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Comparison of post-operative hip abductor muscle strength and functional outcome between dynamic hip screw and proximal femoral nail in intertrochanteric fracture

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ABSTRACT

Extra capsular intertrochanteric femur fractures occur between femoral neck and lesser trochanter of the femur. However, this study aims to study the influence of restoration of femoral offset in relation to the strength of the hip abductor muscle along with the functional outcomes. In patients with ≥18 years of age that were operated for Intertrochanteric fracture and referred for physiotherapy, a prospective cohort study was performed. On the principles of deep venous thrombosis (DVT) prevention, strengthening exercises, ROM exercises and gait training the patients were given physiotherapy. Once weight bearing was allowed on 6 weeks, their gait parameters (stride length, cadence), functional strength (Unilateral stance test) and Harris Hip Score were measured. The same outcome measures along with the strength of hip abductor muscle were repeated at 6 months as femoral offset is important for restoring anatomy. In conclusion, weak hip abductor muscle strength was exhibited in patients with unrestored femoral offset and better outcomes were reported in patients with Dynamic Hip Screw fixation in comparison to other surgeries in young population. Additionally, the functional status of the patients with more than 70 years of age remained poor in comparison to the younger patients post-operatively.

Keywords: Intertrochanteric fracture, post-operative hip abductor muscle strength

1. INTRODUCTION

Femur intertrochanteric fractures are extra capsular that occur between femoral neck and lesser trochanter of the femur (Lu and Uppal, 2019). Intertrochanteric area of proximal femur is made up of cancellous bone which is rich in blood supply. Hence, the fracture healing is good. Previously this type of fractures was treated conservatively as it has rich blood supply. But

conservative treatment carries its own consequences in the form of prolonged immobilization, disuse atrophy and deconditioning. These days, the surgeon chooses surgical intervention since it results in early mobilization and provides an excellent functional outcome (Lu and Uppal, 2019). These fractures are common in both old as well as young population (Prakash et al., 2022).

Many different implants are in use for fixing Intertrochanteric fractures (Yu et al., 2015; Kumar and Chadha, 2016; Chang et al., 2020; Prakash et al., 2022). Depending on the lateral cortex integrity and stability of the fracture fragments, implants are chosen (Lu and Uppal, 2019). Whichever implant is chosen for the fracture fixation should reduce the fracture to its normal anatomy and achieve the maximum functional outcome which is the main perspective of the surgeons (Thakur et al., 2022).

On functional outcomes post intertrochanteric fracture of femur treated with different implants immense amount of literature is available (Zhang et al., 2014; Chen et al., 2021; Parsurampuriya et al., 2021; Prakash et al., 2022). But we have found none which discusses on reduction of fracture and the functional outcome. Hence, this study aims to study the influence of restoration of femoral offset in relation to the strength of hip abductor muscle along with functional outcomes.

2. METHODOLOGY

It is a prospective cohort study which was approved by Institutional ethical committee with reference number COP/484/07/2022. The study was conducted from July 2022 to December 2022. All the postoperative intertrochanteric fracture patients with ≥18yrs of age and were referred for physiotherapy were screened for the study. Any patients with history of surgery in the ipsilateral hip or contralateral hip, polytrauma, unstable Intertrochanteric fracture or OA of hip joint were excluded from the study. The restoration of normal anatomy was assessed on the post-operative Pelvis with both hips plain radiograph (Buecking et al., 2015; Lima et al., 2017). The restoration of normal anatomy was assessed by the experienced orthopaedic surgeon who had not operated any of the recruited patients. The patients were categorized as 'Restored' or 'Not restored' based on their post-operative radiographs.

The patients were given physiotherapy on the principles of deep venous thrombosis (DVT) prevention, strengthening exercises, range of motion exercises and gait training. The hip abductor muscle strength was assessed using sphygmomanometer (Souza et al., 2014) at post-operative day (POD) 12, 6-weeks and 6 months. The cuff was inflated to 60 mmHg and placed at the lateral side of the distal femur. The cuff was stabilized by the therapist. The patients were asked to abduct the limb against the cuff. Total 3 trials were conducted and average of the 3 trials was recorded. At the time of discharge, the patients were informed to continue the exercises till next follow up. On every follow up, the patients were assessed and tailor –made exercises were taught. Once weight bearing was allowed on 6 weeks, their gait parameters (stride length, cadence), functional strength (Unilateral stance test) and Harris Hip Score were measured. The same outcome measures along with the hip abductor muscle strength were repeated at 6 months.

