Oshada; Jurnal Kesehatan
https://nawalaeducation.com/index.php/O/index
Volume 2 Nomor 6, December 2025
e-ISSN : 3047-017X
DOI : https://doi.org/10.62872/p9t9kn67

Outcome of Patients with OA Grade III/IV, with Ligament Laxity Undergoing Proximal Fibular Osteotomy with Lateral Bending Gait and Dextrose 10% Injection : A Case Series

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Input : October 27, 2025
Revised : November 22, 2025
Accepted : December 16, 2025
Published :December 29, 2025

ABSTRACT

Knee osteoarthritis (OA) with varus deformity and ligament laxity presents a complex clinical challenge, particularly in patients experiencing chronic pain, joint instability, and functional limitations. While Total Knee Arthroplasty (TKA) remains the gold standard for severe OA, not all patients are willing or have access to this procedure. Proximal Fibular Osteotomy (PFO) has emerged as a minimally invasive and cost-effective alternative, which can be combined with rehabilitative and regenerative approaches to optimize function. This case series reports two female patients aged 55 and 62 years with grade III and IV knee OA, genu varus deformity, and mild-to-moderate ligament laxity, without a history of major trauma. Clinical examination revealed medial compartment pain, limited range of motion (ROM), and knee instability during gait. The patients underwent PFO, followed by lateral trunk lean gait training using video-assisted education and mirror exercises, and intra-articular injection of 10% dextrose to enhance ligament stability. Interventions were conducted over two months with periodic rehabilitation monitoring. Clinical evaluation using the Knee Society Score (KSS), Visual Analog Scale (VAS), and ROM demonstrated significant improvements. KSS scores improved across pain, function, satisfaction, and activity domains. VAS scores decreased from 8 to 2 (Mrs. Ng) and 7 to 1 (Mrs. Su), representing ≥75% pain reduction. ROM increased from 100° to 125° (Mrs. Ng) and 110° to 130° (Mrs. Su). Both patients were able to ambulate without assistive devices within 3–4 weeks; Mrs. Su reported no ongoing complaints, while Mrs. Ng experienced only mild fatigue and calf tension. PFO effectively reduced medial compartment pressure, lateral trunk lean gait modified knee biomechanics, and 10% dextrose supported ligament stability. This multimodal approach is a promising conservative strategy or bridge to TKA, improving function, reducing pain, and enhancing quality of life, particularly in resource-limited settings or in patients refusing TKA.

Keywords: Osteoarthritis Knee , Proximal Fibular Osteotomy, Lateral Gait , Dextrose, Ligament Laxity

INTRODUCTION

Knee osteoarthritis (OA) is a leading cause of joint pain and functional disability in adults and the elderly. In medial compartment OA, excessive pressure on the inner aspect of the knee joint causes progressive cartilage degeneration, often accompanied by varus deformity and ligament instability. Management of advanced knee OA remains a clinical challenge, particularly for patients who are not ready for total knee arthroplasty (TKA) or have limitations in their ability to undergo invasive procedures. One emerging surgical approach is *Proximal Fibular Osteotomy* (PFO). This technique aims to reduce the load on the medial compartment of the knee by altering pressure distribution through proximal

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fibular resection. According to Wang et al. (2020), PFO has been shown to be effective in reducing pain and improving knee function in patients with medial compartment OA with genu varus deformity, with a relatively low risk of complications and rapid recovery. However, clinical outcomes can vary, and some patients still experience residual pain or functional impairment after surgery. PFO is becoming an increasingly popular alternative intervention for the following reasons:

1. Minimal Cost PFO is a simple procedure, does not require expensive implants like TKR, and can be performed in hospitals with limited facilities. Wang et al. (2020) emphasized that PFO is a cost-effective approach ideal for patients with financial constraints (Wang et al., 2020. J Orthop Surg Res, 15:203).
2. Minimal Equipment: The PFO procedure requires only basic orthopedic equipment such as a bone saw and standard surgical instruments, without the need for prostheses or complex navigation technology. This makes the PFO highly suitable for use in regional hospitals or primary care centers (Luo et al., 2022. BMC Musculoskelet Disord).
3. Maintaining Natural Joint Motion. Unlike TKR, which replaces the joint surface, PFO preserves the patient's natural joint motion and does not interfere with knee kinematics. This is especially important for patients who are still active or who wish to delay definitive procedures such as TKR (Wang et al., 2020).
4. Alternatives in Rural Areas with Limited TKR Access
   TKR requires significant resources, a trained surgical team, and a longer hospital stay. In remote areas or developing countries, PFO can be a practical solution for patients with advanced knee OA (Zhang et al., 2019. Orthop Surg).
5. Alternatives for Patients Afraid of TKR
   Many patients delay TKR due to fear of the risks of major surgery or the long recovery period. PFO, as a minimally invasive procedure with a quick recovery time, is a more psychologically acceptable option (Wang et al., 2020).

