

Varied Clinical Presentation and Functional Outcome by 4in1 Surgical Intervention in Osteoarthritis with Varus Deformity: A Serial Cases

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Abstract: Osteoarthritis (OA) is the most common progressive degenerative disease in older people that involves the whole joint, including cartilage degradation, bone remodeling, osteophyte formation, and synovial inflammation, leading to pain, stiffness, swelling, and loss of normal joint function. In elderly women over 55, the risk of OA is higher than in men by a ratio of 30.7% to 15.6%. The mechanical and biochemical aspects of OA are the two main problems based on the damaged tissue. We combined four therapeutic methods including proximal fibular osteotomy (PFO) as a surgical method and then genicular block, intraosseous injection (IOI) with platelet-rich plasma (PRP) or prolotherapy dextrose, and Intra-articular injection with hyaluronic acid for the regenerative support therapy. Clinical result baseline for 1 and 3 months after surgery. Objective: Nine patients presented in this case series, Patients with medial joint space narrowing and grade III or IV knee OA, as determined by Kellgren and Lawrence, met the inclusion criteria. Furthermore, they are also without inflammatory and rheumatologic illnesses like rheumatoid arthritis. Medication and conventional therapy had no effect. All patients gave their consent to take part in this trial. Patients who had irregular prolotherapy, intra-articular hyaluronic acid injections, a history of using anticoagulant medications, and total knee arthroplasty were excluded from the study. Discussion: The lateral condyle of the tibia is supported by the fibula, which causes the tibial condyles to settle unevenly with more settlement and cartilage degradation on the medial side. PFO is one of the choices of treatment OA that can be an alternative with less complication. Some studies show that PFO has significant pain relief and varus correction. The other combination treatments are Intra-articular injection with hyaluronic acid as viscosupplementation, IOI of PRP, and genicular nerve block as an inflammatory inhibitor, which makes degeneration slower. The following are some of these clinical observation case limitations: 1) The inability to perform radiographic measurements on knee X-ray pictures (Tibio-Femoral Angle before and after treatment, Joint Space Ratio before and after treatment) due to the lack of uniformity. 2) The dependent factors, such as body weight, height, and other diseases, were not taken into account in this study. All nine of our subjects reported appreciable improvement at 3 months follow-up. The patient's knee function improves, and their level of everyday pleasure rises. Treatment for late-stage medial compartment OA may be possible with this combination of therapies. Conclusion: A combination of PFO, IOI, IAI, and genicular block procedures for the long-term results revealed pain alleviation and functional improvement. This indicates that the treatment approach may be useful to treat severe OA with varus deformity and delay the need for TKA in patients for a variety of reasons

Keywords: Intra articular, Intraosseous, Osteoarthritis, Osteotomy.

INTRODUCTION

Osteoarthritis (OA) is the most common progressive degenerative disease in older people that involves the whole joint, including cartilage degradation, bone remodeling, osteophyte formation, synovial inflammation, leading to pain, stiffness, swelling, and loss of normal joint function [Kim, J. R. *et al.*, 2018]. Biomechanical and metabolic problems are two major factors causing the onset of knee OA. Articular cartilage is an avascular connective tissue with a distinctive extracellular matrix. Hyaluronic acid polymers (HA) and a significant amount of proteoglycans make up this substance. These offer a suspension material for shearing force and weight bearing. The cartilage in the knee joint may be harmed by repeated mechanical strain. Additionally, it causes additional synovial membrane inflammation, subchondral bone remodeling, and hypertrophy [Di Nicola, V, 2020]. Surgery is required in cases of severe OA of the knee. When compared to proximal fibula osteotomy (PFO), high tibial

