

Clinical Efficacy Analysis of High Tibial Osteotomy Combined with Meniscal Repair for the Treatment of Degenerative Medial Meniscus Posterior Root Tears

Xiren Yang*, Dong Zhang*, Liangchao Huang, Jinlong Peng, Hui Li, Junqing Liang, Jun Chen#, Jialong Nong#

Department of Joint Surgery and Sports Medicine, Affiliated Southwest Hospital of Youjiang Medical University for Nationalities/Baise People's Hospital, Baise, China

Email: *43582551@qq.com, *17839836150@163.com, #bsdrchen@163.com, #fsnj11508@163.com

How to cite this paper: Yang, X.R., Zhang, D., Huang, L.C., Peng, J.L., Li, H., Liang, J.Q., Chen, J. and Nong, J.L. (2026) Clinical Efficacy Analysis of High Tibial Osteotomy Combined with Meniscal Repair for the Treatment of Degenerative Medial Meniscus Posterior Root Tears. *Open Journal of Regenerative Medicine*, 15, 17-28.
<https://doi.org/10.4236/ojrm.2026.152002>

Received: April 29, 2026

Accepted: June 7, 2026

Published: June 10, 2026

Copyright © 2026 by author(s) and Scientific Research Publishing Inc. This work is licensed under the Creative Commons Attribution International License (CC BY 4.0).

<http://creativecommons.org/licenses/by/4.0/>



Open Access

Abstract

Objective: To compare the clinical efficacy and safety of high tibial osteotomy (HTO) combined with meniscal repair versus isolated meniscal repair in the treatment of degenerative medial meniscus posterior root tears (MMPRTs), and to provide evidence-based support for surgical decision-making in patients with concomitant knee osteoarthritis. **Methods:** A retrospective cohort study was conducted. Surgical allocation was based on lower limb alignment severity, activity demand, and comprehensive surgeon evaluation. A total of 62 patients were initially screened, and 7 were excluded; finally 55 patients with degenerative MMPRTs combined with Kellgren-Lawrence grade II - III knee osteoarthritis treated at Baise People's Hospital from January 2019 to June 2025 were enrolled, all completed 12-month follow-up. Patients were divided into a combined group (30 cases, HTO + meniscal repair) and an isolated group (25 cases, isolated meniscal repair). All surgeries were performed by the same surgical team. A standardized transtibial pull-out technique was used for meniscal repair in all patients. Patients were followed up for 12 months. The visual analog scale (VAS), Lysholm knee score, Hospital for Special Surgery knee score (HSS), Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC), hip-knee-ankle angle (HKA), and weight-bearing line ratio (WBLR) were used to assess pain, functional recovery, and alignment correction. Perioperative indicators and complications were recorded. **Results:** Baseline data including HKA and WBLR were comparable between the two groups ($P > 0.05$). HKA and WBLR were significantly improved

*Co-first authors.

*Corresponding author.

postoperatively in the combined group ($P < 0.05$). At all postoperative time points, VAS and WOMAC scores in both groups were significantly lower than preoperative values, while Lysholm and HSS scores were significantly higher (all $P < 0.001$). Intergroup comparison showed that at 3, 6, and 12 months postoperatively, VAS and WOMAC scores in the combined group were lower than those in the isolated group, and HSS scores were higher (all $P < 0.05$). At 6 and 12 months postoperatively, Lysholm scores in the combined group were higher than those in the isolated group ($P < 0.05$), but no significant difference was found at 3 months ($P > 0.05$). The complication rate was 13.3% in the combined group and 20.0% in the isolated group, with no statistically significant difference ($P > 0.05$). **Conclusion:** Based on this single-center short-term retrospective data, for patients with degenerative MMPRTs complicated by knee varus and early-to-mid-stage osteoarthritis, HTO combined with meniscal repair provides superior pain relief and functional recovery compared with isolated meniscal repair without increasing the risk of complications. The mechanism is associated with correction of lower limb alignment and optimization of the knee biomechanical environment, making it an optional joint-preserving procedure for such patients.