To optimize post-PFO outcomes, biomechanical based rehabilitative approaches such as gait modification have been investigated. One promising strategy is the use of *a lateral trunk lean gait* , a walking technique that involves tilting the trunk toward the affected knee. This strategy aims to reduce *knee adduction moment* (KAM), a key indicator of the load on the medial compartment of the knee. A study by Tokuda et al. (2021) showed that lateral trunk lean significantly reduced KAM and pressure on the medial side, thereby improving gait patterns and reducing pain. These findings also align with previous research by Simic et al. (2012), which demonstrated that variations in trunk lean angle directly affect knee joint loading during gait.

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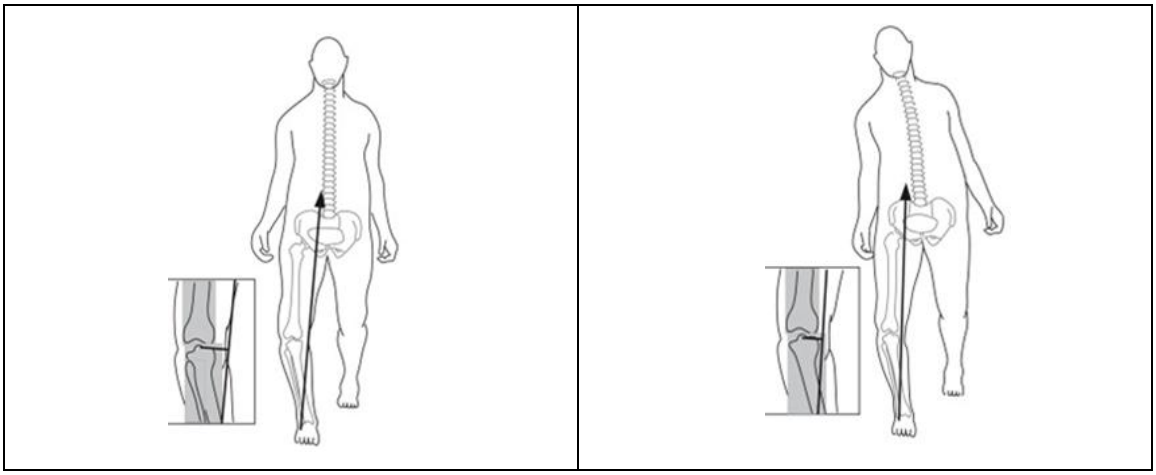

Figure 1. Lateral Trunk Lean Gait Mechanism (*Gerbrands et al., Gait Posture, 2017*)

- Left – Normal Gait:

In a normal gait pattern, the spinal axis remains vertical with the body's center of mass aligned with the midline. The body's weight is transmitted directly downward, resulting in an increased knee adduction moment (KAM), which results in higher pressure on the medial compartment of the knee. This is often seen in patients with knee OA with varus deformity.

- Right – Gait with *Lateral Trunk Lean* :

This image shows how a trunk lean toward the affected knee (ipsilateral *trunk lean*) shifts the body's center of mass closer to the affected knee joint. This strategy results in decreased KAM and reduced pressure on the medial compartment, potentially relieving pain and improving gait biomechanics.

Functional recovery after orthopedic PFO surgery is not only determined by the success of the surgical procedure but also greatly influenced by the quality and adherence to the rehabilitation program, particularly physiotherapy. Physiotherapy plays a crucial role in optimizing joint function, accelerating recovery, and preventing complications such as limited mobility, muscle weakness, and abnormal gait patterns. A post-PFO physiotherapy program is designed to:

- Gradually restore the range of motion (ROM) of the knee joint.
- Strengthens the muscles that support the knee, especially the quadriceps and hamstrings.
- Correcting gait patterns through specific exercises such as *lateral trunk lean gait* , to reduce the load on the medial compartment of the knee.
- Improves proprioception and balance, especially in patients with *ligament laxity* .

