001914286104806	.450485311825929	.458146267121639	.410000000000100	.490000000000100
SINGLE SUPPORT PHASE	1	6	43.64558771929832 0	2.216770016176060	.904992569455486	41.319230258889760	45.971945179706880	39.460000000000001	45.626052 6315790
	2	18	44.153356725146300	1.663271761450365	.392036913825959	43.326231137270824	44.980482313021780	39.870000000000001	45.958421 0526317
	3	26	43.968070850202530	1.528759294380165	.299814364370496	43.350591608112520	44.585550092292536	39.780000000000001	45.891947 3684212
	4	10	44.004305263157990	1.376061817453798	.435148954434553	43.019929938999944	44.988680587316030	41.450000000000001	45.559578 9473685
	Total	60	43.997447368421150	1.585277629010373	.204658461875832	43.587926732121230	44.406968004721065	39.460000000000001	45.958421 0526317
DOUBLE SUPPORT PHASE	1	6	14.563450292397766	.156730273984483	.063984866418157	14.398971957029255	14.727928627766277	14.300000000000001	14.736842 1052633
	2	18	14.462865497076130	.427786389378971	.100830218943136	14.250132330433773	14.675598663718487	13.200000000000001	14.900000 0000001
	3	26	14.626585695006850	.161071888393390	.031588796231201	14.561527351333835	14.691644038679867	14.200000000000001	14.900000 0000001
	4	10	14.589122807017636	.370439841643062	.117143363566485	14.324126108051663	14.854119505983610	13.900000000000001	15.300000 0000001
	Total	60	14.564912280701856	.302802982742909	.039091696978261	14.486689975726943	14.643134585676770	13.200000000000001	15.300000 0000001
MEAN VELOCITY	1	6	1.169298245614133	.015040726490875	.006140350877293	1.153513971184917	1.185082520043349	1.163157894736 94	1.200000 0000010
	2	18	1.130994152046882	.189515723654970	.044669284446045	1.036750199872162	1.225238104221602	.400000000000010	1.300000 0000010
	3	26	1.186032388664066	.077294161393234	.015158632201268	1.154812601238755	1.217252176089378	1.100000000000010	1.500000 0000010

	4	10	1.157894736842204	.100230574435789	.031695690640482	1.086194103230227	1.229595370454181	1.000000000000010	1.400000000000010
	Total	60	1.163157894736941	.122419847615175	.015804334368714	1.131533494711587	1.194782294762294	.400000000000010	1.500000000000010
CADENCE	1	6	113.365497076023449843928	1.567302739843928	.639848664180672	111.72071372233835	115.01028042970854	111.631578947368	116.000000000000
	2	18	113.315789473684263948112	1.683092163948112	.396708627496627	112.47880743153124	114.15277151583729	111.280701754386	118.000000000000
	3	26	113.157219973009528977419	1.637747108977419	.321188633346466	112.49571959992659	113.81872034609245	111.000000000000	117.000000000000
	4	10	113.908771929824703049820	1.982219793049820	.626832936910572	112.49077731171484	115.32676654793455	111.701754385965	118.000000000000
	Total	60	113.350877192982540810810	1.682254910810810	.217178175121617	112.91630466834282	113.78544971762226	111.000000000000	118.000000000000

Graph 16: Type of fracture observed



The findings expressed that based on the type of fracture the abnormal ranges reported was much more prominent when on comparison with type 1 and type 2 fracture. Majority of the respondents showed poor spatiotemporal parameters with abnormal gait variable score & gait profile score from the above observed tabulation.

Table 13: ANOVA

ANOVA						
		Sum of Squares	df	Mean Square	F	Sig.
STRIDE TIME	Between Groups	.002	3	.001	.457	.714
	Within Groups	.071	56	.001		
	Total	.073	59			
STANCE TIME	Between Groups	.002	3	.001	4.161	.010
	Within Groups	.011	56	.000		
	Total	.013	59			
SWING TIME	Between Groups	.002	3	.001	4.161	.010
	Within Groups	.011	56	.000		
	Total	.013	59			
SINGLE SUPPORT PHASE	Between Groups	1.203	3	.401	.153	.928
	Within Groups	147.070	56	2.626		
	Total	148.273	59			
DOUBLE SUPPORT PHASE	Between Groups	.292	3	.097	1.066	.371
	Within Groups	5.117	56	.091		
	Total	5.410	59			
MEAN VELOCITY	Between Groups	.033	3	.011	.717	.546
	Within Groups	.851	56	.015		
	Total	.884	59			
CADENCE	Between Groups	4.111	3	1.370	.471	.704
	Within Groups	162.858	56	2.908		
	Total	166.969	59			

