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# A PROSPECTIVE STUDY ON THE FUNCTIONAL OUTCOME OF PROXIMAL FIBULAR OSTEOTOMY IN GRADE 2 AND 3 MEDIAL COMPARTMENT ARTHRITIS OF THE KNEE.

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**ABSTRACT** **Introduction:** Osteoarthritis of the knee is a common musculoskeletal diseases affecting a major population in India. It can impact the individual's functions and activities of daily living. Total knee arthroplasty may raise controversy when treating the younger, athletic patient with arthritis. Arthroscopic debridement, high tibial osteotomy, unicondylar knee arthroplasty, and total knee arthroplasty allow younger patients to maintain an active, healthy lifestyle but can take a longer time to rehabilitate. PFO could be used as an alternative procedure. The Proximal Fibular Osteotomy, which provides immediate short term relief in cases with medial compartment osteoarthritis. Resecting a segment of fibula, loosens the lateral side allowing the upper tibia to settle into a more favorable lateral alignment, shifting the mechanical axis towards neutral or valgus. **Aims & objectives:**

- To assess the functional, clinical and radiological outcome of proximal fibular osteotomy in grade 2 and 3 OA of knee and followed up for 1 year.
- The clinical and functional outcome is accessed by Knee Society Score and VAS observed pre-op , post-op ,3 months ,6 months and 12 months.
- The improvement in radiology is accessed using change in the medial joint space improvements in CP angle, change in the ratio of medial joint space to lateral joint space observed pre-op and post-op

**Methodology:**
The patients selected had grade 2 and 3 Osteoarthritis of knee according to Kellgren Lawrence classification between the age groups 20yrs-80yrs and are admitted to RajaRajeswari Medical College and Hospital, Bangalore. The Sample Size is 30 and is calculated based on previous studies as well as approximate availability of number of cases in the above mentioned duration satisfying inclusion and exclusion criteria. Clinical, functional and radiological outcome were used, Results were calculated using Knee Society Scoring Scale score. **Conclusion:** This study suggested that Proximal Fibular Osteotomy is an alternative procedure that can be used to treat medial compartment knee Osteoarthritis, if the patients are selected carefully. Patients followed up for one year showed a significant improvement in radiological, clinical and functional outcomes and thereby is an effective method of treatment in younger patients with Grade 2 and Grade 3 Osteoarthritis with an average BMI of 26.2.

**KEYWORDS :** Proximal fibular osteotomy, Medial compartment OA, KSS score.

## INTRODUCTION:

Osteoarthritis (OA) is one of the most common forms of musculoskeletal diseases worldwide [9]. It is a major and growing public health problem with a sizeable impact on individuals' functional capacity and the ability to perform activities of daily living. [3]

It is estimated that 3.8% of the world's population suffer from symptomatic knee OA [10], which equates to approximately 277 million people living with knee OA worldwide [11]. The prevalence of OA is similar across the globe [10]and it is expected to increase dramatically as the population ages, especially in low and-middle income nations [12,13]. OA was estimated to be the 10th leading cause of nonfatal burden [6,7]

Osteoarthritis is the second most common rheumatologic problem and it is the most frequent joint disease with a prevalence of 22% to 39% in India [4,7] and incidence of 30% in the population elder to 60 years [30]. The prevalence of knee OA in rural and urban India is estimated to be 3.9% and 5.5%, respectively [10,14].

OA is more common in women than men, but the prevalence increases dramatically with age [4,6,7]. Nearly, 45% of women over the age of 65 years have symptoms while radiological evidence is found in 70% of those over 65 years [6,7,15].

OA of the knee is a major cause of mobility impairment, particularly among females [16,15]. The mean body mass index (BMI) was 25.6 kg/m2. [8]

Pathological changes in the late stage of OA include softening, ulceration, and focal disintegration of the articular cartilage. Synovial inflammation also may occur [6,7,5].

Typical clinical symptoms are pain, particularly after prolonged activity and weight-bearing; whereas stiffness is experienced after inactivity [6]. It is also known as degenerative arthritis,

which commonly affects the hands, feet, spine, and large weight-bearing joints, such as the hips and knees [4,6].