According to Zhang et al. (2022), physiotherapy initiated early after PFO can accelerate independent ambulation and improve the *Knee Society Score* (KSS) within 4–8 weeks. Furthermore, a study by Dillman et al. (2020) emphasized that posture education, corrective exercises, and the use of visual feedback such as mirrors are highly effective in training a safe and efficient *trunk lean pattern* , reducing the risk of spinal or pelvic compensation. Physiotherapists also play an educational role, providing patients with

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information on proper body positioning, proper walking techniques, and independent home exercises. This has been shown to support patient adherence to rehabilitation programs, a key factor in long-term success. Therefore, integrating physiotherapy into post-PFO management not only accelerates recovery but also plays a role in ensuring long-term functional success in patients with advanced knee OA.

PFO is not intended for all patients with knee OA. Proper patient selection is key to the success of this procedure. Based on recent clinical studies, ideal candidate criteria for PFO include:

1. Patients with Varus Deformity (Medial Compartment OA)
   A PFO is biomechanically designed to reduce pressure on the medial compartment of the knee, making it most appropriate for patients with genu varus OA. A study by Wang et al. (2020) showed that patients with a varus angle ≤10° demonstrated the best clinical outcomes, with significant improvements in function and pain reduction.
2. Patients with Mild to Moderate Ligament Laxity
   Ligament *laxity* causes knee joint instability and abnormally increased pressure on the medial side. The combination of PFO and 10% dextrose injection in the intra-articular area (directly into the knee joint) requires strict aseptic technique, low volume, and usually a lighter concentration , for example, 5-10 % dextrose (Rabago et al., 2020).
3. Patients with Normal Weight to Mild Overweight (Non-obese)
   Obesity has been shown to be a major risk factor for knee OA progression and a decreased effectiveness of orthopedic interventions, including PFOs. Excessive pressure from high body weight can diminish the load-redistribution benefits of PFOs. Therefore, severely obese patients are generally not recommended as initial candidates (Zhang et al., 2022).

Table 1. PFO Patient Criteria

Selection Factors	**Clinical Explanation**
Degree of OA	Grade III–IV based on Radiology
Varus Alignment	Angle ≤10° gives the best results
Ligament Laxity	Mild–moderate, without severe instability
Weight	Non-obese to avoid excess pressure
Psychosocial	Refusing TKA or having limited access to orthopedic services

Source: Analysis Results, 2025

In addition to mechanical and surgical interventions, the addition of a hypertonic dextrose (sugar) solution as a natural "irritant" injected into the knee area to:

- Stimulates mild inflammation
- Triggers the regeneration and repair process of connective tissue

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- Improve joint stabilityIn the treatment of OA, the most common method of injecting an irritant solution is hypertonic dextrose, which aims to stimulate knee healing. Rabago et al. (2020) noted that 10–25% dextrose showed promising results in reducing pain and increasing stability in various musculoskeletal conditions, including knee OA, especially in patients with *ligament laxity* . Therefore, in this case series, the use of 10% dextrose was appropriate for the patient's condition.

Table 2. Dextrose Concentration

Concentration	Clinical Effects	Users
10%	Mild irritating effect , safe, minimal pain	Early patient, sensitive tissue, intra-articular area
12.5 – 15%	Moderate irritation, faster response	Chronic ligament/tendon
25%	Strong irritation , maximum stimulation	The tissue is very fibrotic, the patient is used to

Source: Rabago et al., 2020

Considering this multimodal approach, the combination of PFO, *lateral trunk lean gait training*, and dextrose may be a promising conservative alternative to improve functional outcomes and reduce pain in patients with advanced knee OA with ligamentous laxity. This integrative approach still requires further studies with good design and adequate sample size to confirm its broad effectiveness (Favero et al., 2024; Nakajima, 2022).

Despite the promising outcomes of PFO combined with rehabilitative strategies and dextrose injection, long-term data on its effectiveness and durability remain limited. Most current studies report short-term improvements in pain and function, typically within 6–12 months post-procedure (Banks et al., 2025). Factors such as patient adherence to physiotherapy, variations in surgical technique, and differences in ligament laxity or body mass may influence the sustainability of these benefits (Skou et al., 2022) Therefore, ongoing monitoring and follow-up assessments are crucial to ensure continued functional improvement and to identify patients who may eventually require more definitive interventions such as TKA (Ferdiansyah & Chilmi, 2022).

Furthermore, integrating patient education and self-management strategies into post-PFO care is essential for optimizing outcomes. Educating patients on weight management, joint protection, and appropriate activity modifications can reduce the risk of OA progression and enhance the effectiveness of mechanical unloading and physiotherapy. Studies have shown that informed patients who actively participate in their rehabilitation process demonstrate better adherence to exercise programs, improved gait patterns, and reduced pain levels. This highlights the importance of a comprehensive, patient-centered approach that combines surgical, biomechanical, and educational strategies in managing advanced knee OA.