Table 14: Spatial parameters with type of fit

Descriptives									
		N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
						Lower Bound	Upper Bound		
STRIDE LENGTH	1	6	1.394616959064427	.053015237235172	.021643379969854	1.338980879652863	1.450253038475990	1.290000000000010	1.433947368422115
	2	18	1.400736842105364	.043302597072169	.010206520010983	1.379202967190936	1.422270717019792	1.270000000000010	1.439298245614140
	3	26	1.419628205128305	.086295949512748	.016924028096600	1.384772516795685	1.454483893460924	1.300000000000010	1.800000000000010
	4	10	1.397238596491329	.048558495783423	.015355544642798	1.362501941189181	1.431975251793477	1.290000000000010	1.460000000000010
	Total	60	1.407728070175539	.066386079681009	.008570406034239	1.390578727312891	1.424877413038187	1.270000000000010	1.800000000000010
STEP LENGTH	1	6	.638134502924077	.012925877979364	.005276967587879	.624569625895803	.651699379952351	.620666666666767	.655263157894837
	2	18	.639257309941621	.019090398684442	.004499650121851	.629763878019951	.648750741863290	.590000000000100	.660350877193083
	3	26	.619954116059479	.036686289411330	.007194773291991	.605136203086511	.634772029032448	.500000000000100	.659333333333433
	4	10	.636575438596591	.015163138938426	.004795005552370	.625728382440867	.647422494752315	.619649122807118	.660000000000100
	Total	60	.630333333333433	.028444565040391	.003672177556472	.622985323015615	.637681343651252	.500000000000100	.660350877193083
STEP WIDTH	1	6	.101283625731094	.008834467717060	.003606656342707	.092012420449483	.110554831012705	.090000000000001000	.112894736842050
	2	18	.103134502924077	.010593987839903	.002497026880544	.097866236713447	.108402769134706	.080000000000001000	.115614035087819 0
	3	26	.101126180836807	.011829410239448	.002319938217205	.096348178638674	.105904183034940	.070000000000001000	.120000000000001000
	4	10	.088080701754486	.021031098799727	.006650617390385	.073035959988021	.103125443520951	.060000000000001000	.112350877193083 0
	Total	60	.099570175438697	.013904429177446	.001795054088179	.095978280505032	.103162070372361	.060000000000001000	.120000000000001000

With regards to the gait parameters concerned the majority of the respondents exhibited abnormal or restricted gait movement from the observed spatiotemporal parameters especially with type 3 and type 4 IT fractures as indicative from the above table.

Table 15: Spatiotemporal parameters

ANOVA						
		Sum of Squares	df	Mean Square	F	Sig.
STRIDE LENGTH	Between Groups	.007	3	.002	.493	.688
	Within Groups	.253	56	.005		
	Total	.260	59			
STEP LENGTH	Between Groups	.005	3	.002	2.179	.101
	Within Groups	.043	56	.001		
	Total	.048	59			
STEP WIDTH	Between Groups	.002	3	.001	3.111	.033
	Within Groups	.010	56	.000		
	Total	.011	59			

As P-value is > 0.05 for majority of the cases, there is a significant relationship observed with regards to the gait parameters concerning with IT fracture in the following investigation.

Table 16: GAIT PROFILE SCORE & GAIT DEVIATION INDEX WITH THE TYPE OF FIT

Descriptives									
		N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
						Lower Bound	Upper Bound		
GAIT PROFILE SCORE	1	6	7.687719298245715	.22548603 5011640	.09205428 8317036	7.45108621 6807733	7.92435237 9683697	7.3736842 1052642	7.9105263 1578957
	2	18	7.758771929824664	.40931093 4094347	.09647551 2370714	7.55522639 0945696	7.96231746 8703632	7.2947368 4210536	8.7000000 0000010
	3	26	7.748582995951518	.42512584 4669261	.08337403 7603972	7.57687095 1207654	7.92029504 0695382	7.3105263 1578957	9.4000000 0000010
	4	10	7.838421052631680	.47288464 0309906	.14953925 3388946	7.50013975 9458606	8.17670234 5804753	7.3894736 8421063	8.7000000 0000010
	Total	60	7.760526315789575	.40608603 0448176	.05242548 1101863	7.65562317 0410913	7.86542946 1168236	7.2947368 4210536	9.4000000 0000010
GAIT DEVIATION INDEX	1	6	85.906327485380230	.47701756 7690321	.19474160 6530863	85.4057282 48993770	86.4069267 21766700	85.292561 4035089	86.520000 0000001
	2	18	86.168163742690170	3.4532545 52395441	.81393990 3720787	84.4509006 54400140	87.8854268 30980200	79.220000 0000001	94.730000 0000001
	3	26	85.188484480431950	2.7227817 46600480	.53398143 2968161	84.0887291 32779860	86.2882398 28084040	76.530000 0000001	91.630000 0000001
	4	10	85.284817543859750	4.0069514 92955713	1.2671093 19155287	82.4184171 21484480	88.1512179 66235010	77.340000 0000001	93.730000 0000001
	Total	60	85.570228070175550	3.0404571 73053279	.39252133 3203161	84.7847946 96635320	86.3556614 43715770	76.530000 0000001	94.730000 0000001

Table 17: ANOVA and Gait profile score and Deviation

ANOVA						
		Sum of Squares	df	Mean Square	F	Sig.
GAIT PROFIE SCORE	Between Groups	.096	3	.032	.186	.905
	Within Groups	9.633	56	.172		
	Total	9.729	59			
GAIT DEVIATION INDEX	Between Groups	11.717	3	3.906	.410	.747
	Within Groups	533.702	56	9.530		
	Total	545.418	59			

From the ANOVA test, it could be inferred that the variables associated with Gait deviation indices & GAIT profile score that had been found to show the significant differences with regards to the impact of IT fracture in their parametric scoring and the resultant abnormal findings exhibited from the measures as well.

DISCUSSION

IT fractures in general are attributed to be one of the commonest form of injuries that are sustained especially among the senile groups. However the predominant occurrences was observed among patients over 60 years of age. Considering the mortality and morbidity tend to increase with growing age, as the IT fractures in general are 3-4 times quite common among women when compared with that of female. However, asides the general aging factors there are numerous factors contributing to IT fractures in early adult category as well, of which the RTA is regarded as quite common factor responsible for IT fractures in the first place among young adult groups. For instance, when considering the mortality rate, approximately 10-30% of the patients were susceptible to death within 1 year time frame of the fracture [64- 67]. In earlier decades, only little attention was paid for IT fractures in general, since it occurs through cancellous bone which is endowed with excellent blood supply naturally, thus happens to healing with no regards of the treatment. Yet, malunion is resulted by the conservative treatment with varus that followed with the external resultant of rotation in the short leg gait and resultant limping motion among many patients. Also, another major factor namely being the mortality cases due to the complications incurred from recumbency followed with immobilization such as deep vein thrombosis followed by respiratory infections and bedsores were observed quite commonly in earlier time periods [65] [66].