osteotomy (HTO), and total knee arthroplasty (TKA), it is distinctive. In cases of severe knee OA with a narrowing medial compartment, PFO has emerged as the new alternative surgery to lessen discomfort and enhance joint function. PFO is not only a safe, rapid, and easy operation compared to HTO and TKA, which are the gold standards, but it also does not require extra insertion [Rahman, A. N. *et al.*, 2022]. PFO improved patient subjective pain and function scores, reduced varus deformity, and enhanced joint space ratio [Utomo, D. N. *et al.*, 2018]. The process of degeneration has been effectively slowed down and the rate of tissue repair has accelerated recently. It consists of hypertonic dextrose, ozone therapy, mesenchymal stem cells, platelet-rich plasma (PRP) therapy, and botulinum toxin type A. Prolotherapy, an application of hypertonic dextrose, is used to treat musculoskeletal pain. A simple, inexpensive, and safe method that produces a noticeable improvement is hypertonic dextrose injection. It

was injected into the articular region to start the inflammation, proliferation, and regeneration of the injured cartilage in order to repair and restore the soft tissues in the joint [Shen, L. *et al.*, 2017; Sit, R. W. S. *et al.*, 2020; Duymus, T. M. *et al.*, 2017]. Severe OA with deformity is necessary for surgery to restore joint function. This report intends to describe the potency of combination therapy for OA by comparing pre- and post-operation calculated by the Visual Analog Scale (VAS), Western Ontario McMaster Universities Osteoarthritis (WOMAC).

METHOD

In order to characterize the patient's conditions and publish the data, the writers needed their informed consent. Patients who met Kellgren and Lawrence's classification of grade III and IV (late-stage) knee OA with medial joint space narrowing qualified for inclusion. In addition, they don't have any rheumatologic or inflammatory disorders, such as rheumatoid arthritis. Both medicine and conventional therapy produced no results in history. To take part in this trial, all patients gave their consent. Contrarily, the exclusion criteria were that patients had irregular prolotherapy, intra-articular hyaluronic acid injections, a history of anticoagulant drug use, and a history of total knee arthroplasty. Combined four therapeutic methods including Proximal Fibular Osteotomy (PFO), Genicular block, Intraosseous injection (IOI) with

Platelet Rich Plasma (PRP) or Prolotherapy dextrose, and Intra-articular injection with hyaluronic acid. Clinical result baseline for 1 and 3 months after surgery. Nine late-stage medial compartment knee OA patients who matched the inclusion criteria had their condition evaluated by the doctor Soeroto General Hospital, Ngawi, East Java outpatient between July and September 2023.

Operative procedure following subarachnoid block (SAB) anesthesia, We administered genicular block with 2.5 ml of lidocaine and 2 mg of dexamethasone injected. Doppler ultrasound confirmed that the target injection sites were adjacent to the superior lateral, superior medial, and inferior medial genicular arteries, which were located close to the periosteal regions at the epicondyle and the shafts of the femur and tibia [González Sotelo, V. *et al.*, 2017]. Hyaluronic acid 500 kDa was injected into the knee joint for the viscosupplementation method. the PFO surgery was performed by removing a small section (1-2 cm) of the fibula 7-8 cm below the fibular head by entering the intermuscular area between the extensor digitorum longus and peroneus longus brevis. Only the foot that the patient complained about the most had the PFO operation. After PFO, six patients got dextrose 10%, 2 patients dextrose 12,5%, and 1 patient with platelet-rich plasma injected to the bone.



Figure 1: Knee X-Ray of a 56-year-old female. (A) The X-ray showed grade IV knee OA sinistral with varus deformity. (B) Knee X-ray after PFO, IOA, IAI, and genicular block.

The patients gave marks on the line to best describe their current pain state on the visual analog scale (VAS), which has a straight line with scores from 0 to 10 cm, anchored by "no pain" on the left side (score of 0) and "very severe pain" on the right side (score of 10). The Western Ontario and McMaster Universities Osteoarthritis

(WOMAC) functional index assessed the patient's clinical signs and complaints. It has a score range of 0 to 96 and is divided into three primary categories: physical function disability (68 points), stiffness, and pain (20 points). Higher ratings denote symptoms and functions that are more severe. Mild (0–24 points), moderate (25–48

points), severe (49–72 points), and very severe (73–96 points) were the four groupings of outcome points based on the severity.