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METHOD

Methods arranged according to topic: *combination of PFO, lateral trunk lean gait exercise, and injection dextrose 10% in patients with grade III/IV knee OA with ligament laxity . This method is written in* a scientific style commonly used in case reports or observational clinical studies . This study is a case *series* that evaluates the clinical outcomes of two patients with advanced grade III/IV knee OA with *ligament laxity, who underwent a combination intervention of PFO, lateral trunk lean* gait training , and 10% dextrose injection. *in the intra- articular area.*

Subject Study

The study subjects consisted of two female patients aged 55 years (Mrs. Ng) and 62 years (Mrs. Su) , each diagnosed with grade III and IV knee OA with varus deformity and mild-moderate ligament instability. The patients had no history of major trauma, and had never undergone *total knee arthroplasty (TKA)*. Both patients agreed to the intervention and clinical evaluation process by providing written informed consent.

Procedure Intervention

1. PFO: Action performed by orthopedics specialist with incision incision small in one third above the fibula, accompanied by resection bone ±2 cm long according to technique standard (Wang et al., 2020). Patients allowed walk with support temporary since day second Postoperatively . PFO procedures are performed by orthopedic specialists in a type C hospital facility. Osteotomy is performed on the proximal third of the fibula with a 2–3 cm bone resection using minimally invasive surgical techniques. Mobility is limited for the first 1–2 days, after which patients are allowed to gradually ambulate.
2. Lateral Trunk Lean Gait Exercise : Start in week First postoperative . Patient given educational videos containing demonstration patient real and physiotherapist tutorials about technique lateral *trunk bending* exercise done 2x a day for 10-15 minutes with guide mirrors and verbal cues from physiotherapist . Goal exercise is direct stem body A little leaning to side sore knees moment phase support walk use reduce *knee adduction moment* (KAM) (Tokuda et al., 2021; Simic et al., 2012).
3. Dextrose 10%: use 10% dextrose injection into the intra - articular area . performed by a doctor rehabilitation medical with technique aseptic , referring to the guide Rabago et al. (2020).

Evaluation Clinical

Evaluation clinical done before intervention (baseline) and after 1 and 2 months post-intervention . Instrument main used is :

1. Knee Society Score (KSS) version 2011 The
   KSS instrument assesses five important domains :
   - Knee Score (0–100 points): includes pain , stability , and range movement
   - Function Score (0–100 points): includes ability standing , walking , and activities daily .

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- Patient Satisfaction (0–40 points)
- Patient Expectations (0–15 points)
- Functional Activities (0–30 points)
  Assessment done through combination inspection clinical direct and filling questionnaire by patient based on guide official from The Knee Society (2011).

2. Visual Analog Scale (VAS): For evaluate intensity painful moment walking and resting , with range score 0–10. The formula used For know decline VAS pain , namely :

Score Drop = $\mathrm{VAS}_{\text{Pre-Op}} - \mathrm{VAS}_{\text{Post-Op}}$

Decrease (%) = $\left(\frac{\text{VAS Pre-Op} - \text{VAS Post-Op}}{\text{VAS Pre-Op}}\right) \times 100$

A decrease of >2 points on the VAS is generally considered clinically significant, and a decrease of ≥5 points is considered a significant improvement in chronic pain, according to the WHO pain guidelines pain measurement study.

- Range of Motion (ROM): Measured using a goniometer by a physiotherapist For evaluate flexibility joints knee in a way objective . ROM size how much Far joints can moved in direction certain , usually measured in degrees (°) using a goniometer. For joints knee , normal ROM is usually :

- Extension full : 0°
- Flexibility maximum : 130°–140°

In a way general written in shaped :

$\mathrm{ROM} = \text{Ekstensi} - \text{Fleksi}$

In a way practice clinical , written as following :

$\mathrm{ROM} = 0^\circ\ (\text{ekstensi}) - \mathrm{X}^\circ\ (\text{fleksi})$

Before operation : ROM 0-100° i.e. Flexibility only up to 100°, strength joints
After surgery : ROM 0-125° , namely Flexibility getting better up to 125°.

Data analysis

Data from each domain of KSS, VAS, and ROM are presented descriptively in tables and graphs. Comparison of pre- and post-intervention values was used to evaluate patient clinical changes. Due to the limited sample size (two cases), no inferential statistical tests were performed; interpretations were directed at change trends and individual outcomes. like interview patient .