Most cases of OA have no known cause and are referred to as primary OA [7]. Primary osteoarthritis is mostly related to aging [4,6]. It can present as localized, generalized, or as erosive OA [7,15]. Secondary osteoarthritis is caused by another disease or condition [15].

Kellgren-Lawrence (K-L) grades 1 and 2 were most common with 35.0% and 31.1% of patients falling in these categories, respectively. [8]

Its prevalence increases with age and generally affects women more frequently than men. OA is strongly associated with aging and heavy

physical occupational activity, a required livelihood for many people living in rural communities in developing countries. Determining OA prevalence and risk factor profiles will provide important information for planning future cost effective preventive strategies and health care services [4].

The majority of patients had previously been prescribed medications (91.6%), supplements (68.6%), and non-pharmacological (81.9%) treatments to manage their knee OA. [8]

Non-surgical treatment involves patient education, lifestyle modification and the use of orthotic devices. These can be achieved in the community. Surgical options include joint sparing procedures such as arthroscopy and osteotomy or joint-replacing procedures. Joint-replacing procedures can be isolated to a single compartment such as patellofemoral arthroplasty or uni-compartmental knee replacement or total knee arthroplasty. [1]

Total knee arthroplasty has been extremely successful in elderly patients with osteoarthritis. However, there is considerable controversy regarding how best to treat the younger, athletic patient with advanced arthritis. When properly indicated, arthroscopic debridement, high tibial osteotomy, unicondylar knee arthroplasty, and total knee arthroplasty allow younger patients with arthritis to maintain an active, healthy lifestyle. [2,24]

At the time of their clinic visit, over half of the surgeons (56.2%) indicated that they would also consider other surgical options such as knee realignment surgery. [8]

In healthy knees, the medial compartment bears 60% to 80% of the load as the mechanical axis is more frequently medial to the center of the knee joint [32]

Total Knee Arthroplasty (TKA), which is a gold standard treatment for late-stage OA [27], unicompartmental knee replacement and High Tibial Osteotomy (HTO) are commonly used procedures for OA of the knee [17,28,20]. Though total knee arthroplasty corrects alignment, relieves pain, and improves function, it may not be the treatment of choice in relatively younger, active patients or patients with moderate OA [22,24].

However, these procedures are relatively costly, complex and unsuitable either for young patients or patients with severe comorbidities that have the potential to cause complications or even death at the time [17] And some patients require multiple revisions. [22]

HTO procedure is a surgical treatment option for young patients with osteoarthritis in the medial compartment part of the knee [23] but also has some disadvantages including the delay of patients undergoing full-weight bearings (FWB), increased risk of nonunion and delayed union, peroneal nerve paralysis and surgical wound infection (SSI) [18,19,31].

Several other surgical procedures have been developed to prevent the progression of OA, including Proximal Osteotomy Fibula (PFO) [20,21].

Most patients made less than Rs300,000 annually (62.2%) and did not have health insurance (69.3%). Approximately half of the patients had a comorbid disease at the time of the assessment (54.2%). Common comorbidities included hypertension (40.8%), diabetes (24.4%), and osteoporosis (11.8%). [3]

Therefore, PFO could be an alternative procedure in most developing countries that are still constrained by funding and advanced instrumentation. (22)

The Proximal Fibular Osteotomy, which provides excellent short to medium term relief in cases with medial compartment osteoarthritis. [30,26] With increasing age reduction of bone mass is a common occurrence. in knee joints too, a gradual increasing varus occurs with age causing medial compartment arthritis [33]. Resecting a segment of fibula, loosens the lateral side Resecting a segment of fibula, loosens the lateral side allowing the upper tibia to settle into a more favorable lateral alignment, shifting the mechanical axis towards neutral or valgus [34,25].