3. RESULTS

The distribution of patients according to their age demonstrated that 8 patients were between 41-50 years of age, 3 patients were between 51-60 years, 8 were between 61-70 years, 9 were between 71-80 years and 2 were between 81-90 years of age-group. Figure 1 and 2 illustrates comparison of strength of muscles following dynamic hip screw (DHS) fixation between 41-50 years and 51-70 years of age group respectively.

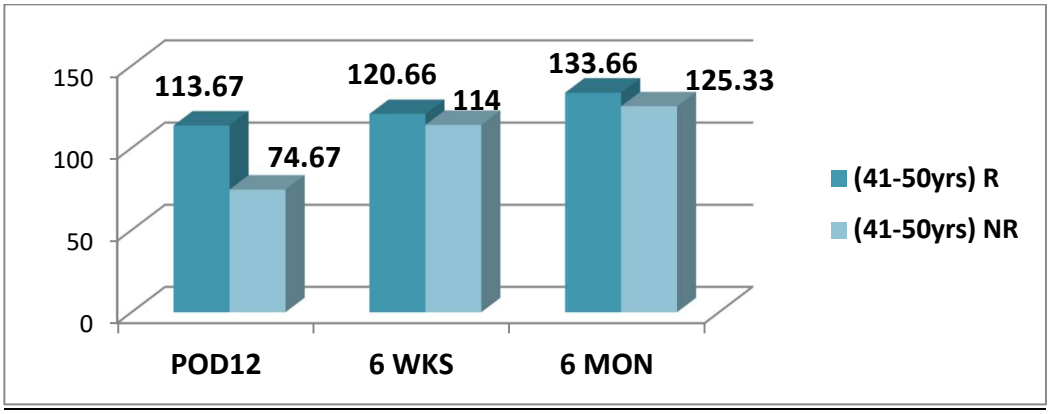

Figure 1 Comparison of strength of muscle between patients with restored and unrestored femoral offset following dynamic hip screw fixation in the age-group between 41-50 years

wks = weeks, mon = months, R = restored, NR = Not restored

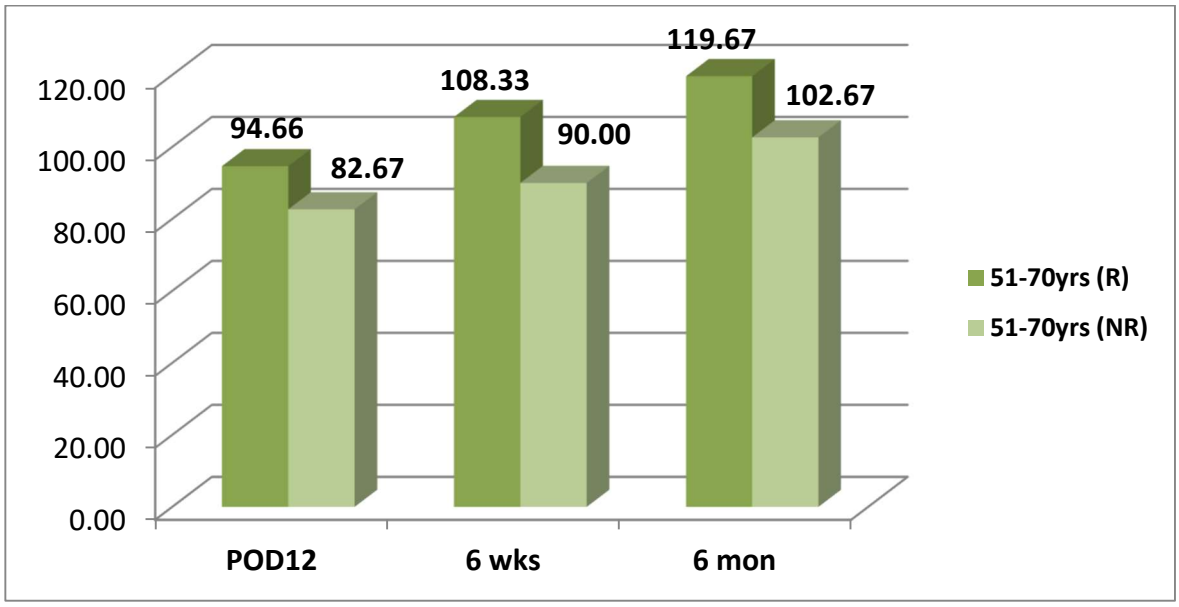

Figure 2 Comparison of strength of muscle between patients with restored and unrestored femoral offset following DHS fixation in the age-group between 51-70 years