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Novelty (Research Originality)

Aspects	Existing Evidence	Novelty in This Research
PFO Intervention	Proximal Fibular Osteotomy (PFO) effective in reducing pain in medial OA with varus deformity (Wang et al., 2020; Luo et al., 2022).	This study combines PFO with additional interventions for optimal outcomes, paticularly in patients with ligament laxity.
Lateral Trunk Lean Gait Training		Use of structured trumk lean training post-PFO has not been widely studied. This study integrates it into postoperative rehabilitation.
10% Dextrose Injection	Dextrose prolotherapy beneficial for musculoskeletal conditions, including OA, but typically administered separately (Rabago et al., 2020).	Intra-articular 10% dextrose injection combined with PFO and gait training as a multimodal approach for joint stability.
Ligament Laxity Condition		This research focuses on patients with OA and mild-moderate ligament laxity, an underexplored population.
TKA-Denied Population	Most studies excluse patients with ligament laxity, or do not assess its specific impact	Study leads towards conservative alternatives for patients who decline or lack access to TKA.
Study Duration and Sample	TKA still ragarded as gold standard, and most studies compare conservative Interventions to TKA	This research is an in-depth case series of two patients, emphasizing qualitative alata (Interviews, functional adaptation) aloniang KSS and VAS.

Figure 2. Research Originality

Ethics

This study has received ethical approval from the relevant institution's Health Research Ethics Committee. All patients provided written informed consent for clinical procedures and data publication, ensuring confidentiality.

RESULT AND DISCUSSION

Pre- Operative Evaluation Results

A preoperative evaluation was performed to assess the patient's initial functional condition before undergoing a combination of PFO, lateral trunk lean gait, and 10% dextrose intervention. The assessment was conducted using the 2011 KSS instrument, which consists of five main components. can seen in the table and graph as following This :

Table 3 . Evaluation Results Patient (Pre- Operative)

KSS Components	Patient : Mrs. Ng	Patient : Mrs. Su
Knee Score	48/100	52/100
Function Score	40/100	46/100
Patient Statistics	12/40	14/40
Patient Expectation	9/15	10/15
Functional Activities	18/30	20/30

Source: Analysis Results . 2025

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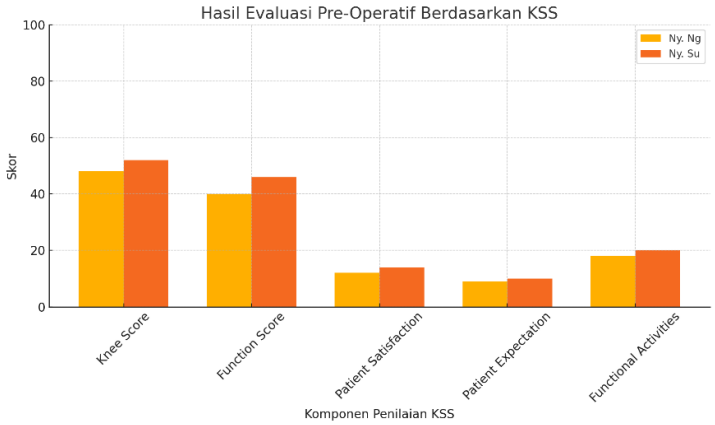

Figure 3. Post- Operative Evaluation Results Based on KSS (Analysis Results , 2025)

The preoperative KSS values of both patients indicated functional status consistent with the characteristics of advanced knee OA, which is the primary indication for PFO. These data provide an important baseline for comparing the effectiveness of postoperative interventions and demonstrate that both patients had clinical profiles consistent with evidence-based conservative intervention recommendations. that is as following :

1. Knee Score values on both patient be under the number 55, shows existence painful knee currently until heavy , accompanied by with limitations range motion and instability joints . Score This in line with findings of Wang et al. (2020), which stated that patient with grade III/IV medial compartment OA and *a Knee Score* below 60 is ideal candidate for PFO intervention .
2. Besides that is , a Function Score value below 50 indicates existence decline ability mobility functional , such as walking , standing for long periods, and climbing stairs . Zhang et al. (2022) in studies clinical also reported that knee OA patients degrees carry on generally own score low function on pre - operative assessment , with mark around 40–50, which is in line with condition second patient in studies This .
3. Score low in Patient Satisfaction and Patient Expectation reflects dissatisfaction to condition knee before intervention as well as height hope to results treatment . This is become indicator important in determine readiness patient For undergo intervention conservative and surgery .
4. Temporary that , the scores on Functional Activities (18 for Mrs. Ng and 20 for Mrs. Su) showed limitations in operate activity daily like work House stairs , activities social , or recreation light . Patient has limit part big activity Because pain and discomfort stable moment walking . Findings This strengthen need will approach multimodal therapy that does not only target aspect biomechanics (through PFO and gait training), but also stabilization of the knee area through intra- articular dextrose injection .
5. More further , Hunt et al. (2022) in review systematically mention that patient with mark function and stability low tend get benefit more big from strategy modification