A descriptive analysis was performed in order to present information regarding the mean (\pm standard deviation) and minimal-maximal of patients' age, duration of follow-up, as well as their Visual Analogue Scale (VAS) and Western

Ontario and McMaster Universities Osteoarthritis Index (WOMAC) scores. The data analysis was conducted using IBM Corp's SPSS Statistics version 25. The Wilcoxon test was utilized to assess the normality of continuous variables. All analyses were conducted with a significance level of $p < 0.05$.

Table 1: Baseline characteristic

	Mean\pmStd.deviation	Min-max
Age	65.75 \pm 7.96	51-72
VAS (pre)	7.33 \pm 0.71	6.0-8.0
VAS (1 month)	3.44 \pm 0.88	2.0-5.0
VAS (3 month)	2.00 \pm 0.5	1.0-3.0
WOMAC (pre)	58.89 \pm 4.26	52-63
WOMAC (post)	26 \pm 2.06	24-31

From the table above it can be seen that of the 9 samples, the average age was 65.75 years, with the lowest age 51 years and the oldest age 72 years. For VAS scores (pre) has an average of 7.33 units, with the lowest VAS score (Pre) of 6 units and the highest vAS score of 8 units. For vas scores (1 month) has an average of 3.44 units with the lowest vas score of 1 month and a top VAS

scoring of 5 units for VAS (1 month). For vass scores (3 months) has an average of 2.0 units; with a minimum vass score of 3 months with a top vass point of 3. As for the WOMAC score (pre) has an average of 58.89 units, with the lowest WOMCA score of 52 units and the highest WOMAC score of 63 units.

Table 2: VAS score pre with 1 month follow up

	Pre	1 month	P value
	Mean \pm Std.deviation	Mean \pm Std.deviation	
VAS	7.33 \pm 0.71	3.44 \pm 0.88	0.006

Based on the comparison results for VAS Scores at pre and at 1 month, it can be found that out of 9 samples, VAS scores (pre) have an average of 7.33 units and VAS (1 month) scores have a average of

3.44 units. From the Wilcoxon test results obtained a p value of 0.006 ($p < 0.05$), so it may be concluded that there is a significant difference in VAS scoring during pre and during 1 month.

Table 3: VAS score pre with 3 month follow up

	Pre	3 month	P value
	Mean \pm Std.deviation	Mean \pm Std.deviation	
VAS	7.33 \pm 0.71	2.00 \pm 0.5	0.007

Comparison results for VAS Scores at pre and at 3 months can be found that out of 9 samples, VAS scores (pre) have an average of 7.33 units and VAS (1 month) scores have a average of 2.0 units. From the Wilcoxon test results obtained a p value

of 0.007 ($p < 0.05$), so it can be concluded that there is a significant difference in the VAS score during pre and during 3 months, where VAS (3 month) score has a lower average than VAS scoring at pre.

Table 4: VAS score 1 month with 3 month follow up

	1 month	3 month	P value
	Mean \pm Std.deviation	Mean \pm Std.deviation	

VAS	3.44±0.88	2.00±0.5	0.006
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The comparison results for VAS Scores at 1 month and at 3 months, it can be found that of 9 samples, VAS scores (1 month) have an average of 3.44 units and the VAS score (1 months) have a average of 2.0 units. From the results of Wilcoxon test

obtained a p value of 0.006 ($p < 0.05$), so it may be concluded that there is a significant difference in VAS scoring at 1 months and at three months, where VAS (3 months) scores have a lower average than VAS in 1 month.