Keywords

Degenerative Medial Meniscus Posterior Root Tear, High Tibial Osteotomy, Meniscal Repair, Knee Osteoarthritis, Lower Limb Alignment, Joint-Preserving Therapy

1. Introduction

Degenerative medial meniscus posterior root tear (MMPRT) is a major contributor to knee pain, functional impairment, and progression of osteoarthritis in middle-aged and elderly individuals, accounting for 10% - 21% of meniscal injuries and affecting a large number of patients annually [1]. The meniscus posterior root is a critical attachment for maintaining hoop tension. A tear can lead to meniscal extrusion and loss of load transmission function, with biomechanical effects similar to total meniscectomy, thereby causing stress concentration in the medial compartment and accelerated cartilage degeneration, forming a vicious cycle of osteoarthritis progression [2]. In clinical practice, MMPRTs are often accompanied by knee varus deformity and early-to-mid-stage osteoarthritis. Isolated meniscal repair cannot correct the abnormal mechanical environment, leading to poor healing, repair failure, and symptom recurrence, and the optimal treatment strategy remains controversial [3].

Meniscal repair is a mainstream joint-preserving procedure for MMPRTs, with the transtibial pull-out technique being the most widely used, as it restores the anatomical structure and hoop tension of the meniscus [4]. High tibial osteotomy (HTO) corrects the varus alignment by shifting the mechanical axis to the lateral compartment, reducing medial compartment load and providing a stable mechanical environment for meniscal healing and cartilage protection [5]. Theoret-

ically, combining the two procedures can achieve synergistic effects of structural repair and alignment correction. However, comparative clinical studies are scarce, particularly high-quality evidence for patients with Kellgren-Lawrence grade II - III osteoarthritis [6].

Therefore, this retrospective cohort study was designed to systematically compare the early-to-mid-term outcomes of HTO combined with meniscal repair versus isolated meniscal repair for degenerative MMPRTs, to clarify the clinical value of the combined procedure and provide a reference for individualized surgical decision-making.

2. Materials and Methods

2.1. Study Subjects

This study was approved by the Medical Ethics Committee of Baise People's Hospital. Patient flow: A total of 62 patients with MMPRT were initially screened from January 2019 to June 2025; 1 case of acute trauma, 2 cases of severe osteoporosis, 2 cases of inflammatory arthropathy, and 2 cases of lost follow-up were excluded, and 55 patients were finally enrolled. A retrospective review was conducted on 55 patients with degenerative MMPRTs treated in the Department of Joint Surgery/Sports Medicine of our hospital from January 2019 to June 2025. All patients were diagnosed by weight-bearing knee radiography, full-length lower limb radiography, and MRI, and presented with Kellgren-Lawrence grade II - III knee osteoarthritis and knee varus deformity. Surgical selection rule: Patients were assigned by the same team based on hip-knee-ankle angle (HKA), weight-bearing line ratio (WBLR), and daily activity demand. Patients were divided into a combined group (HTO + meniscal repair, 30 cases) and an isolated group (isolated meniscal repair, 25 cases) according to the surgical procedure. All patients or their guardians provided informed consent, and complete medical records were available. Preoperative DR imaging results are shown in **Figure 1(A)** and **Figure 1(B)**.

2.1.1. Inclusion Criteria

1) Age > 50 years (female > 40 years) and ≤ 75 years; 2) MRI-confirmed medial meniscus posterior root tear (type III, IV, or V); 3) Concomitant knee varus deformity and Kellgren-Lawrence grade II - III knee osteoarthritis; 4) Indication for surgery and tolerance to surgery; 5) Complete follow-up data.

2.1.2. Exclusion Criteria

1) Acute traumatic meniscal injury; 2) Concomitant knee ligament rupture, infection, tumor, or severe osteoporosis; 3) Inflammatory arthropathies such as gout or rheumatoid arthritis, or osteonecrosis of the distal femur; 4) Severe cardiovascular, cerebrovascular, liver, or renal dysfunction precluding surgery; 5) Cognitive impairment or poor compliance preventing evaluation and rehabilitation.