POD = Post-operative Day, wks = weeks, mon = months, yrs = years, R = restored, NR = Not restored

Figure 3, 4 and 5 depicts comparison of strength of muscle following proximal femoral nail (PFN) fixation in the age-group between 41-50 years, 51-70 years and 71-90 years respectively. Figure 6 illustrates comparison of strength of muscle following cemented total hip arthroplasty in the age-group between 71-80 years.

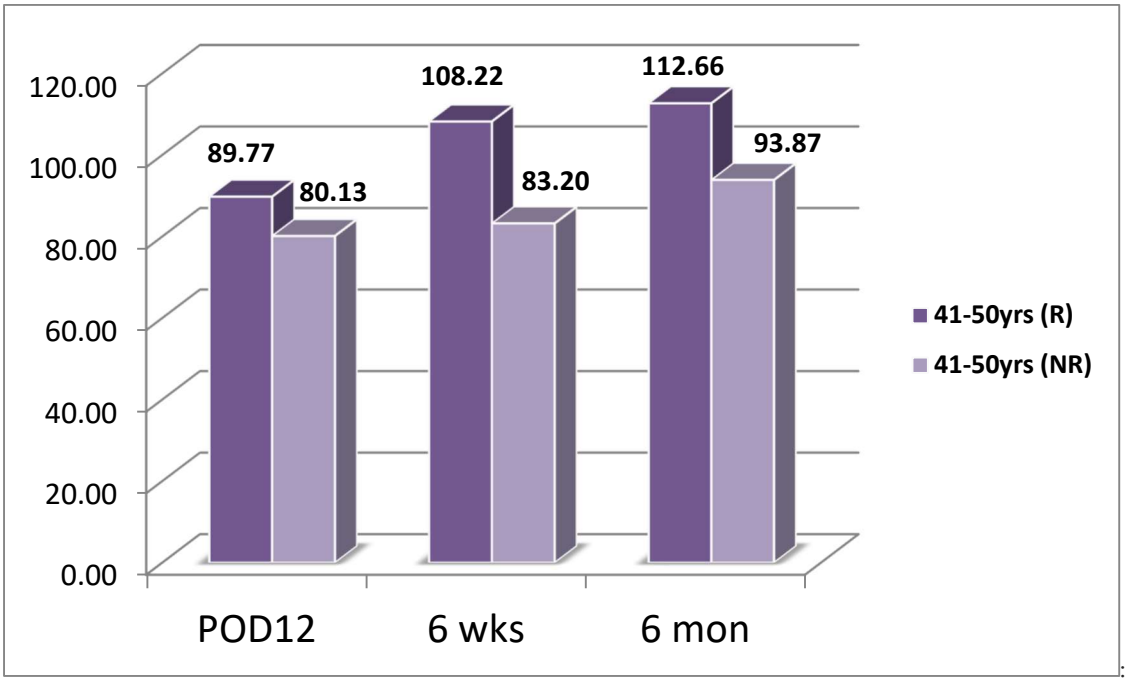

Figure 3 Comparison of strength of muscle between patients with restored and unrestored femoral offset following proximal femoral nail (PFN) fixation in the age-group between 41-50 years

POD = Post-operative Day, wks = weeks, mon = months, yrs = years, R = restored, NR = Not restored