In accordance with the previous article, the procedure of proximal fibular osteotomy can be used as an alternative to total knee replacement and high tibial osteotomy procedures. In addition, patients can still undergo a total knee replacement if needed. [19]

PFO is a reliable, and safe alternative to both HTO and uni-compartmental replacement. [30]

## METHODOLOGY:

Subjects who have grade 2 and 3 OA of knee above the age of 18 years and are admitted to RajaRajeswari Medical College and Hospital, Bangalore Satisfying the inclusion criteria are taken for this study. Cases selected from the patients with grade 2 and 3 OA who need uni-compartment arthroplasty, after taking consent, will be analyzed clinically and radiologically. All the patients selected for the study will be examined according to protocol, clinical and laboratory investigations will be carried out in order to get fitness for surgery. Post-operated patients will be followed up for 6months.

**Study design:** A Prospective Analytical study.

**Study period:** Cases satisfying the inclusion criteria admitted in RRMCH, Bangalore during the study period of October 2019 to May 2021 will be included.

**Sample size estimation:** The Sample Size is 30 and is calculated based on previous studies as well as approximate availability of number of cases in the above mentioned duration satisfying inclusion and exclusion criteria

All cases meeting the inclusion criteria of both sex presenting with grade 2 and 3 OA of knee centered in Hospital attached to Rajarajeshwari Medical College and Hospital, Bengaluru.

**ETHICAL CLEARANCE:** Obtained from the institutional ethics committee.

## INCLUSION CRITERIA:

1. Grade 2 and 3 (KL grade) primary osteoarthritis of knee.
2. Unfit for Uni-compartment knee replacement or HTO. 3.Both gender.
4. Ages above 18 years
5. The BMI < 33 kg/m 2
6. Medial compartment arthritis with significant symptoms of medial joint pain.
7. Candidates who would, otherwise, be suitable for HTO or uni-compartmental knee arthroplasty.
8. Varus angulation <15degrees.

## EXCLUSION CRITERIA:

1. Subjects who had pathological fracture other than osteoporosis.
2. Subjects who were non ambulatory, prior to the fracture.
3. Evidence of recent surgery in the affected knee;
4. History of tumor in the affected knee or proximal skeletal structure
5.History of fracture in the tibial plateau, femoral condyle, or patella.
6.Patients with fixed flexion deformity. 7.Patients with patella-femoral arthritis

## DATA ANALYSIS:

The collected data will be evaluated using descriptive and interferential statistics (MS excel and using SPSS version 24). The categorical variables will be described by means of frequency and percentages and presented graphically whenever necessary. For quantitative data it will be described using descriptive statistics means and 95 percent confidence interval and will be presented graphically whenever necessary. P value ≤0.05 will be considered statistically significant

## Results

There were 30 patients who underwent surgery under sterile aseptic condition and the average age of the patients were 44 years and 26.17average BMI. The KSS score of each patient was evaluated.

### Clinical assessment-

KSS1 score was 13% Excellent ,36% Good, 43% Fair and 6% Poor at 12 Months

### Functional assessment-

KSS2 score at 12 weeks was 43% Excellent ,43.3% Good ,0% Fair and 13% Poor at 12 Months.

**BMI and KSS score-**
It was found that there was a correlation with BMI and improvement in the KSS score.

**Radiological assessment –**
The average change in post op CP angle was 2.0 degrees, increase in medial joint line was 2.16cm and decrease in lateral joint line was 2cm and ratio between medial and lateral joint space 1.04 which was significant.

**Clinical outcome**
In the study 73% had improvement, 20% had no significate difference and 7% had worsening of symptoms.

There were 20 males and 10 females. From them 10 were grade 2 and 20 were grade 3, from them 16% had BMI above 26 and 40% had BMI <26.The average age was 37yr for grade 2 and 47yr for grade 3. The average BMI 25.9 for grade 2 and 26.2 for grade 3.

Comparison of BMI with KSS scores showed p value < 0.05 and improvement in score for BMI <26 and worsening of score >26.The score was also seen to decrease at higher grade.

Radiological outcome was accessed by increase in medial joint line from 1.96 to 2.16 the CP angle changed from 3.5 to 2.07. The lateral joint line decreased from 2.38 to 2.16.

The KSS1 score pre-op was 6.6% Good ,13.3% Fair and 80.7% Poor and after post op 1 year 13% Excellent ,36% Good ,43.3% Fair and 6.7% Poor.