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style walk such as lateral trunk lean gait, because technique This can lower *knee adduction moment* (KAM) and correct pattern distribution load on joints knee

Post- Operative Evaluation Results

Evaluation post-operative done to two patients (Mrs. Ng and Mrs. Su) with knee OA degrees continue to undergo combination PFO intervention , lateral trunk lean gait exercise , and 10% dextrose. Assessment done using the 2011 version of KSS , which includes five main domains : *Knee Score, Function Score, Patient Satisfaction, Patient Expectation,* and *Functional Activities* .

Table 4 . Evaluation Results Patient (Post- Operative)

KSS Components	Patient : Mrs. Ng	Patient : Mrs. Su
Knee Score	86/100	90/100
Function Score	85/100	88/100
Patient Statistics	32/40	35/40
Patient Expectation	13/15	14/15
Functional Activities	25/30	27/30

Source: Analysis Results, 2025

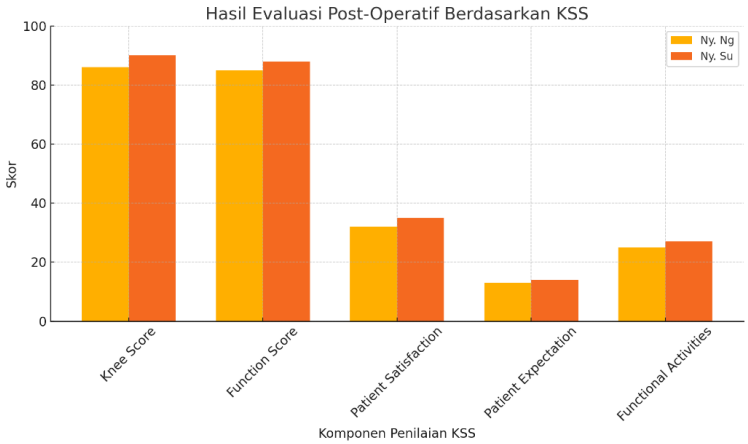

Figure 4. Post- Operative Evaluation Results Based on KSS (Analysis Results, 2025

a. Improvement Function Joints Knee and Pain

Second patient show significant improvement in Knee Score (86 and 90 out of 100), which reflects improvements in pain , stability , and range of motion movement knee . This is in line with literature that PFO can lower pressure on the medial compartment of the knee and improve alignment biomechanics (Wang et al., 2020).

b. Activities Functional and Mobility

The increase in Function Score indicates patient capable standing and walking longer without aids . Exercises *lateral trunk lean gait* proven effective in reduce medial load and repair pattern walking, supporting the results achieved by Tokuda et al. (2021).

c. Level of Satisfaction Patient

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e-ISSN : 3047-017X
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Both patients reported high levels of satisfaction (scores of 32 and 35 out of 40), with significant pain reduction and near-normal knee function. These findings align with recent studies showing that gait modifications, such as the lateral trunk lean, are effective in reducing *knee adduction moment* (KAM) and pain in patients with knee osteoarthritis. For example, a study by Cheung et al. (2021) showed that a six-week gait training program with sensory feedback decreased KAM and reduced knee pain in patients with medial knee osteoarthritis. Furthermore, a systematic review by Hunt et al. (2022) confirmed that gait modification strategies, including the lateral trunk lean, are effective in reducing medial knee joint loading indicators, contributing to decreased pain and improved function.

d. Expectations and Activities Advanced

High value on expectations patients and activities advanced (average above 85 %) indicates that combination of PFO, physiotherapy , and dextrose injections does not only improve clinical status but also provide quality a better life good . This is supported by findings Rabago et al. (2020) regarding dextrose concentration in increase stability knees and trust self patient in doing activities .

Pre- Operative and Post- Operative Comparison Results with Visual Analog Scale (VAS) method

VAS is used to assess the intensity of pain felt by the patient, with a score range of 0–10 (0 = no pain, 10 = very severe pain).