2.2. Surgical Procedures

All surgeries were performed by the same team of chief surgeons under spinal

anesthesia or nerve block combined with non-intubated general anesthesia, with the patient in the supine position and a pneumatic tourniquet applied to the upper thigh.

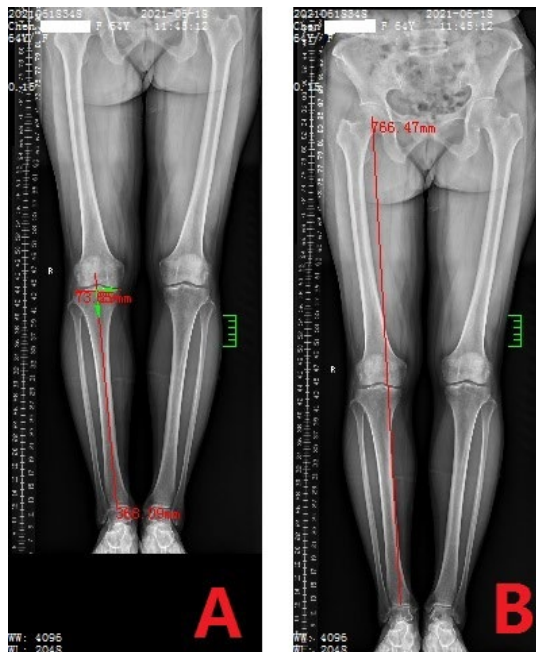


Figure 1. Preoperative DR imaging results.

2.2.1. Isolated Group (Isolated Meniscal Posterior Root Repair)

Conventional anteromedial and anterolateral arthroscopic portals were used, with an incision approximately 1.0 cm in length. MMPRT was confirmed under arthroscopy, and other structural injuries were excluded. The bony bed at the meniscal posterior root attachment was abraded with a burr. A tibial bone tunnel was created using a point-to-point guide. The standardized pull-out technique was used for suturing and fixation. High-strength sutures passed through the tibial tunnel and secured with a staple or a lateral row anchor [7]. The joint cavity was irrigated, a drain was placed, and the incisions were closed in layers.

2.2.2. Combined Group (HTO Combined with Meniscal Repair)

Arthroscopic meniscal posterior root repair was performed first, as in the isolated group, using the standardized pull-out technique, but the sutures were left untied temporarily. Subsequently, medial open-wedge HTO was performed. A straight incision of 6 - 8 cm was made on the anteromedial knee to expose the tibial tubercle and patellar ligament. The pes anserinus and superficial layer of the medial collateral ligament were released. Subperiosteal dissection was performed to protect the posteromedial neurovascular structures. Guide pins were inserted approximately 5 cm below the tibial plateau, with the hinge point located 1 cm below the lateral tibial plateau. Osteotomy direction and depth were confirmed by C-arm fluoroscopy. A biplanar oscillating saw was used for the osteotomy, and the osteotomy site was gradually opened using stacked osteotomes to the preplanned an-

gle, HKA and WBLR were confirmed to meet the standard under fluoroscopy, with fluoroscopic confirmation that the mechanical axis passed near the Fujisawa point. A locking plate was placed and fixed with screws. Finally, the meniscal repair sutures were tensioned through the tibial tunnel and secured with anchors. Satisfactory reduction was confirmed arthroscopically. A drain was placed, and the incisions were closed in layers. Intraoperative arthroscopic exploration and surgical images are shown in **Figure 2(A)** and **Figure 2(B)**.

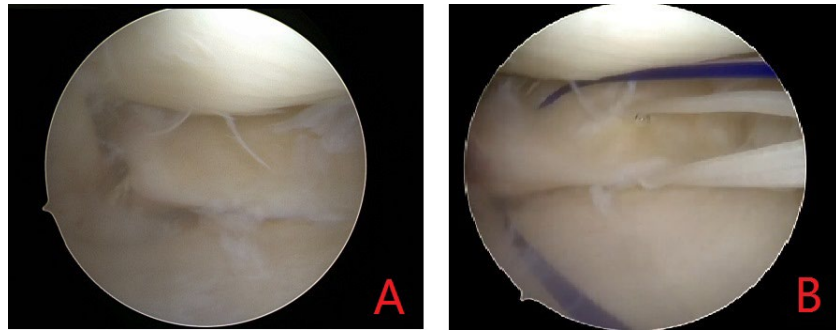


Figure 2. Intraoperative arthroscopic exploration and surgical images.