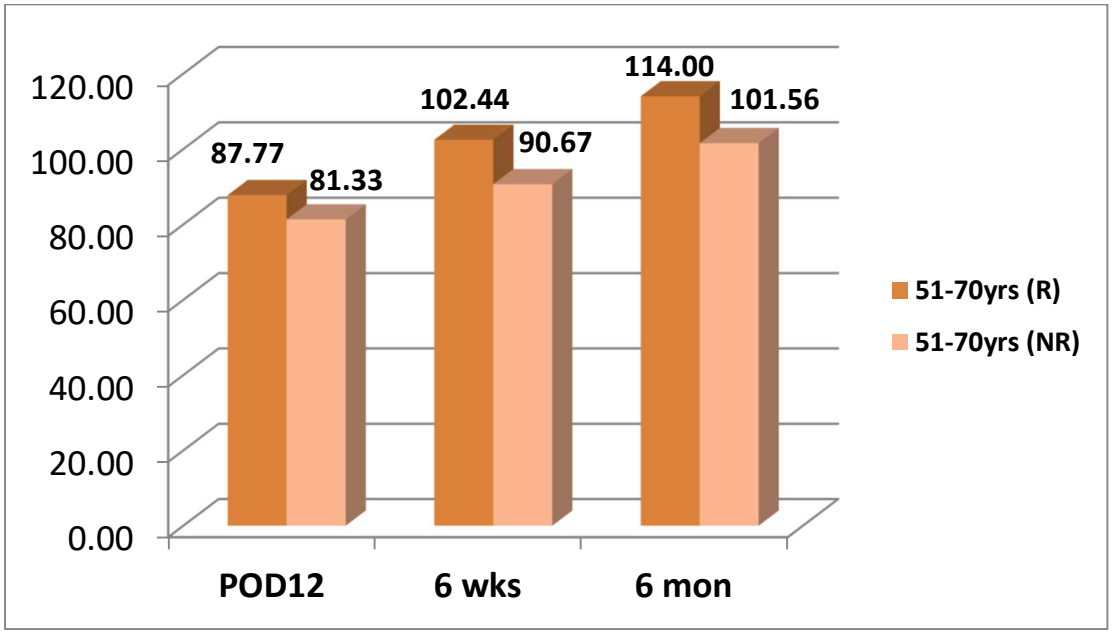

Figure 4 Comparison of strength of muscle between patients with restored and unrestored femoral offset following PFN fixation in the age-group between 51-70 years

POD = Post-operative Day, wks = weeks, mon = months, yrs = years, R = restored, NR = Not restored

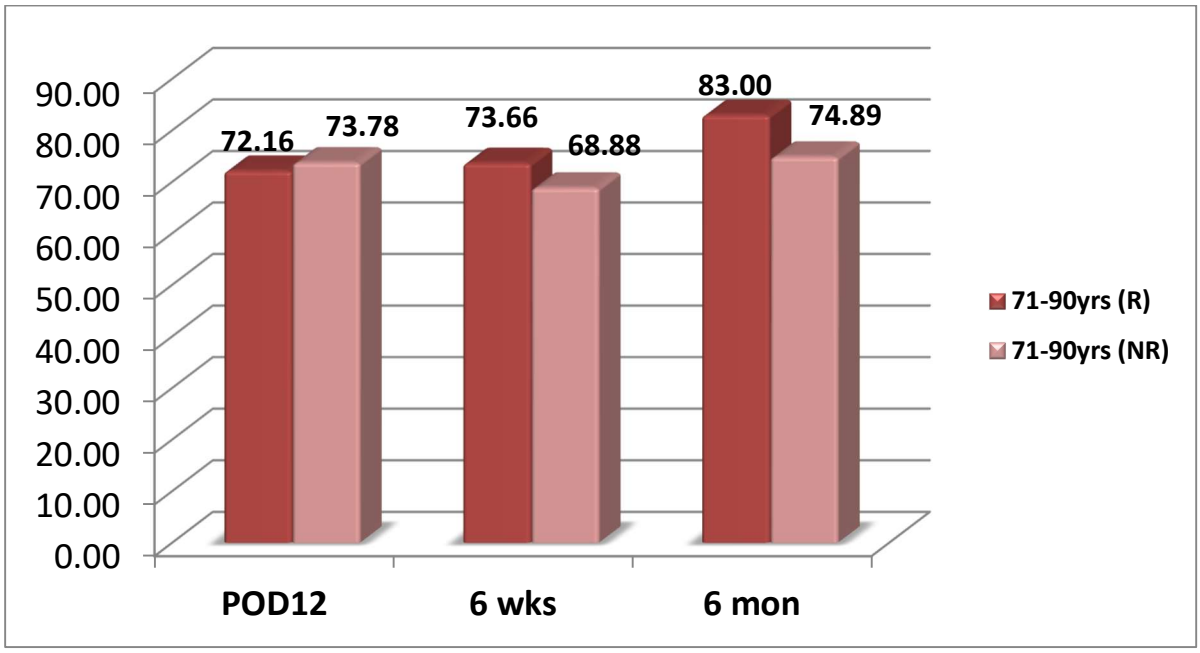

Figure 5 Comparison of strength of muscle between patients with restored and unrestored femoral offset following PFN fixation in the age-group between 71-90 years