Untuk Ny. Ng:

$$\text{VAS Pre-Op} = 8, \quad \text{VAS Post-Op} = 2$$

$$\text{Penurunan} = 8 - 2 = 6$$

$$\text{Persentase Penurunan} = \left(\frac{6}{8}\right) \times 100\% = 75\%$$

Untuk Ny. Su:

$$\text{VAS Pre-Op} = 7, \quad \text{VAS Post-Op} = 1$$

$$\text{Penurunan} = 7 - 1 = 6$$

$$\text{Persentase Penurunan} = \left(\frac{6}{7}\right) \times 100\% \approx 85.7\%$$

Table 5. Visual Analog Scale (VAS)

Patient	Pre-Op VAS	Post-Op VAS	Pain Reduction	Decrease (%)
Mrs. Ng	8	2	-6	7 5%
Mrs. Su	7	1	-6	8 5.7%

Source: Analysis Results , 2025

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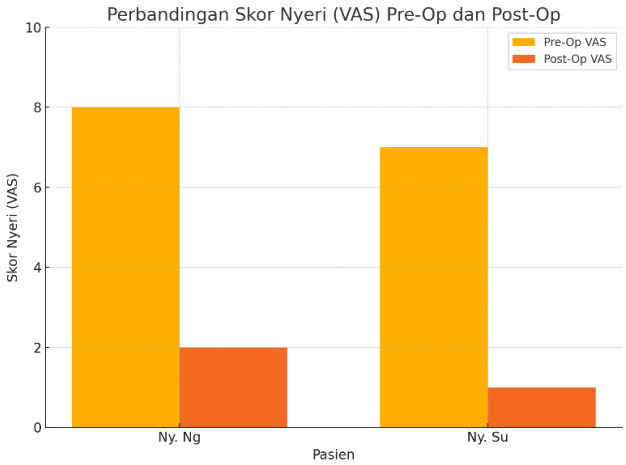

Figure 5. Comparison Pre- Operative and Post- Operative VAS Scores (Analysis Results, 2025

Can seen in the results In this study , both patients showed a significant reduction in pain after the intervention. Pain scores decreased by more than 70%, which is clinically categorized as meaningful pain improvement. This effect aligns with the findings of Rabago et al. (2020), who stated that 10% dextrose can reduce chronic pain in patients with *ligament laxity* . Furthermore, the use of *a lateral trunk lean gait* has been shown to reduce *knee adduction moment* (Hunt et al., 2022), which also contributes to reduced joint loading and pain.

Comparison Results Pre- Operative and Post- Operative with Range of Motion (ROM) method

ROM is measured in degrees (°), indicating how much the patient is able to flex and extend the knee joint

$$\text{Peningkatan ROM} = \text{ROM Post-Op (Fleksi)} - \text{ROM Pre-Op (Fleksi)}$$

Untuk Ny. Ng:

ROM Pre-Op: 0–100°

ROM Post-Op: 0–125°

$$\text{Peningkatan ROM} = 125^\circ - 100^\circ = 25^\circ$$

Untuk Ny. Su:

ROM Pre-Op: 0–110°

ROM Post-Op: 0–130°

$$\text{Peningkatan ROM} = 130^\circ - 110^\circ = 20^\circ$$

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Table 6. Range of Motion (ROM)

Patient	Pre-Op ROM	Post-Op ROM	ROM Upgrade
Mrs. Ng	0-100 °	0-125 °	+25 °
Mrs. Su	0-110 °	0-130 °	+20 °

Source: Analysis Results , 2025

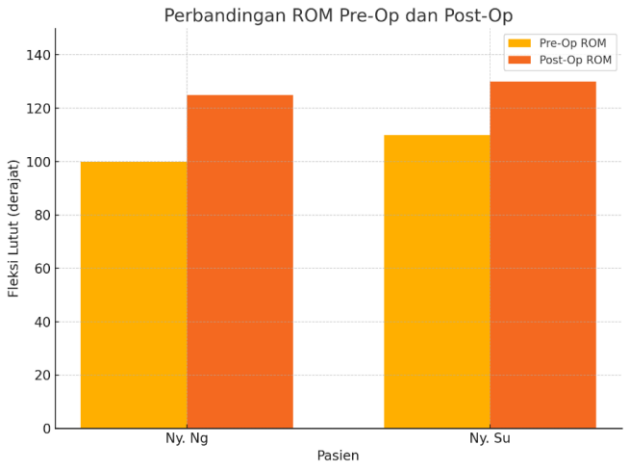

Figure 6. Comparison of Pre- Operative and Post- Operative ROM (Analysis Results, 2025