2.3. Postoperative Management

Both groups received elastic bandage compression postoperatively. Intravenous cefazolin sodium was administered within 24 hours postoperatively to prevent infection, along with measures for reducing swelling, pain relief, anticoagulation, and functional exercise guidance. The isolated group progressed to gradual weight-bearing postoperatively. The combined group was non-weight-bearing for 6 weeks, then partial weight-bearing with crutches, transitioning to full weight-bearing within 3 months.

2.4. Outcome Measures

Two specialized surgeons who were not involved in the surgery performed blinded assessments preoperatively and at 3, 6, and 12 months postoperatively. 1) Pain assessment: VAS score (0 - 10, higher score indicates more severe pain). 2) Knee function: Lysholm score and HSS score (higher scores indicate better function). 3) Osteoarthritis severity: WOMAC index (higher score indicates more severe impairment). 4) Alignment parameters: Hip-knee-ankle angle (HKA), weight-bearing line ratio (WBLR). 5) Complications: incision infection, deep vein thrombosis, knee stiffness, internal fixation loosening, nonunion of osteotomy, etc.

2.5. Statistical Analysis

SPSS 30.0 software was used for data analysis. Continuous data were expressed as mean \pm standard deviation ($x \pm s$) or median (interquartile range). Intragroup comparisons were performed using paired t-tests or Wilcoxon signed-rank tests, and intergroup comparisons using independent two-sample t-tests or Mann-Whitney U tests. Categorical data were expressed as n (%) and compared using

the χ^2 test or Fisher's exact test. The significance level was set at $\alpha = 0.05$, with $P < 0.05$ considered statistically significant.

3. Results

3.1. Comparison of Baseline Data

No statistically significant differences were found between the two groups in age, sex, affected side, BMI, K-L grade, HKA, WBLR, operative time, or intraoperative blood loss ($P > 0.05$), indicating comparable baselines (**Table 1**).

Table 1. Comparison of baseline data between the two groups.

Variable	Isolated group (n = 25)	Combined group (n = 30)	Statistic	P value
Age (years, $x \pm s$)	58.12 \pm 8.70	54.27 \pm 7.35	t = -1.78	0.08
Sex (male/female, n)	4/21	3/27	$\chi^2 = *$	0.69
Affected limb (left/right, n)	18/7	24/6	$\chi^2 = 0.48$	0.54
BMI (kg/m ² , $x \pm s$)	25.71 \pm 3.25	26.49 \pm 3.62	t = -0.83	0.41
Operative time (min, $x \pm s$)	83.72 \pm 19.15	163.63 \pm 49.68	t = 8.12	<0.001
Intraoperative blood loss (mL, M (P25, P75))	23.00 \pm 12.83	79.67 \pm 25.12	Z = 10.78	<0.001
K-L grade (II/III, n)	18/7	20/10	$\chi^2 = 0.18$	0.77

Note: * Fisher's exact test.

3.2. Preoperative Score Comparison

No statistically significant differences were found between the two groups in preoperative VAS, Lysholm, HSS, or WOMAC scores ($P > 0.05$), indicating comparability (**Table 2**).

Table 2. Comparison of preoperative scores between the two groups.

Variable	Isolated group (n = 25)	Combined group (n = 30)	Statistic	P value
VAS (M (P25, P75))	8.00 (7.00, 8.00)	7.00 (7.00, 8.00)	Z = -1.37	0.18
Lysholm ($x \pm s$)	41.16 \pm 2.87	39.50 \pm 3.74	t = -1.82	0.07
HSS ($x \pm s$)	42.12 \pm 5.40	44.57 \pm 5.75	t = 1.62	0.11
WOMAC (M (P25, P75))	58.00 (55.50, 62.00)	55.50 (50.75, 59.50)	Z = -1.84	0.07

3.3. Intragroup Comparison of Preoperative and Postoperative Scores

At 3, 6, and 12 months postoperatively, VAS and WOMAC scores in both groups were significantly lower than preoperative values, and Lysholm and HSS scores were significantly higher, and HKA and WBLR were significantly improved (all $P < 0.001$; **Tables 3-6**).