POD = Post-operative Day, wks = weeks, mon = months, yrs = years, R = restored, NR = Not restored

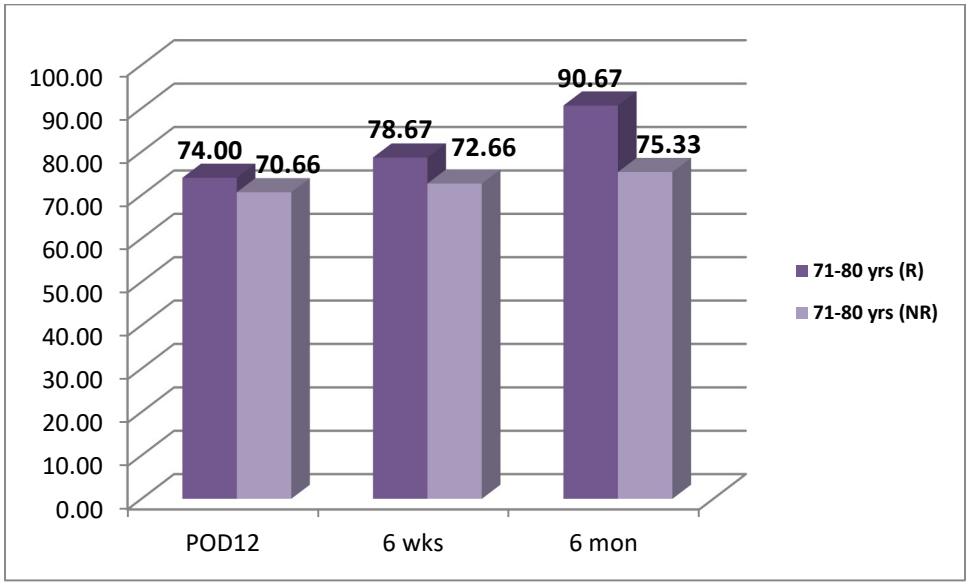

Figure 6 Comparison of strength of muscle between patients with restored and unrestored femoral offset following cemented total hip arthroplasty in the age-group between 71-80 years

POD = Post-operative Day, wks = weeks, mon = months, yrs = years, R = restored, NR = Not restored

4. DISCUSSION

This study aimed to assess the influence of restoration of femoral offset on hip abductor muscle strength along with functional outcomes in patients who underwent surgery for Intertrochanteric femur fracture. After any trauma, restoration of femoral offset is evaluated by functional performance as well as daily living and return to occupations.

Total 30 patients with mean age 64 yrs (42-85 yrs) were recruited for the study. Of these 30 patients, 14 were females and 16 were males. Majority of patients (27) were operated with lateral (Patel and Golwala, 2023) approach, 02 patients with posterolateral approach and 01 patient with posterior approach. In this study, 14 patients were operated using Proximal Femoral Nailing (PFN) (Singh, 2021) and with Dynamic Hip Screw (DHS) 12 patients were operated (Kumar and Chadha, 2016), 03 patients underwent cemented Total Hip Arthroplasty (THA) (Yuan et al., 2017) and 01 patient underwent cement less Total Hip Arthroplasty (Chang et al., 2020).

Femoral offset was measured on the plain radiographs – Anteroposterior view (Buecking et al., 2015). Out of 12 patients which were operated using DHS, 09 restored the femoral offset and 03 did not restored the femoral offset compared to the contralateral limb. In PFN group, out of 14 patients, 08 restored the femoral offset and 06 did not restore the femoral offset compared to the contralateral limb. In cemented THA patients, 02 restored the femoral offset. Only 01 patient underwent cement less THA and had restored femoral offset.

Strength of hip abductor muscle

In the present study, we noticed that all the patients who had restored femoral offset postoperatively (whether operated using DHS or PFN or cemented THR) showed improvement in hip abductor muscle strength from POD 12 to 6 months than the patients showing unrestored femoral offset.

In DHS fixation patients, on comparing patients with 41-50 yrs of age with 51-70 yrs patients with restored femoral offset post-surgery, it was observed that younger age group showed more muscle strength than older age group from POD 12 to 6 months (Kumar et al., 2012). The same was noticed in patients with PFN fixation after Intertrochanteric fracture. When comparing 41-50 years aged patients with 51-70 years, like DHS, younger patients (41-50 yrs) showed more strength than older (51-70) patients from POD 12 to 6 weeks except at 6 months. At 6 months, the older group showed better strength than the younger patients. However, the difference was very minimal.