Table 5: WOMAC score pre and post follow up

	pre	post	P value
	Mean±Std.deviation	Mean±Std.deviation	
WOMAC	58.89±4.26	26±2.06	0.008

The WOMAC score at pre and the WOMAC score at post is known that of the 9 samples, the pre score has an average of 58.89 units and the post score has an average of 26.0 units. From the Wilcoxon test results obtained a p value of 0.008 ($p < 0.05$), so it can be concluded that there is a significant difference in the pre-WOMAC Score and the post-WOMOC Score, where the post has a lower average than the pre.

DISCUSSION

The most typical joint condition, knee OA, results in considerable discomfort and physical impairment. Because it is so effective at lowering pain and enhancing knee function, TKA is the gold standard for severe knee OA. TKA, however, is a demanding and complicated treatment that some patients need many alterations for. Additionally, it may result in a number of side effects, such as periprosthetic fracture, osteolysis, peripheral nerve damage, and wound infection. The HTO is another option for treating knee OA besides TKA. Surgery called HTO is successful in treating mild knee OA with varus deformity. By shifting the weight-bearing axis to the lateral compartment, it reduces pain. Similar to TKA, the HTO surgery does have certain drawbacks, including deep vein thrombosis, wound infection, peroneal nerve paralysis, delayed union, and mechanical failure [Duivenvoorden, T. *et al.*, 2014; Hernigou, P. *et al.*, 2020]. PFO is one of the choices of treatment OA that can be an alternative with less complication. Load-bearing joints such as the knee, bone density, and mass tend to decline with age. The lateral condyle of the tibia is supported by the fibula, which causes the tibial condyles to settle unevenly with more settlement and cartilage degradation on the medial side. Some studies show that PFO has significant pain relief and varus correction. The other combination treatments are Intra-articular injection with hyaluronic acid as viscosupplementation, IOI Prolotherapy of PRP, and genicular nerve block as an inflammatory

inhibitor, which makes degenerative slower. [Rady, H. M. E - Richardson, S. S. *et al.*, 2019]

The bone density of the knee tibial plateau gradually declines with age. The medial and lateral sides make up the two sides of the tibial plateau. The lateral side is supported by the fibula bone, not the medial side. One-sixth of the body's weight is supported by the fibula, according to clinical research by Zhang *et al.* As a result, there is an unequal distribution of stress inside the tibial plateau. Varus deformity can happen if the tibial plateau experiences more medial-side stress. Additionally, because of the nonuniform settlement and the tibial plateau's slope, the femoral condyle may move to the medial when walking. [Richardson, S. S. *et al.*, 2019- Wang, X. *et al.*, 2017] PFO removes a small fibula segment, altering the way that stress is distributed in the knee joint and lowering medial compartment stress. By moving the stress pathway from the anterior medial area to the posterior medial area on the tibial plateau, PFO could lessen stress in the medial compartment of the knee joint, according to Pan *et al* analyze of computer tomography (CT) and magnetic resonance imaging (MRI) data for a finite element model [Pan, D. *et al.*, 2020]. Additionally, it was shown that PFO might help slow the course of knee OA by an examination of a three-dimensional gait study.[Sfeir, A. *et al.*, 2017] Additionally, it has the ability to readjust the soft tissue surrounding the knee joint. Following the completion of the treatment, it is expected that the lateral ligaments and muscles surrounding the knee joint will experience a tightening effect, while the medial side will undergo a relaxation response. The action of the lateral soft tissue results in the elevation of the femoral condyle, thereby decreasing the stress experienced by the medial tibial plateau.[Guo, J. *et al.*, 2019] The utilization of PFO has been shown to have a notable impact on reducing varus deformity, enhancing the medial joint space, and elevating

patient subjective and functional assessments as measured by the Knee Injury and Osteoarthritis Outcome Score (KOOS) index and Oxford knee score.[Shen, L. *et al.*, 2017] One typical consequence associated with PFO is the occurrence of peroneal nerve injury and its branches. This condition arises due to the surgical procedure's bypassing of the lateral border of the fibula, which is where about one-third of the deep peroneal nerve is located. Hence, the optimal location for performing the fibula osteotomy is situated approximately 6-10 centimeters distal to the fibular head.[Ryan, W. *et al.*, 2003]