Increased ROM by 20–25 degrees show existence recovery flexibility meaningful knees in a way clinical . This is signify that interventions provided that is combination of PFO, lateral trunk lean gait exercise , and 10% dextrose did not only lower painful but also return mobility joints . From the results said, both patient shows meaning . This matter show success intervention in restore function joints , reducing stiffness , and increase capacity activity functional . According to Wang et al. (2020), ROM improvement after PFO is results from redistribution burden knees and lower back pressure on the medial compartment. Gait exercises with *trunk lean* also plays a role in optimize movement functional without give burden excess in structure knee (Hunt et al., 2022). Besides that , dextrose injection provides stabilization additional knee support movement joints (Rabago et al., 2020).

Data analysis

To complement the quantitative data (VAS, KSS, and ROM), semi-structured interviews were conducted with both patients to assess their subjective experiences during the postoperative recovery phase. The interviews focused on postoperative adaptation, use of walking aids, and any lingering complaints after the intervention.

Patient 1: Mrs. Ng

- On two Sunday First post surgery , patient use walking aids in the form of a legged walker four For maximize stability and adaptation burden beginning
- Two Sunday next , the patient switch to one- legged stick , signifying existence improvement ability ambulation .
- Exercise physiotherapy with swing gait approach begins since day First after operation .
- After a week fourth , the patient Already No Again use AIDS .

Complaints that still exist felt :

- Patient complain Power endurance that still exists limited moment walk distance Far .
- Sometimes a feeling like calf pull part behind , possibly related with tension muscle gastrocnemius or new gait adaptation .

Analysis: Complaints This is common things in the phase recovery functional early , especially in patients with weakness muscle consequence immobilization or limitations activity before operation . Exercise strengthening muscle and increase capacity aerobics will help overcome complaint A " pulling " sensation in the calf is also possible . caused by imbalance posterior leg muscles consequence compensation style walk .

Patient 2: Mrs. Su

- Patient use two stick during two Sunday First post operation .
- On week third , the patient Enough use One stick , and only undergo One session physiotherapy before stop use full- fledged tools .
- Patient continuing a total of six session physiotherapy , including lateral bending gait training , which according to his confession give significant improvement to stability and methods walk .

Complaint moment This :

- No There is reported complaints . Patient feel stable , comfortable moment walk , and declare satisfied with results recovery .

Analysis : Response positive from Mrs. Su reflect success intervention in a way comprehensive—good in a way biomechanical (through PFO), functional (through gait training), and regenerative (via dextrose). Success progressive lateral trunk lean gait training possibility big participate contribute to adaptation optimal biomechanics , as supported in Hunt et al.'s (2022) study.

CONCLUSION

Patients with advanced knee osteoarthritis (OA), presenting with varus deformity and ligament laxity, often experience significant pain and functional limitations, as demonstrated by pre-operative evaluations. In addressing these challenges, patellofemoral osteotomy (PFO) has been shown to effectively reduce

pressure on the medial compartment of the knee, thereby contributing to improved joint biomechanics. Complementing this, the implementation of a lateral trunk lean gait during walking exercises has a positive impact on redistributing joint load in the knees and supporting the patient's walking pattern. Additionally, intra-articular injections of 10% dextrose serve as a regenerative therapy, enhancing knee stability, particularly in patients with ligament laxity. Evaluations using the Knee Society Score (KSS) indicate significant improvements across all domains, including both objective measures such as pain and function, and subjective measures such as patient satisfaction and activity levels. Visual Analogue Scale (VAS) assessments further demonstrate clinically meaningful reductions in pain, with a 75% decrease in Mrs. Ng and 85.7% in Mrs. Su. Functional range of motion (ROM) also improved, increasing from 100° to 125° in Mrs. Ng and from 110° to 130° in Mrs. Su, indicating restored knee flexibility. Based on follow-up interviews, the second patient was able to walk without assistive devices within four weeks, with Mrs. Su reporting no ongoing complaints and Mrs. Ng experiencing only minor issues, such as decreased endurance and mild calf discomfort. Overall, the combined intervention of PFO, lateral trunk lean gait training, and 10% dextrose injections has proven effective as a conservative approach for improving function, reducing pain, and enhancing quality of life in knee OA patients, particularly for those who are not ready for or do not have access to Total Knee Arthroplasty (TKA).

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