Based on KSS 2 at pre-op 3.33% Excellent ,26.66% Good ,46.66% Fair and 23.33% Poor

when compared to KSS 2 score at 1 year 43% Excellent ,43% Good ,0% Fair and 13% Poor.

The VAS decreased from 5 pre-op to 3 post op 12 months which says that the pain decreases when the patent receives physio and range of movement exercises. The KSS score was seen to increase after 6 months.

It was understood that for better outcome the procedure needed careful selection of patients which had less flexion deformity and no patella femoral arthritis. This surgery maintains the normal morphology of the knee joint. This surgery resulted in limb realignment and pain relief in most of the patients.

## DISCUSSION

This study was done to access the clinical and functional outcome of PFO to relive medial joint line pain and also restore patient daily routine following the surgery. It was a prospective study was conducted on 30 patients in the age group of 18 to 60 years, at Rajarajeswari Medical College & hospital, Bangalore from the period November 2019 to August 2021.

30 patients were taken in OPD basis out of which grade 2 and grade 3 OA knee patients were selected with average age of 43.09 years with 8 females and 22 males which were taken for surgery after counseling. Patients were followed up post op,3momths ,6 months and 1 year. Post-operatively the patient was made to bear weight, x-ray taken to access medial joint space increase, relief of pain using VAS scores and the functional outcome of the surgery was addressed using KSS.

In my study pre operatively 80% of patients had poor Knee Society Score grading while Post operatively at 1year 43% fair, 36% patients had good and 13% had excellent Knee Society Score Grade. Pre-operative mean of the medial joint space of 30 patients was 1.95 mm and the mean of medial joint space at immediate post op was 2.15mm. The pre-operative mean (SD) VAS was 6.53 and at final follow up 3.13. Post-operative the lowest VAS score was 3 and the highest was 7 mostly attributed to surgical site pain. Mean condyl-plateau Angle pre-operatively was 3 degrees and immediate post-operatively was 2 degrees.

Patient was made to actively perform quadriceps strengthening exercise and analgesics given and started on physio from day 1 post op. It was noticed that 12 patients with BMI< 26 in my study group showed better outcome with the surgery and the higher BMI individual required longer duration of physiotherapy. Two patents had worsening of symptoms mostly attributed improper physiotherapy regime and higher BMI. The remaining patients said they had minimal improvement in pain but with physio and analgesics were able to mobile and climb stairs pain free after 2 months' post-surgery.

Complications like EHL weakness and CPN palsy were not seen and there was significant improvement in VAS and significant increase in Knee Society Score.

Zhang et al., in 2015 did study on 47 patients who underwent proximal fibular osteotomy for medial compartment osteoarthritis and were retrospectively followed up. He had succeeded in discovering PFO techniques as a new surgical technique to significantly relieve pain in a relatively short time to improve joint function, to allow postoperative ambulation conditions, and to restore joint space on the medial side of the knee. [19]

Juan Wang, MD et al., in 2019 performed a retrospective study in the Third Hospital of Hebei Medical University where he took Weight-bearing full-leg anteroposterior (AP) radiographs of 280 adults (560 knees) obtained from 1 January 2018 to 31 October 2018 were enrolled according to their inclusion and exclusion criteria, including 157 men and 123 women, with an average age of 50.3±14.8 years (range, 19–80 years). He discovered Anatomical Adaptation of Fibula and how Proximal Partial Fibulectomy can relieve symptoms in patients with Medial Compartment Knee Osteoarthritis [34]

L Prakash in 2019 conducted a study in Chennai from 2006 to 2017 with a total of 51 patients (87 knee joints) with medial compartment OA who were treated by proximal fibular osteotomy by the him. While as from 2015 to 2017, 37 patients, (62 additional knee joints) were treated by the second author. Totally 149 knee joints in 88 patients were treated with Proximal Fibular Osteotomy for patients with Medial Compartment Arthritis of the Knee with Varus Deformity. He concluded that PFO is a simple easy procedure for early medial compartment arthritis of the knee and causes a significant reduction in pain, and restoration of function. [29]