Prolotherapy, also known as proliferative therapy, has been documented as a viable approach for the treatment of musculoskeletal and joint ailments. Hypertonic dextrose is the prevailing solution administered via injection. The interaction between human cells and hypertonic dextrose results in an increase in growth factors within several cell types, hence promoting the proliferation of chondrocytes, osteocytes, and fibroblasts. Furthermore, this physiological mechanism expels the extracellular matrix, augmenting the stability of articulations by fortifying and constricting the ligaments and tendons. [Rabago, D. *et al.*, 2013] Despite the current lack of clarity regarding the precise process, prolotherapy elicits a minor inflammatory response and induces cellular stress within the compromised region of the ligament or tendon. Subsequently, the release of cytokines and growth factors occurs, which initiates a novel healing cascade inside the designated region. This process effectively triggers the activation of fibroblasts, leading to the production of collagen precursors and fortification of the connective tissue. [Rabago, D. *et al.*, 2012] The use of hypertonic dextrose injection into the joint space at four-week intervals in individuals with moderate knee osteoarthritis (OA) resulted in significant enhancements in pain monitoring, range of motion (ROM), and an improved score on the WOMAC index. These changes were statistically significant.[Eslamian, F. *et al.*, 2015] The efficacy of hypertonic dextrose prolotherapy (HDP) in pain reduction and functional improvement surpasses that of local anesthesia. Furthermore, it is noteworthy that this particular intervention has comparable efficacy to hyaluronic acid (HA), ozone, and radiofrequency. However, it is important to acknowledge that its effectiveness falls short when compared to erythropoietin and Platelet-rich plasma (PRP).[Arias-Vázquez, P. I. *et al.*, 2019]

Nevertheless, the implementation of the HDP application entails a straightforward methodology, cost-effectiveness, and the ability to be conducted in remote areas, all while significantly alleviating pain.[Eslamian, F. *et al.*, 2015; Arias-Vázquez, P. I. *et al.*, 2019]

Hyaluronate is a biopolymer with a large molecular weight that is ubiquitously present in both cartilage and synovial fluid. The structure consists of a sequence of N-acetyl D-glucosamine and D-glucuronic acid residues that are linked together by $\beta(1-4)$ and $\beta(1-3)$ bonds. The molecular mass of this structure ranges from 6,500 to 10,900 kilodaltons. [Altman, R. D. *et al.*, 2015] It acts as a lubricant, an agent that scavenges free radicals, and a regulator of cellular activity, including the process of protein binding. As osteoarthritis (OA) advances, the high molecular weight (6,500-10,900 kDa) endogenous hyaluronic acid (HA) present in the joint undergoes depolymerization, resulting in a decrease in molecular weight (2,700-4,500 kDa). This process leads to a reduction in the mechanical and viscoelastic properties of the synovial fluid within the afflicted joint. [Stern, R. *et al.*, 2006] HA is administered to OA patients through either oral ingestion or local injection. Several injectable HA formulations are currently available for clinical use, including Synvisc and Synvisc-One (Genzyme), Gel-One (Zimmer), Hyalgan (Fidia), Spartz FX (Bioventus), Orthovisc (Anika), Euflexxa (Savient), Monovisc (Anika Therapeutics), and Gel-Syn (Institute Biochimique SA). [Hisada, N. *et al.*, 2008] The analgesic effect of the intravenously administered HA is hypothesized to be mediated by various mechanisms. The strategies encompass enhancing the creation of extracellular matrix proteins, altering inflammatory mediators to impede breakdown, restricting lymphocyte mobility, and maintaining the thickness, area, and surface smoothness of cartilage [Cooper, C. *et al.*, 2017].