Table 3. Comparison of preoperative and postoperative Lysholm and HSS scores in the isolated group ($x \pm s$).

Variable	Preoperative	Postoperative 3 months	Postoperative 6 months	Postoperative 12 months	t value	P value
Lysholm	41.16 ± 2.87	52.40 ± 3.82	62.92 ± 4.09	71.80 ± 3.90	-23.22/ -30.05/ -37.44	<0.001
HSS	42.12 ± 5.40	66.20 ± 3.35	73.22 ± 3.58	80.64 ± 4.27	-19.26/ -23.23/ -31.03	<0.001

Table 4. Comparison of preoperative and postoperative VAS and WOMAC scores in the isolated group (M (P25, P75)).

Variable	Preoperative	Postoperative 3 months	Postoperative 6 months	Postoperative 12 months	Z value	P value
VAS	8.00 (7.00, 8.00)	6.00 (5.00, 6.50)	4.00 (4.00, 5.00)	3.00 (2.00, 3.00)	-4.46/ -4.47/ -4.42	<0.001
WOMAC C	58.00 (55.50, 62.00)	42.00 (35.00, 43.00)	25.00 (23.50, 27.50)	15.00 (12.00, 17.00)	-4.38/ -4.37/ -4.36	<0.001

Table 5. Comparison of preoperative and postoperative Lysholm and HSS scores in the combined group ($x \pm s$).

Variable	Preoperative	Postoperative 3 months	Postoperative 6 months	Postoperative 12 months	t value	P value
Lysholm	39.50 ± 3.73	53.56 ± 4.77	67.83 ± 4.63	78.52 ± 3.95	22.24/ 30.95/39.63	<0.001
HSS	44.56 ± 5.75	78.10 ± 3.50	85.90 ± 3.27	91.91 ± 2.06	34.34/35.42 /35.41	<0.001

Table 6. Comparison of preoperative and postoperative VAS and WOMAC scores in the combined group (M (P25, P75)).

Variable	Preoperative	Postoperative 3 months	Postoperative 6 months	Postoperative 12 months	Z value	P value
VAS	7.00 (7.00, 8.00)	5.00 (5.00, 6.00)	3.00 (3.00, 4.00)	2.00 (2.00, 3.00)	-4.90/ -4.85/ -4.23	<0.001
WOMAC	55.50 (50.75, 59.50)	36.00 (27.75, 39.00)	19.00 (16.00, 22.25)	10.00 (7.00, 12.00)	-4.78/ -4.78/ -4.20	<0.001

3.4. Intergroup Comparison of Postoperative Scores

At all postoperative time points, the combined group had lower VAS and WOMAC scores and higher HSS scores than the isolated group (all $P < 0.05$). At 6 and 12 months postoperatively, Lysholm scores in the combined group were higher than

those in the isolated group ($P < 0.05$), but no significant difference was found at 3 months ($P > 0.05$) (**Table 7**, **Table 8**). The improvements in HKA and WBLR were significantly greater in the combined group than in the isolated group ($P < 0.05$). Comparisons of pain and functional scores between the two groups at each postoperative time point are shown in **Figure 3(A)** and **Figure 3(B)**.