Dwikora Novembri Utomo et al., in 2018, conducted a study in hospitals in Surabaya from July to December 2017, collected Data and analyzed on 15 patients. Radiological evaluation on Tibio-femoral Angle and Joint Space Ratio increases significantly. Patient satisfaction evaluation significantly improved. Evaluation using KOOS and Oxford Knee Score also increase significantly. He concluded that Proximal fibula osteotomy could be an alternative to TKA and HTO in late-stage of knee osteoarthritis. [17]

Xiaohu Wang et al., in 2017 conducted a study from January 2015 to May 2015 on 47 patients who underwent proximal fibular osteotomy for medial compartment osteoarthritis and were retrospectively followed up. He found that Medial pain relief was observed in almost all patients after proximal fibular osteotomy and Most patients exhibited improved walking postoperatively. He concluded that proximal fibular osteotomy effectively relieves pain and improves joint function in patients with medial compartment osteoarthritis at a mean of 13.38 months postoperatively. [35]

Bo Liu et al., in 2018 conducted a study to determine the association between preoperational factors and patient's short-term outcome after proximal fibular osteotomy (PFO) and to provide a basis for detailed surgical indication and patient selection. He performed a retrospective study on patients undergoing PFO between January 2015 and December 2015.A total of 84 patients and 111 knees were followed-up. Of these, 17 knees were from males and 94 were from females. According to KL grading, there were 17 knees of grade 2, 47 knees of grade 3, and 47 knees of grade 4. In clinical outcomes, there were 51 knees in the satisfaction group and 77 knees in the significant improvement group. He concluded that the independent factors affecting postoperative clinical outcome after PFO were KSS clinical score, CP angle and medial joint space width. In addition, the independent factors that influenced functional outcome included age, VAS score, KSS score, HKA angle and settlement value. In particular, as objective evidence of radiography, HKA angle and settlement value were less affected by subjective factors and were easy to measure.

Therefore, these two factors could be used as the main bases for patient selection for PFO. [36]

Di Qin 1,2 et al., in 2018 did a prospective study on Fifty-two patients with medial compartment knee OA with varus deformities. Preoperative and postoperative knee function and OA severity were evaluated using the Hospital for Special Surgery (HSS) knee score and the Kellgren–Lawrence (KL) score. Sixty-seven knee joints of 45 patients undergoing PFO were included. The HSS scores were significantly better at the final follow-up than preoperatively. He concluded that PFO is a simple and effective procedure for medial compartment knee OA and Suggested that Greater the distal displacement of the fibular head, greater is the range of motion of the tibiofibular joint and more evident improvement of postoperative OA symptoms. [37]

## LIMITATIONS:

- My study was time constrained and were followed up radiologically only pre-op and post- op and clinically for 12 months so the long-term effects remain unknown.
- The alteration in the hip and ankle joint biomechanics could not be evaluated.
- Our study sample size was small and require a larger size for better assessment of this surgical intervention.
- The sample was selected carefully and the study was not blindfolded.
- Higher grade of osteoarthritis cannot be treated by this surgery.