One of the most discussed aspects of HA injection relates to the timing and duration of its administration, and whether these factors impact its effectiveness and long-term sustainability. Comparison between intraarticular injections of Hylan G-F 20 and saline, administered three times per week, in individuals diagnosed with osteoarthritis (OA). It was discovered that the group receiving HA treatment achieved significant pain relief by the third week, and saw functional improvement by the eighth week [Chavda, S. *et al.*, 2022] Patrella *et al.* conducted a randomized

controlled trial to examine and compare the effects of administering three consecutive weekly HA injections against six consecutive weekly HA injections. The study demonstrated that there were no discernible differences in pain levels, functional outcomes, or patient satisfaction when comparing the effects of either 3 or 6 HA injections [Altman, R. D. *et al.*, 2011] There is already a range of HA formulations available in the market for the treatment of OA. The preparations under consideration exhibit variations in terms of their origin, structural composition, molecular weights, concentrations, and volume of injection. The prevailing trend in the current market for HA preparations primarily consists of several injection regimens. Nevertheless, there has also been a rise in the utilization of single injection HA, which is increasingly gaining popularity in clinical settings. In a randomized multicenter study conducted by Zhang H *et al.*, the benefits of single and repeated injections of HA were investigated in individuals with osteoarthritis (OA). The study revealed that single injections were comparable to multiple injections of HA in terms of their ability to alleviate pain, reduce knee stiffness, and improve physical function over a period of 18 and 26 weeks. [Henrotin, Y. *et al.*, 2019] Baron *et al.* presented findings that demonstrated comparable outcomes, indicating that the administration of a solitary HA injection exhibited clinical efficacy in managing OA. In their study, Ha *et al.* discovered that the administration of a solitary injection of crosslinked hyaluronate shown comparable efficacy to the utilization of several injections of linear high molecular hyaluronate in the mitigation of weight-bearing pain experienced by individuals with symptomatic OA. The findings of this study suggest that the number of HA injections may not exhibit a statistically significant variation in terms of therapeutic efficacy [Baron, D. *et al.*, 2018; Ha, C. W. *et al.*, 2017] HA has been found to be both safe and effective in various applications, with the exception of minor adverse effects such as localized pain and swelling that often subside within a few days. Severe allergic responses to the preparations are quite rare. The pain relief and functional improvement provided by these interventions are sufficient, albeit temporary, lasting up to six months regardless of the number of injections or the type of preparations administered. The utilization of combination formulations containing corticosteroids or platelet-rich plasma (PRP) has been observed to yield superior outcomes compared to the use of hyaluronic acid (HA) alone. Further investigation

is necessary in order to explore the potential of integrating hyaluronic acid (HA) with contemporary compounds, such as peptides or diclofenac, to achieve prolonged and therapeutic impacts on diseases [Chavda, S. *et al.*, 2022]

The knee joint receives sensory innervation from the tibial, common peroneal, femoral, and obturator nerves. The nerves that surround the knee joint and are responsible for sensory perception are referred to as the genicular nerves. The nerves that are involved are the superior medial genicular nerve (SMGN), the superior lateral genicular nerve (SLGN), and the inferior medial genicular nerve (IMGN). [Tran, J. *et al.*, 2018]. The application of genicular block has significantly increased in recent years, with a greater number of publications even for individuals who have previously undergone total knee replacement (TKR). The procedures aim to alleviate pain by blocking the nerve fibers that supply the knee joint [Kim, P. Y. *et al.*, 2021; Qudsi-Sinclair, S. *et al.*, 2017] The genicular nerves that are targeted are those that are closely related to the cortical surfaces of the bones, primarily the femoral epicondyles (SLGN and SMGN) and the medial tibial epicondyle (IMGN) [Tran, J. *et al.*, 2018]. Undamaged and untreated nerve terminals in the joints compensate for the transmission of sensory information and feedback related to body position and movement. Therefore, partial sensory denervation does not result in any challenges related to joint proprioception, motor control, or ambulation [Pineda, M. M. S]. A nerve block is typically administered via local anesthesia either alone or in conjunction with corticosteroids [Kirksey, M. A. *et al.*, 2015]. Corticosteroids have been widely utilized as a supplementary agent to local anesthetics in both neuraxial and peripheral nerve blocks. The glucocorticoid receptor can influence the activity of nociceptive C fibers by acting on the potassium channels, hence changing their function [Krishna Prasad, G. V. *et al.*, 2020]. In the present study, genicular nerve block (GNB) was conducted by administering a combination of corticosteroids (triamcinolone, 1 ml, 40 mg) and local anaesthetic (6 ml bupivacaine 0.25%). Local anaesthetic offers the advantage of promptly alleviating pain, diluting the corticosteroid agent, and reducing or preventing post-injection inflammation [Freire, V. *et al.*, 2016].