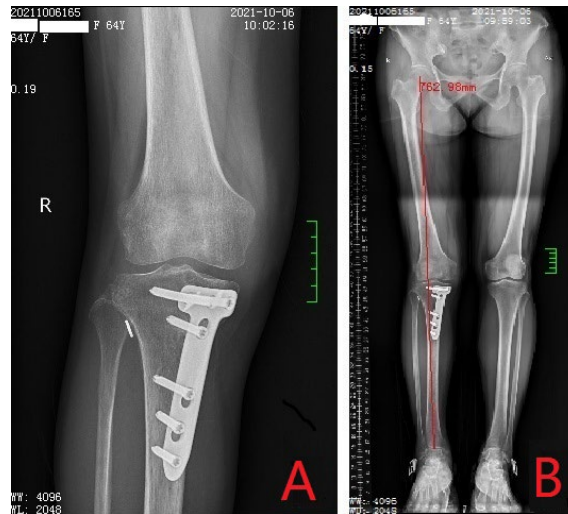


Figure 3. Postoperative lateral shift of the mechanical axis, improvement of the medial joint space, and healing of the osteotomy line.

Table 7. Comparison of postoperative VAS and WOMAC scores between the two groups (M (P25, P75)).

Variable	Isolated group (n = 25)	Combined group (n = 30)	Z value	P value
Postoperative 3 months VAS	6.00 (5.00, 6.50)	5.00 (5.00, 6.00)	-3.09	0.002
Postoperative 6 months VAS	4.00 (4.00, 5.00)	3.00 (3.00, 4.00)	-4.77	<0.001
Postoperative 12 months VAS	3.00 (2.00, 3.00)	2.00 (2.00, 3.00)	-2.65	0.008
Postoperative 3 months WOMAC	42.00 (35.00, 43.00)	36.00 (27.75, 39.00)	-3.22	<0.001
Postoperative 6 months WOMAC	25.00 (23.50, 27.50)	19.00 (16.00, 22.25)	-5.12	<0.001
Postoperative 12 months WOMAC	15.00 (12.00, 17.00)	10.00 (7.00, 12.00)	-4.78	<0.001

Table 8. Comparison of postoperative Lysholm and HSS scores between the two groups ($x \pm s$).

Variable	Isolated group (n = 25)	Combined group (n = 30)	t value	P value
Postoperative 3 months Lysholm	52.40 \pm 3.82	53.57 \pm 4.77	0.97	0.32
Postoperative 6 months Lysholm	62.92 \pm 4.09	67.83 \pm 4.64	4.12	<0.001
Postoperative 12 months Lysholm	71.80 \pm 3.90	78.52 \pm 3.95	5.92	<0.001
Postoperative 3 months HSS	66.20 \pm 3.35	78.10 \pm 3.51	12.78	<0.001
Postoperative 6 months HSS	73.22 \pm 3.58	85.90 \pm 3.27	13.60	<0.001
Postoperative 12 months HSS	80.64 \pm 4.27	91.91 \pm 2.07	11.79	<0.001

3.5. Comparison of Postoperative Complications

The complication rate was 13.3% (4/30) in the combined group and 20.0% (5/25) in the isolated group, with no statistically significant difference ($P > 0.05$). No serious complications such as internal fixation loosening or nonunion occurred (Table 9).

Table 9. Comparison of postoperative complications between the two groups (n, %).

Complication	Isolated group (n = 25)	Combined group (n = 30)	χ^2 value	P value
Incision infection	0 (0.0)	2 (6.6)	-	0.495
Lower extremity DVT	2 (8.0)	1 (3.3)	-	0.585
Knee stiffness	3 (12.0)	1 (3.3)	-	0.320
Total complications	5 (20.0)	4 (13.3)	0.09	0.765

Note: Fisher's exact test was used.

4. Discussion

4.1. Pathological Mechanism and Treatment Difficulties of Degenerative MMPRT

MMPRT disrupts the hoop tension structure of the meniscus, leading to meniscal extrusion and a sharp increase in medial compartment stress, accelerating cartilage degeneration and forming a vicious cycle of “abnormal alignment—stress concentration—meniscal failure—osteoarthritis progression” [8]. In the presence of knee varus, the abnormal mechanical environment further reduces meniscal healing rates, making isolated repair insufficient to halt disease progression, which poses a clinical challenge [9]. The patients in this study all had degenerative cases with concomitant K-L grade II - III osteoarthritis, closely reflecting real-world clinical scenarios.