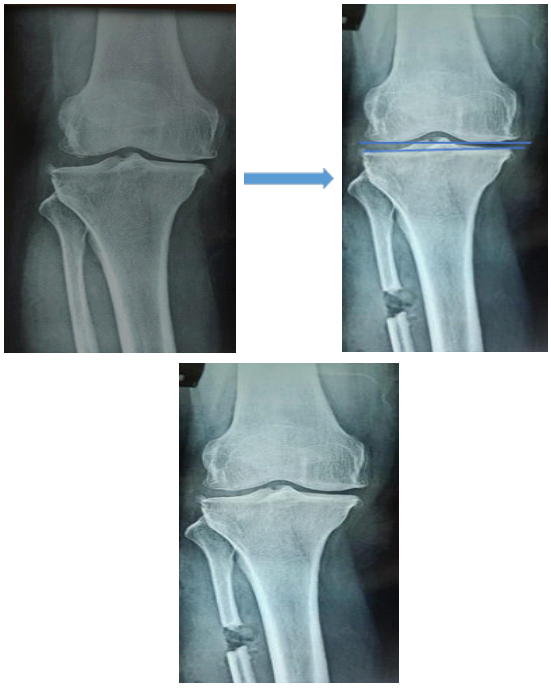
## CONCLUSION

- In my study Proximal Fibular Osteotomy provided good clinical and functional outcome for patients with early onset medial compartment knee Osteoarthritis according to KSS score with fall in VAS at the end of 1 year. The only complication encountered was worsening of pain in 2 patients.
- The followed up patients had improvement in clinical and functional outcomes and was observed that good results were seen in younger patients with Grade 2 and Grade 3 Osteoarthritis with an average BMI of 26.2.
- There was increase in medial joint space and improvement in CP angle according to radiological parameters.
- This is a low cost surgery and can be performed as an adjunct to other definitive surgeries. But should be careful while selecting patients.

Hence proximal fibular osteotomy can be considered as good surgical option

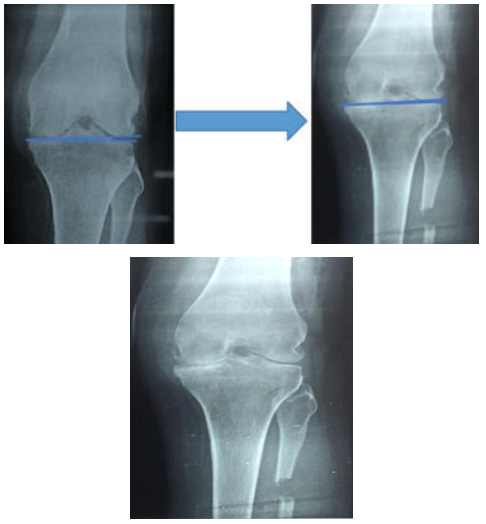
## CLINICALALBUM:

**Case 1 showing improvement**



| Case 1 | Pre-op | Post-op |
|---|---|---|
| Medial joint line | 2cm | 2.6cm |
| Lateral joint line | 2.6cm | 2.2cm |
| CP angle | 4□□ | 3 □ |
| M/L ratio | 0.77 | 1.1 |

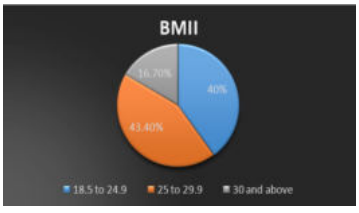
**Case 2 Showing worsening**

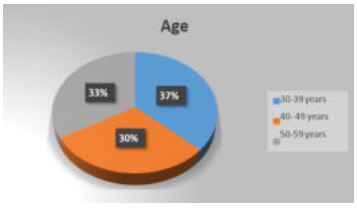


| Case 2 | Pre-op | Post-op |
|---|---|---|
| Medial joint line | 2cm | 1.5cm |
| Lateral joint line | 2.2cm | 2cm |
| CP angle | 3 □ | 1 □ |
| M/L ratio | 0.9 | 0.75 |

## STUDY DISTRIBUTION

| Gender | Number | Percentage |
|---|---|---|
| Male | 20 | 66.7 |
| Female | 10 | 33.3 |
| Total | 30 | 100.0 |




**BMI and KSS score-**

| KSS1 | BMI | | P Value |
|---|---|---|---|
| | <=26 | >26 | |
| Pre | 66.40±1.96 | 61.80±4.18 | 0.001 |
| Post Op | 69.00±2.93 | 65.27±2.82 | 0.001 |
| Post 3 Months | 72.40±3.85 | 66.47±3.07 | 0.0001 |
| Post 6 Months | 75.33±4.79 | 66.07±2.96 | 0.0001 |
| Post 12 Months | 76.53±6.28 | 66.00±3.84 | 0.0001 |

| KSS2 | BMI | | |
|---|---|---|---|
| | <=26 | >26 | |
| Pre | 67.67±6.51 | 55.33±12.46 | 0.003 |
| Post Op | 74.00±6.04 | 62.00±11.46 | 0.002 |
| Post 3 Months | 79.00±3.87 | 62.67±11.63 | 0.0001 |
| Post 6 Months | 79.67±5.49 | 65.33±12.17 | 0.001 |
| Post 12 Months | 81.79±4.21 | 66.67±13.18 | 0.001 |