It is worth mentioning that there has been a considerable improvement in the treatment of IT fractures significantly. Treatment governing with peritrochanteric fracture was further then moved to the operative side from conservative treatment approaches. Closed reduction & Internal fixation in general for peritrochanteric fracture can be attributed as the treatment of choice in recent times. There were greater deal of reports showcasing the success of fixation implants which were devised and were further then discarded. There exists certain

differences concerning with the type of implant that was employed for the operative treatment for IT fractures. These fixation devices in turn facilitated compression on the fracture site without exhibiting any sorts of complications from the screw cut out or any form of implant breakage mediated issues with nail plate. However, when considering the downside of the internal fixation of implants usually comprised of extensive surgical dissection, followed by extended surgical time required for the procedure and blood loss were often regarded as the major contraindication especially among the elderly population with comorbidities [67- 69]. In early 90s, there was a massive development in the intermedullary devices for the sake of fixation of IT fractures. As the devices in general had numerous biological as well as biomechanical advantage when on comparison with that of the conventional dynamic hip screws that were employed in the previous decades for the treatment predominantly. From literature findings so far from the long-term investigations revealed that with the utilization of the devices in general were associated with radiation exposure, higher intra operative, and delayed presentation of certain bodily complication which requires revision surgery for the patients [78] [79]. The present investigation was to analyze post operatively patients gait parameters with many different intertrochanteric fractures' types that treated with proximal nailing of femoral with the help of simple 3-D Gait analyzer's Helen Hayes Protocol. From the patient demographics it could be inferred that the majority of the sample population comprised of males (N-34; 56.7%) when compared to that of the female population (N-26; 43.3%). This provides an indication that the male population in general are much more prone/ susceptible to IT fracture.

Based on the diagnostic presentation of IT fracture among the sample population showed that the majority cases were presented with left IT fracture (N-34; 56.7%) followed closely by right IT fracture among 25 respondents (41.7%). Only 1 respondent was presented with bilateral IT fracture.

With regards to IT fracture and its severity, the sample population had been separated into Type 1, Type 2, Type 3 and Type 4 fractures. From the observed findings it was presented that the majority of the respondents were presented with type 3 IT fracture followed by 18 of the respondents presented with Type 2 fracture and 10 with severe Type 4 IT fracture. Only 6 of the respondents were presented with Type 1 IT fracture.

Temporal findings of the gait parameters concerned there was an increase in the single support asymetry(43.997 ± 1.585) and double support phase (14.56 ± 0.302) indicative of the IT fracture's impact on the limbs during gait. The observed mean velocity was reported to be 1.16 ± 0.122m/s (i.e.) within normal ranges with no deviation despite the IT fracture's impact among the study population. The reported cadence (steps/ min) on an average estimate was reported tobe decreased to a certain extent (113.35 ± 1.68).

Also there was a reduced or minimal step length observed among the sample population in this case 0.63 ±0.284 m. IT fracture sample population with the estimated mean range observed was 7.76 ±.406 (whereas the normal ranges were < 7) thus presenting a deviation/ differences observed in the gait scores in the sample population so far from the report. There is an abnormal ranges in the gait deviation score was reported as 85.57 ±3.04 (< 100), thereby deviating from the normal ranges among patients reported with IT fracture. P-value is > 0.05 for majority of the cases, there is a significant relationship observed with regards to the gait parameters concerning with IT fracture in the following investigation.

Various studies that showcased the PFN effectiveness as observed from the meta-analysis investigation carried out by Zeng C et al [70] by whom PFN was revealed to being superior when compared with other fixation techniques and also has a lesser duration for the surgery, followed by intra operative blood loss and fixation failure rates and most importantly considering the post-op outcome rendered from the overall complications were minimal

from the gait analysis. However, Shen et al. [71] stated that employing PFN exhibited lesser complication such as minimal signs of infection, lesser degree of sliding, as well as less discrepancy in the limb length when on comparison with other fixation technique employed (DHS group).

Our findings by far concerning with the gait speed's spatiotemporal parameters, stance/ swing ratio and step length that were reported with an overall improvement in patients in terms of their walking ability. Gait speed was considerably lower in case of older adult patients who were reported with IT fractures. So far, when considering age and the overall vulnerability from the following investigation is greatly supported by literature sources as postoperative functional goals were indicated collectively by them that intended for attaining the similar independence degree and ambulation in the pre-fracture condition [72].

Also, there are previous literature studies that showcased that the functional independence tends to be reported with a sharp decline in the functional outcome scores as well as from the ADLs,[73] However upon considering the changes on the gait biomechanics post-operation of the ITF were still being left unexplored. Also, there are ample amount of data that has provided greater emphasis considering the gait parameters and the functional outcomes as well as potential mechanisms involving with the functional deficiencies and how it stems from. From the resultant findings illustrated an overall improvement of hip, knee, and the ankle biomechanics during the post-operative assessment period of the ITF patients primarily from the Gait analyzer findings.

Reports indicated that when considering the elderly, the study reported with minimal/ decreased ankle dorsiflexion, hip power generation & peak hip abduction [74] were found to be directly with the overall likelihood for increased risk of falls among the senile population

with ITF. Studies further indicated with regards to the increased ankle plantarflexion as well as power generation were attributed to be significantly associated mechanisms when considering with the increase in the overall increase of the gait speed, [75] This would in turn contribute in the reduced gait speeds that can be possibly observed in the fractured patients. The following statement is likely to suggest that with minimizing declines of the hip ROM as well as the power generation by the abductor muscle mechanism would in turn be regarded as important for maintenance of the functional independences after ITF.