A linear transducer is used to visualize the Superior Medial Genicular Nerve. The transducer is positioned in the coronal plane and in the long axis with respect to the femur. The medial femoral

epicondyle is recognized, and the junction between the medial femoral epicondyle and the femoral shaft is located. The superior medial genicular artery and nerve should be observed next to the periosteum, either in a transverse or oblique orientation. The Superior Lateral Genicular Nerve can be visualised by utilising a linear transducer positioned in the coronal plane and in long axis with respect to the femur. This allows for identification of the lateral femoral epicondyle and locating the junction between the medial femoral epicondyle and the femoral shaft. The superior lateral genicular artery and nerve should be observed next to the periosteum, either in a transverse or oblique orientation. The medial femoral-tibial joint line is identified through visualisation of the Inferior Medial Genicular Nerve utilising a linear transducer calibrated along its long axis in relation to the femur. If you are having trouble identifying the joint line, begin by mentally visualising the lower end of the patella in the sagittal plane (long axis). Position the probe such that the inferior pole is at the centre, then scan towards the medial direction until the joint line becomes visible. The medial collateral ligament (MCL) can be identified as a soft-tissue band that originates from the medial epicondyle. The MCL should be followed until it attaches to the tibia. It is important to rotate the probe obliquely in relation to the tibial shaft. The neurovascular bundle can be readily observed in close proximity to the tibial connection. [Henry, S. et al., 2022]

LIMITATION

The following are some of these clinical observation case limitations: 1) The inability to perform radiographic measurements on knee X-ray pictures (Tibio-Femoral Angle before and after treatment, Joint Space Ratio before and after treatment) due to the lack of uniformity. 2) The dependent factors, such as body weight, height, and other diseases, were not taken into account in this observational study.

Our cases offer medical evidence for a new treatment for severe knee OA. The biomechanical benefits of PFO and biochemical therapy were combined to treat patients with late-stage medial compartment knee OA. Both methods for reducing pain and improving knee function are simple, quick, safe, and reasonably priced. Based on their subjective pain scores using the VAS and functional scores using the WOMAC measure, all ten of our subjects reported appreciable

improvement at long-term follow-up. The patient's knee function improves, and their level of everyday pleasure rises. Treatment for late-stage medial compartment OA may be possible with this combination of therapies.

SUGGESTION

Based on this article we provides some of suggestion to the future study, there are

1. This treatment evaluate for 6 month to one year using VAS and WOMAC score
2. Comparison of PRP and prolotherapy dextrose as intraosseus injection
3. The effectiveness of Hyaluronic acid 2000 Kda as single injection on combination of other PFO, IOA, and genicular block

CONCLUSION

The PFO, IOI, IAI, and genicular block procedures were performed on ten patients with severe knee OA, and the long-term results revealed pain alleviation and functional improvement. This case series indicates that the treatment approach may be useful to treat severe OA with varus deformity and delay the need for TKA in patients for a variety of reasons.

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