**Radiological assessment –**

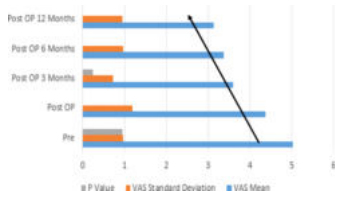
| Duration | CP | | P Value |
|---|---|---|---|
| | Mean | Standard Deviation | |
| Pre | 3.50 | 1.31 | 0.0001 |
| Post OP | 2.07 | 0.74 | |

| Duration | Medial Joint line | | P Value |
|---|---|---|---|
| | Mean | Standard Deviation | |
| Pre | 1.96 | 0.51 | 0.0001 |
| Post OP | 2.16 | 0.43 | |

| Duration | Lateral | Joint | Line | P Value |
|---|---|---|---|---|
| | Mean | Standard | Deviation | |
| Pre | 2.38 | 0.52 | | 0.0001 |
| Post OP | 2.16 | 0.60 | | |

**Improvement of VAS in study participants**

| Duration | VAS | | | P Value |
|---|---|---|---|---|
| | Mean | Standard | Deviation | |
| Pre | 5.03 | 0.96 | | 0.954 |
| Post OP | 4.37 | 1.19 | | |
| Post OP 3 Months | 3.60 | 0.72 | | 0.249 |
| Post OP 6 Months | 3.37 | 0.96 | | 0.009* |
| Post OP 12 Months | 3.13 | 0.94 | | 0.003* |

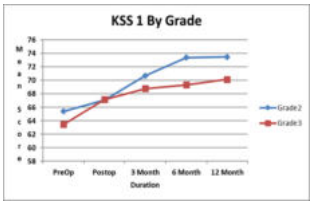


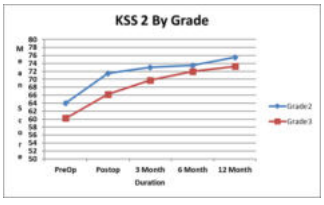

**Functional assessment-**

| Duration | KSS1 | | P Value |
|---|---|---|---|
| | Mean | Standard Deviation | |
| Pre | 64.10 | 3.97 | 0.0001 |
| Post OP | 67.13 | 3.40 | |
| Post OP 3 Months | 69.43 | 4.56 | 0.0001 |
| Post OP 6 Months | 70.70 | 6.13 | 0.0001 |
| Post OP 12 Months | 71.27 | 7.40 | 0.0001 |

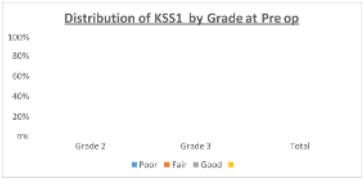
| Duration | KSS2 | | | P Value |
|---|---|---|---|---|
| | Mean | Standard | Deviation | |
| Pre | 61.50 | 11.61 | 0.0001 | |
| Post OP | 68.00 | 10.88 | | |
| Post OP 3 Months | 70.83 | 11.89 | | 0.0001 |
| Post OP 6 Months | 72.50 | 11.79 | | 0.0001 |
| Post OP 12 Months | 74.00 | 12.21 | | 0.0001 |

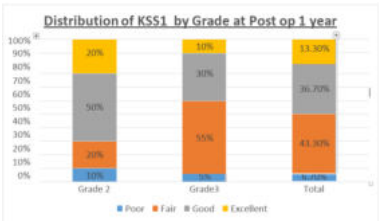
**Functional assessment-**



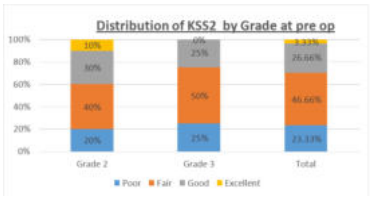



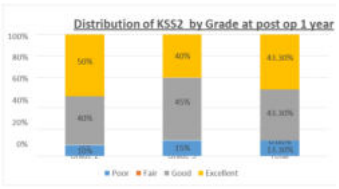

**Functional assessment-(KSS 1)**




**Functional assessment-(KSS 2)**

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