CONCLUSION

As intertrochanteric fractures are one of the prevalent and commonly presented injuries, especially among the senile population, it is of paramount importance for imparting a suitable operation modality. The present study utilized PFN as a suitable fixation device for treatment of intertrochanteric fracture. This study was performed with an intention of understanding the spatiotemporal parameters during the post-operative assessment via employing 3-D gait analyser that employed Helen Hayes protocol. The findings showcased that with the application of PFN presented with better functional outcome in terms of gait, despite there are instances wherein the ITF patients due to the dynamic loads on the joints and from the surgical approach tend to damange the abductor muscles as well as the surroundingsystem as it has been linked with the overall gait patterns and their movements concerned. The outcomes of the 3-D gait analyzer recommended nailing of proximal femoral nailing /PFNA2 that will allow greater restoration after surgery regarding bearing of weight. This can also be concluded as the execution of anti-rotation of Proximal femoral nail that was a better seeking choice for treating fractures that were osteoporotic pertrochanteric, alsoresulting to an initial after surgery therapy and holding the weight that is related to future detection with concerning to handling modality in relation with IT fracture. Significantimprovements were showed by patients in gait biomechanics at the time of their post-operative assessment. Yet, it had been considerably short of controls that elderly in themeasures that is in association with the rise of risk.

This study can serve as a limelight for the future researchers and healthcare specialists with regards to conduct a detailed analysis that could basically emphasis towards improving the overall quality of gait and mobility of the patient and management of ITF patients after surgical fixation . Also the post-operative management studies could be explored in detailed

for improving the patients' quality among the older adults with quality adjusted life expectancy post their injury. Also innumerable efforts were made to ensure towards improving the patients' functionality as well as quality of life post their surgical fixation. Furthermore, it is essential for improving the patients' gait quality via conducting a well-equipped rehabilitation protocol that would likely aid in treating the affected muscle groups of ITF patients. Ultimately, the application of suitable classification (Boyd & Griffun) of fracture types alongside with the utilization of Helen Hayes protocol can be attributed as a suitable diagnostic approach that facilitates physicians to employ a definitive management approach for ITF depending on the outcomes observed.

SUMMARY

The present study exhibited the major outcomes gained from measuring the spatiotemporal parameters via employing 3-D gait analyzer comprising a total of 60 respondents who were presented with IT fractures. The major outcomes gathered so far from the findings are as follows.

From the patient demographics it could be inferred that the majority of the sample population comprised of males (N-34; 56.7%) when compared to that of the female population (N-26; 43.3%). This provides an indication that the male population in general are much more prone/ susceptible to IT fracture.

Based on the diagnostic presentation of IT fracture among the sample population showed that the majority cases were presented with left IT fracture (N-34; 56.7%) followed closely by right IT fracture among 25 respondents (41.7%). Only 1 respondent was presented with bilateral IT fracture.

With regards to IT fracture and its severity, the sample population had been classified into 4 types of fractures: Type 1, Type 2, Type 3 and Type 4. From the observed findings it was presented that the majority of the respondents were presented with type 3 IT fracture followed by 18 of the respondents presented with Type 2 fracture and 10 with severe Type 4 IT fracture. Only 6 of the respondents were presented with Type 1 IT fracture.

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IT fracture's impact among the study population. The reported cadence (steps/ min) on an average estimate was reported to be decreased to a certain extent (113.35 ± 1.68).

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P-value is > 0.05 for majority of the cases, there is a significant relationship observed with regards to the gait parameters concerning with IT fracture in the following investigation.

Scope and Limitation

This study of ours will help identify the parameters which has to be addressed after proximal femoral nailing for intertrochanteric patients and helps both physician and physiotherapists with quantitative and objective data to analyze any possible gait dysfunction and frame a proper rehabilitation protocol which will help them in their gait by treating the affected muscle groups. Further this study can be enhanced by assessing the patients 12 months after intervention in the form of proper physiotherapy and then reassessing their gait parameters in future study. Limitations of the study include the sample size can be increased more and assess the patients after physiotherapy.

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ETHICAL CLEARANCE LETTER

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Ref: MDC/DOME/ 36 **Date: 25/01/2021**

To,

PG student in Orthopaedics,
J. N. Medical College,
BELAGAVI.

Sub: Institutional Ethical Clearance for the study.

With reference to the above, we wish to inform you that your proposed research project titled **"ANALYSIS OF DIFFERENCES IN THE GAIT PARAMETERS IN POST OPERATIVE PATIENTS WITH INTERTROCHANTERIC FRACTURES USING 3D GAIT ANALYSER"**, is ethical and justifiable. The proposed research project has been cleared by the JNMC Institutional Ethics Committee on Human Subjects Research.

(Dr. Smita Sonali)
Member Secretary
JNMC Institutional Ethics Committee
on Human Subjects Research,
J.N.Medical College, Belagavi.

(Dr. Harsha Hegde)
Chairman,
JNMC Institutional Ethics Committee
on Human Subjects Research,
J.N.Medical College, Belagavi

INFORMED CONSENT

TITLE OF THE STUDY **"ANALYSIS OF DIFFERENCES IN THE GAIT PARAMETERS IN PATIENTS WITH INTERTROCHNTERIC FRACTURES USING 3D GAIT ANALYSER"**

PRINCIPAL INVESTIGATOR:

GUIDE:

INTRODUCTION AND PURPOSE:

Inter-trochanteric fractures of femur are one of the commonest injuries sustained by the elderly population. The incidence is growing rapidly due to increase in ageing of human population and lifestyle modifications. It is commonly associated trivial trauma in older age patient, high energy trauma in younger age patient will result in fractures configuration. On operative approach includes reduction via traction and immobilization. However it usually resulted in malunion, varus and external rotation deformities resulting in short limb gait. Due to prolonged immobilization complications like bedsores, deep vein thrombosis, and respiratory infections can happen. Since the fracture is more common in older age patients, the aim of treatment is to early stabilization, rigid and stable fixation, thus preventing the complication of prolonged recumbence. This leads to recommendation of surgery by internal fixation.