In PFN fixation with restored anatomy following surgery, the geriatric (71-90 yrs) patients showed least muscle strength from POD 12 to 6 months than patients with 41-50 yrs and 51-70 years of age. Comparison between DHS and PFN fixation patients with restored femoral offset showed increased muscle strength in DHS fixation (Hakim et al., 2019) patients than in PFN fixation patients from POD 12 to 6 months (Table 2, 3, 4, 5). In Kumar et al., (2012) DHS and PFN were compared for functional outcome which concluded that DHS showed better results in younger patients. In a study abductor muscle strength in patients operated with PFN

for intertrochanteric fractures concluded that weakness in abductor muscle strength persisted after the surgery which was often overlooked and hence suggested for a physiotherapy program for abductor muscles (Wale et al., 2018).

On comparing PFN fixation with cemented Total Hip Arthroplasty in geriatric patients (71-90 years) who had restored femoral offset following surgery, showed more muscle strength in THR patients from POD 12 to 6 months than in PFN fixation patients (Chen et al., 2021). The findings of the present study were supported by a previous study which concluded that if the anatomy is restored, the abductor muscle strength seems to be restored to near normal irrespective of the fracture type (Patil and Dhanda, 2020). Hence, the study results suggests that the patients with restored femoral offset postoperatively have improved hip abductor muscle strength compared to not restored hip abductor muscle strength.

It was observed that the muscle strength showed more improvement at 6 months follow up. This result was consistent with Ivanona et al., (2011) findings, which stated that a fractured leg's strength-generating capacity had significantly improved over the course of a 6-month follow-up.

Functional outcome

Femur intertrochanteric fractures in progressing age group results in morbidity, hospitalization and mortality. This study observed the functional recovery using Harris Hip Score (HHS) and the influence of different implants on functional performance. Highest functional performance was seen in DHS fixation patients (41-50 yrs). They had mean score of 91.2 (Excellent) on HHS. PFN fixation patients (41-50 yrs) had mean core of 83.33 (Good). Patients at 6 months of surgery with DHS fixation (51-70 yrs) and PFN fixation (51-70 yrs) had mean score of 80 and 78.66 on HHS. Geriatric patients with age 71-90 yrs who underwent total hip replacement had mean score of 71.33 and PFN had mean score of 70.25 on HHS at 6 months post-surgery. In a study, it was suggested that the geriatric patients' muscle strength was weak and never achieved pre-fracture level (Wale et al., 2018).

Total 3 patients operated for cemented THR, had Fair score and again these patients were geriatrics with mean age 74.67 years. These observations were similar to the study which reported significantly higher atrophy score in patients with ≥65 yrs of age of gluteus medius (hip abductor) on the affected side compared to the normal side (Erinç et al., 2020). Hence, the study findings revealed that the muscle strength of the operated limb in the geriatric patients having ≥ 70 yrs does not reach to its contralateral sound limb.

Also, pathology of fractures (whether stable or unstable), the type of implant used, the operative techniques and the comorbidities in elderly patients are all factors that may affect the outcome functionally of intertrochanteric fractures (Patil and Dhanda, 2020).

5. CONCLUSION

Femoral offset plays an important role as a measure for restoration of anatomy. Patients with unrestored femoral offset exhibited weak strength of hip abductor muscle. Patients with Dynamic Hip Screw fixation showed better results than other surgeries in young patients. Post-surgery functional status of the patients (>70 yrs) remained poor in comparison with younger population.

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Author's contribution

Niketa Patel conceptualized and prepared the original draft. Niketa Patel and Paresh Golwala approved the final draft before submission. The final manuscript was reviewed and approved by both the authors.

Ethical approval

The study was approved by the Medical Ethics Committee of Sumandeep Vidyapeeth Deemed to be University, Vadodara, Gujarat, India. Ethical Approval Code: COP/484/07/2022.

Informed consent

Written and Oral informed consent was obtained from all individual participants included in the study.

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This study has not received any external funding.

Conflict of interest

The authors declare that there is no conflict of interests.

Data and materials availability

All data sets collected during this study are available upon reasonable request from the corresponding author.

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