The advantages of operative treatment are:

1. Decreases hospitalization (4)
2. Reduces complications of prolong recumbence(4)
3. Early mobilization and weight bearing
4. Walking exercise is possible with new implant and fixation technology(5).
5. Helps to achieve anatomical reduction.

There are several implants invented for fixation of inter-trochanteric fractures both intramedullary and extramedullary. It includes Dynamic Hip Screw (Extramedullary fixation), Gamma Nail and PFN (Intramedullary Fixation). Dynamic Hip screw has been associated with complications such as collapse of Femoral Neck and shortening of leg.

To overcome the disadvantage of dynamic hip-screw, new intramedullary fixation device was introduced for treatment of unstable intertrochanteric fractures. Gamma nail is the earliest version of intramedullary fixation device.

The proximal femoral nail (PFN) was introduced in 1997(Mathys Medical, Bettlach, Switzerland) for treatment of unstable inter trochanteric fractures. The fixation of fracture with PFN offers minimal surgical incision and thus reduces the risk of infection (6). In view of these considerations, the study of surgical management of inter trochanteric fracture is undertaken to study the functional outcome of proximal femoral nail and to evaluate the complications associated with proximal femoral nailing in the trochanteric fractures of femur.

The purpose of this study is to determine the best GAIT ANALYSIS for" POST OPERATIVE INTERTROCHANTERIC FRACTURES" in Orthopaedic department of KLE'S Dr.Prabhakar Kore Hospital and Medical Research Centre and Charitable Hospital, Belagavi from 1st January 2021 to 31st December 2021.

PROCEDURE:

-The purpose of the study will be explained and written informed consent will be obtained from all participants.

-The subject will be selected based on inclusion and exclusion criteria.

-Study will be conducted over a period of one year.-Once the patient signs the informed consent, history and examination to be recorded as per the proforma. In our study we used GAIT 3D ANALYSER to analysis the differences in the gait parameters of the operated limb and the normal (contralateral limb) of post operative patients in context with age matched normal individuals.

GAIT 3D ANALYSER will be used to assess the changes in the gait parameters in patients of intertrochanteric fractures.

Post operative Intertrochanteric fractures patients due to dynamic load on the joints and the surgical approach which damages the muscles and the surrounding supporting system is linked to always changes in the gait pattern. Spatio-temporal, Kinematic and Kinetics are the three variables which affect the gait patterns with different levels of fracture severity like stable and unstable intertrochanteric fractures. External abductor is the moment in the variable which needs to be studied as this variable is the min predictor of joint loading. The biomechanical condition of the gait subjects can be evaluated by studying the biomechanical gait parameters such as Spatio-temporal Gait data. This data can aid in knowing the effect on the gait alteration/pattern in different groups.

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COMPENSATION:

As the subject voluntarily consents to be a part of the study, no compensation will be given.

CONFIDENTIALITY:

All information collected about the subject during the course of the study will be kept confidential to the extent permitted by the law. The code numbers will identify the subject in this research record. Information from this study may be presented but the subjects' identity will be confidential in any publication

If any enquiries in the future or in case of study related injury or illness, you may contact following person:

PRINCIPAL INVESTIGATOR:

PG. JUNIOR RESIDENT,

DEPARTMENT OF ORTHOPAEDICS,

KAHER,

JAWAHARLAL NEHRU MEDICAL COLLEGE,

NEHRU NAGAR,

BELAGAVI – 590010

GUIDE:

ASSOCIATE PROFESSOR,

DEPT. OF ORTHOPAEDICS,

KAHER ,J. N. MEDICAL COLLEGE,

BELAGAVI –590010.

If you still have any queries please contact:

Chairperson,

JNMC, IEC & Scientist D,

ICMR, National Institute of Traditional Medicine,

Belagavi- 9480422500.

CONSENT TO PARTICIPATE IN THE STUDY

I, Mr./Ms._____ have been explained about the research study, the need of the study, the intervention, their risks, benefits and alternatives available in my own vernacular language.

I voluntarily agree to participate in this study by signing up this form below. I understand that I may withdraw at any time from this study. I have been given adequate time to clarify my doubts about the study and my rights as a study participant.

My signature/thumb impression below indicates that I have read or information in the consent been read to me including the risks and benefits and have cleared my doubts.

Name of participant: **Signature/LTI:**

Name of legally authorized Representative (if applicable): **Signature/LTI:**
Relationship with participant:

Name of witness: **Signature:**

Name of investigator: **Signature:**

Date:
Place:

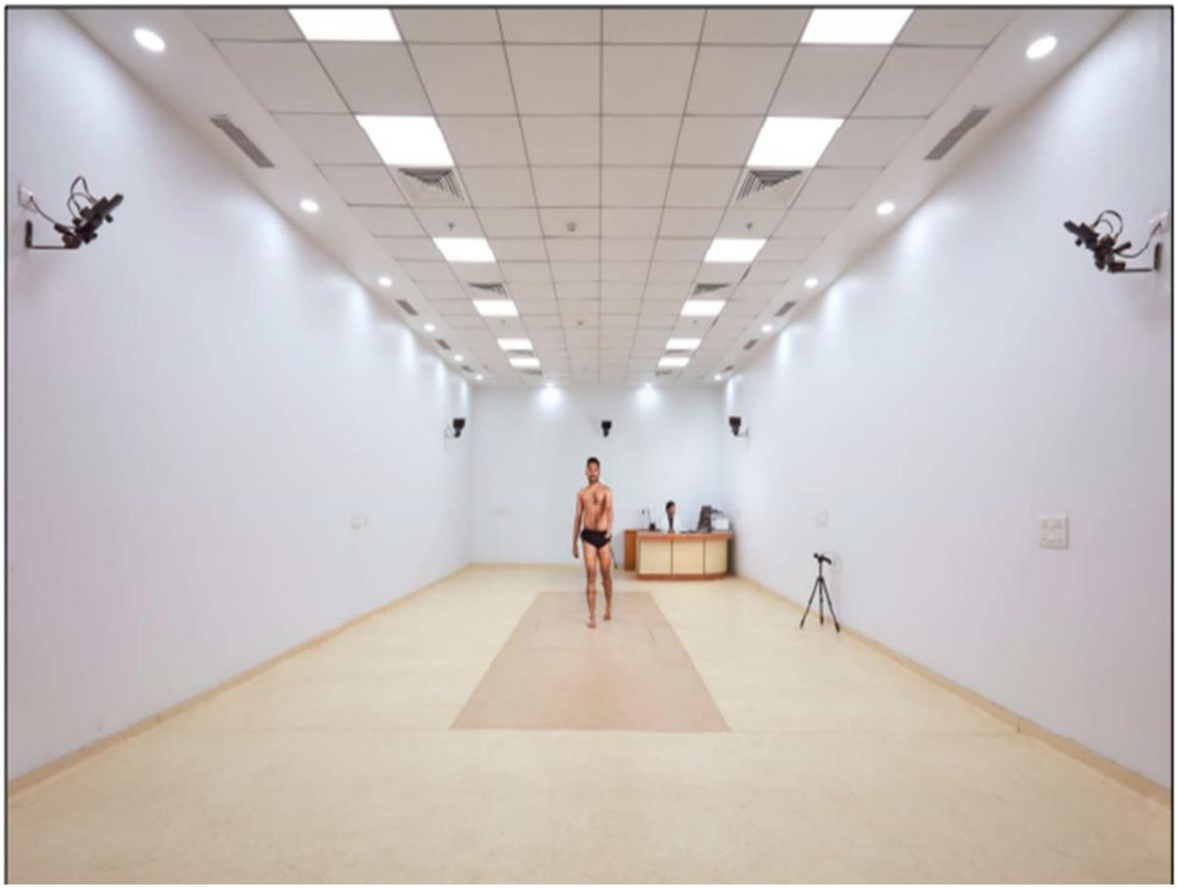
PROFORMA

ANALYSIS OF DIFFERENCES IN THE GAIT PARAMETERS IN INTERTROCHANTERIC FEMUR FRACTURE PATIENTS OPERATED BY PROXIMAL FEMORAL NAILING USING 3D GAIT ANALYSER- A CROSS SECTIONAL STUDY

OPD/IPD No.	
NAME	
AGE(years)	
GENDER(M/F)	
ADDRESS:	
BRIEF CLINICAL NOTES:	
Gait Lab ID no.	
HEIGHT(cms)	
WEIGHT(kgs)	
Pelvic width between ASIS(cm)	
Right Limb Length from ASIS(cm)	
Left Limb Length from ASIS(cm)	
Left Pelvic depth(cm)	
Right Pelvic depth(cm)	
Left Knee width(cm)	
Right Knee width(cm)	
Left Malleolar width(cm)	
Right Malleolar width(cm)	

BTS SMART GAIT ANALYZER is to evaluate the main parameter after doing gait analysis by following the simple Halen Hayes protocol.

PARAMETERS	**RIGHT**	**LEFT**	**NORMAL**
A) Temporal Parameters			
Swing time (sec)			
Stride time (sec)			
Cadence (steps/ min)			
Stance time (sec)			
Mean Velocity (m/s)			
Single Support Phase (%)			
Double Support Phase (%)			
B) Spatial Parameters			
Step width (m)			
Stride length (m)			
Step length (m)			
C) Gait Profile Score			
Gait Profile Score(deg)			
D) Gait Deviation Index			
Gait Deviation Index			
E) Ground Reaction Force			
Vertical Force(%body weight)			



Photograph 1. Gait lab

Photograph 2. Subject Walking On Pressure Sensor Foot Plates

Photograph 3. Infrared sensitive probes placed on landmarks

Photograph 4. Infrared sensitive probes placed on landmarks on the back

Key to Master Chart

Gender	: 1-male, 2-female
Occupation	: 1-housewife, 2- employed, 3-unemployed
Activity	: 1-mild, 2-moderate, 3-heavy
	Smoking, alcohol, H/o OA in family, Diabetes, ass trauma: 1-yes, 2-no
Deformity	: 1-varus, 2-valgus
Pain	: -no pain, 2-mild, 3-moderate, 4-severe
IT#	:- 1- Right, 2- Left, 3- Bilateral

MASTER CHART

S.NO	IP NO	AGE/SEX	DIAGNOSIS	TYPE OF IT#	STRIDE TIME	STANCE TIME	SWING TIME	SINGLE SUPPORT PHASE	DOUBLE SUPPORT PHASE	MEAN VELOCITY	CADENCE	STRIDE LENGTH	STEP LENGTH	STEP WIDTH	GROUD REACTIO	GAIT PROFIE SCORE	GAIT DEVIATIO N INDEX
1	948292	68/F	1	3	1.06	0.62	0.42	42.45	14.2	1.3	111	1.3	0.58	0.07	AB N	7.5	79.51
2	955013	56/F	1	2	1.15	0.64	0.44	42.46	14.5	1.2	116	1.4	0.59	0.11	AB N	8.5	85.76
3	957218	82/ M	2	4	1.03	0.65	0.45	42.67	14.2	1.1	116	1.35	0.66	0.06	AB N	7.8	93.73
4	961957	87/ M	1	4	1.13	0.67	0.47	41.45	14.8	1.4	118	1.38	0.63	0.07	AB N	8.7	77.34
5	962753	50/F	2	1	1.08	0.66	0.46	39.46	14.3	1.2	116	1.29	0.64	0.09	AB N	7.9	86.52
6	962648	77/F	2	3	1.17	0.67	0.47	45.57	14.9	1.3	117	1.8	0.59	0.1	AB N	8.5	83.44
7	962256	69/ M	2	2	1.04	0.66	0.46	39.87	13.2	0.4	115	1.27	0.6	0.11	AB N	8.7	94.73
8	962416	63/ M	1	3	1.16	0.61	0.41	42.89	14.8	1.1	112	1.3	0.57	0.12	AB N	7.8	76.53
9	963732	82/F	2	4	1.07	0.69	0.49	45.52	15.3	1.1	115	1.46	0.62	0.07	AB N	7.4	84.45
10	967234	82/ M	2	4	1.14	0.68	0.48	43.56	13.9	1	113	1.29	0.63	0.06	AB N	8.6	82.65
11	965476	65/ M	2	3	1.08	0.62	0.42	40.51	14.8	1.5	116	1.33	0.5	0.09	AB N	8.2	91.63
12	967546	55/ M	1	2	1.15	0.65	0.45	40.7	13.9	1.3	114	1.32	0.64	0.08	AB N	7.8	79.63
13	969180	80/ M	2	3	1.09	0.63	0.43	44.67	14.2	1.2	117	1.44	0.59	0.09	AB N	9.4	84.64
14	969247	71/F	1	3	1.13	0.61	0.41	42.56	14.6	1.1	115	1.4	0.58	0.1	AB N	7.5	88.62
15	969910	34F	1	2	1.1	0.67	0.47	43.78	13.8	1.3	118	1.42	0.65	0.11	AB N	8.3	91.54
16	969675	72/F	1	3	1.12	0.63	0.43	39.78	14.8	1.2	111	1.44	0.57	0.07	AB N	7.6	82.22
17	975085	75/ M	2	2	1.06	0.67	0.47	45.67	14.9	1.1	114	1.38	0.65	0.09	AB N	8.2	79.22
18	976059	74/F	2	2	1.18	0.69	0.49	44.34	14.2	1.1	113	1.37	0.66	0.08	AB N	7.4	88.92

19	977142	72/F	2	3	1.1	0.63	0.43	42.15	14.7	1.2	114	1.39	0.63	0.11	ABN	7.8	83.37
20	977605	81/F	1	4	1.12192982	0.652105263	0.45210526	43.29947368	14.49122807	1.163157895	114.0877	1.396491228	0.619649123	0.09385965	ABN	7.926315789	85.26333333
21	978872	38 M	1	1	1.12338596	0.652315789	0.45231579	43.36594737	14.49824561	1.163157895	114.0175	1.397561404	0.620666667	0.09440351	ABN	7.910526316	85.2925614
22	980906	72/F	2	2	1.12484211	0.652526316	0.45252632	43.43242105	14.50526316	1.163157895	113.9474	1.398631579	0.621684211	0.09494737	ABN	7.894736842	85.32178947
23	980896	68/F	1	3	1.12629825	0.652736842	0.45273684	43.49889474	14.51228077	1.163157895	113.8772	1.399701754	0.622701754	0.09549123	ABN	7.878947368	85.35101754
24	986829	78/M	2	3	1.12775439	0.652947368	0.45294737	43.56536842	14.51929825	1.163157895	113.807	1.400771933	0.623719298	0.09603509	ABN	7.863157895	85.38024561
25	988626	85/F	2	3	1.12921053	0.653157895	0.45315789	43.63184211	14.52631579	1.163157895	113.7368	1.401842105	0.624736842	0.09657895	ABN	7.847368421	85.40947368
26	990699	95/F	2	4	1.13066667	0.653368421	0.45336842	43.69831579	14.53333333	1.163157895	113.6667	1.402912281	0.625754386	0.09712281	ABN	7.831578947	85.43870175
27	987222	85/F	2	4	1.13212281	0.653578947	0.45357895	43.76478947	14.54035088	1.163157895	113.5965	1.403982456	0.626771933	0.09766667	ABN	7.815789474	85.46792982
28	992188	28/M	1	1	1.13357895	0.653789474	0.45378947	43.83126316	14.54736842	1.163157895	113.5263	1.405052632	0.627789474	0.09821053	ABN	7.8	85.49715789
29	993337	74/M	1	3	1.13503509	0.654	0.454	43.89773684	14.55438596	1.163157895	113.4561	1.406122807	0.628807018	0.09875439	ABN	7.784210526	85.52638596
30	993730	77/F	2	3	1.13649123	0.654210526	0.45421053	43.96421053	14.56140351	1.163157895	113.386	1.407192982	0.629824561	0.09929825	ABN	7.768421053	85.55561404
31	1000130	85/M	2	2	1.13794737	0.654421053	0.45442105	44.03068421	14.56842105	1.163157895	113.3158	1.408263158	0.630842105	0.09984211	ABN	7.752631579	85.58484211
32	1000458	60/F	1	3	1.13940351	0.654631579	0.45463158	44.09715789	14.575438	1.163157895	113.2456	1.409333333	0.631859649	0.10038596	ABN	7.736842105	85.61407018
33	1000708	67/M	2	3	1.14085965	0.654842105	0.45484211	44.16363158	14.58245614	1.163157895	113.1754	1.410403509	0.632877193	0.10092982	ABN	7.721052632	85.64329825
34	1003424	75/M	2	2	1.14231579	0.655052632	0.45505263	44.23010526	14.58947368	1.163157895	113.1053	1.411473684	0.633894737	0.10147368	ABN	7.705263158	85.67252632
35	1003739	77/M	1	3	1.14377193	0.655263158	0.45526316	44.29657895	14.59649123	1.163157895	113.0351	1.412543860	0.634912281	0.10201754	ABN	7.689473684	85.70175439
36	995859	39/M	1	1	1.14522807	0.655473684	0.45547368	44.36305263	14.60350877	1.163157895	112.9649	1.413614035	0.635929825	0.10256144	ABN	7.673684211	85.73098246
37	1004991	73/M	2	3	1.14668421	0.655684211	0.45568421	44.42952632	14.61052632	1.163157895	112.8947	1.414684211	0.636947368	0.10310526	ABN	7.657894737	85.76021053
38	1008044	76/M	2	2	1.14814035	0.655894737	0.45589474	44.496	14.61754386	1.163157895	112.8246	1.415754386	0.637964912	0.10364912	ABN	7.642105263	85.7894386
39	1008552	62/F	1	2	1.14959649	0.656105263	0.45610526	44.56247368	14.624561	1.163157895	112.7544	1.416824561	0.638982456	0.10419298	ABN	7.626315789	85.81866667
40	1014254	69/F	2	3	1.15105263	0.656315789	0.45631579	44.62894737	14.63157895	1.163157895	112.6842	1.417894737	0.64	0.10473684	ABN	7.610526316	85.84789474
41	1014401	59/M	2	3	1.15250877	0.656526316	0.45652632	44.69542105	14.63859649	1.163157895	112.614	1.418964912	0.641017544	0.1052807	ABN	7.594736842	85.87712281

42	1015115	78/F	1	3	1.15396491	0.656736842	0.45673684	44.76189474	14.64561404	1.163157895	112.5439	1.420035088	0.642035088	0.10582456	ABN	7.578947368	85.90635088
43	1015608	61/M	1	2	1.15542105	0.656947368	0.45694737	44.82836842	14.65263158	1.163157895	112.4737	1.421105263	0.643052632	0.10636842	ABN	7.563157895	85.93557895
44	1018136	60/F	2	2	1.15687719	0.657157895	0.45715789	44.89484211	14.65964912	1.163157895	112.4035	1.422175439	0.644070175	0.10691228	ABN	7.547368421	85.96480702
45	1019512	56/M	1	2	1.15833333	0.657368421	0.45736842	44.96131579	14.66666667	1.163157895	112.3333	1.423245614	0.645087719	0.10745614	ABN	7.531578947	85.99403509
46	1039929	77/M	1	3	1.15978947	0.657578947	0.45757895	45.02778947	14.67368421	1.163157895	112.2632	1.424315789	0.646105263	0.108	ABN	7.515789474	86.02326316
47	1046574	68/F	1	3	1.16124561	0.657789474	0.45778947	45.09426316	14.68070175	1.163157895	112.193	1.425385965	0.647122807	0.10854386	ABN	7.5	86.05249123
48	1055923	78/F	2	4	1.16270175	0.658	0.458	45.16073684	14.68771930	1.163157895	112.1228	1.426456140	0.648140351	0.10908772	ABN	7.484210526	86.08171930
49	1059099	33/M	2	1	1.16415789	0.658210526	0.45821053	45.22721053	14.69473684	1.163157895	112.0526	1.427526316	0.649157895	0.10963158	ABN	7.468421053	86.11094737
50	1063129	64/M	2	2	1.16561404	0.658421053	0.45842105	45.29368421	14.70175439	1.163157895	111.9825	1.428596491	0.650175439	0.11017544	ABN	7.452631579	86.14017544
51	1065476	86/M	3	4	1.16707018	0.658631579	0.45863158	45.36015789	14.70877193	1.163157895	111.9123	1.429666667	0.651192982	0.11071923	ABN	7.436842105	86.16940351
52	1066219	85/M	1	3	1.16852632	0.658842105	0.45884211	45.42663158	14.71578947	1.163157895	111.8421	1.430736842	0.652210526	0.11126316	ABN	7.421052632	86.19863158
53	1066312	60/M	1	2	1.16998246	0.659052632	0.45905263	45.49310526	14.72280702	1.163157895	111.7719	1.431807018	0.653228071	0.11180702	ABN	7.405263158	86.22785965
54	1065868	95/M	1	4	1.17143866	0.659263158	0.45926316	45.55957895	14.72982456	1.163157895	111.7018	1.432877193	0.654245614	0.11235088	ABN	7.389473684	86.25708772
55	1062769	40/M	2	1	1.17289474	0.659473684	0.45947368	45.62605263	14.73684211	1.163157895	111.6316	1.433947368	0.655263158	0.11289474	ABN	7.373684211	86.28631579
56	1063446	81/F	2	3	1.17435088	0.659684211	0.45968421	45.69252632	14.74385965	1.163157895	111.5614	1.435017544	0.656280702	0.1134386	ABN	7.357894737	86.31554386
57	1062980	38/M	2	2	1.17580702	0.659894737	0.45989474	45.759	14.75087719	1.163157895	111.4912	1.436087719	0.657298246	0.11398246	ABN	7.342105263	86.34477193
58	1068717	65/M	1	3	1.17726316	0.660105263	0.46010526	45.82547368	14.75789474	1.163157895	111.4211	1.437157895	0.658315789	0.11452632	ABN	7.326315789	86.374
59	1071104	75/M	2	3	1.17871933	0.660315789	0.46031579	45.89194737	14.76491228	1.163157895	111.3509	1.43822807	0.659333333	0.11507018	ABN	7.310526316	86.40322807
60	1071528	65/F	2	2	1.18017544	0.660526316	0.46052632	45.95842105	14.77192982	1.163157895	111.2807	1.439298246	0.660350877	0.11561404	ABN	7.294736842	86.43245614