4.2. Synergistic Efficacy of HTO Combined with Meniscal Repair

Our results showed that the combined group had significantly better pain relief and functional recovery than the isolated group, with greater alignment improvement and without an increase in complications, confirming the synergistic effect of HTO and meniscal repair [10]. HTO corrects lower limb alignment, reduces peak pressure in the medial compartment, provides a stable mechanical environment for meniscal healing, decreases tension on the repair, and delays cartilage degeneration [11]. Meniscal repair restores the anatomical structure and load transmission function. The two procedures complement each other, achieving the dual goals of “structural repair + alignment reconstruction” [12]. The lack of difference in Lysholm score at 3 months postoperatively may be related to the early postoperative weight-bearing restrictions in the combined group; as osteotomy healing progresses and rehabilitation advances, the functional advantages gradually emerge and persist through 12 months postopera-

tively [13].

4.3. Clinical Value and Indications

For patients with degenerative MMPRTs complicated by knee varus and early-to-mid-stage osteoarthritis, HTO combined with meniscal repair is an optional option with favorable short-term outcomes, particularly for relatively young, active patients seeking joint preservation, potentially delaying or avoiding knee arthroplasty [14]. Clinical decision-making should emphasize evaluation of lower limb alignment, moving beyond the limitation of isolated structural repair toward a comprehensive biomechanical reconstruction concept to achieve individualized precision treatment [15]. Postoperative imaging and functional evaluation results are shown in **Figure 4(A)** and **Figure 4(B)**.

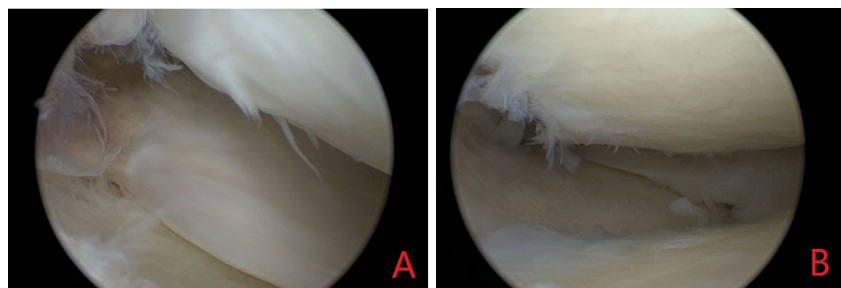


Figure 4. Postoperative second-look findings.

4.4. Limitations of This Study

- 1) Single-center retrospective design with a relatively small sample size, potentially introducing selection bias; conclusions require validation by multicenter, large-sample studies.
- 2) Follow-up duration of only 12 months, lacking long-term data on osteoarthritis progression, meniscal retear rate, and joint survival.
- 3) Lack of randomization; despite baseline matching, bias cannot be completely eliminated.
- 4) Outcome assessment primarily based on subjective scales, lacking objective biomechanical and imaging indicators.

5. Conclusion

For the treatment of degenerative medial meniscus posterior root tears complicated by knee varus and early-to-mid-stage osteoarthritis, based on the short-term retrospective results of this study, HTO combined with meniscal repair significantly improves postoperative pain and knee function, achieving superior outcomes compared with isolated meniscal repair, with good safety and no increase in complication risk. By correcting lower limb alignment, this procedure optimizes the knee biomechanical environment, providing favorable conditions for meniscal healing and cartilage protection, and represents an optional joint-preserving strategy for this patient population [16].

Acknowledgements

We thank the Medical Ethics Committee of Baise People's Hospital for approval, the Department of Joint Surgery/Sports Medicine team for their collaboration, and all patients for their cooperation.

Funding

Baise City Science and Technology Research and Development Plan Project (Baiké 20222916).

Conflicts of Interest

All authors declare no corporate sponsorship or financial conflicts of interest. The data are authentic and reliable, and no academic misconduct exists.

References

- [1] Randazzo, E., Duerr, R. and Baria, M.R. (2022) Meniscus Root Tears: A Clinical Review. *Current Sports Medicine Reports*, **21**, 155-158.
<https://doi.org/10.1249/jsr.0000000000000959>
- [2] Gannon, N.P., Wise, K.L. and Macalena, J.A. (2021) Arthroscopic Transosseous Repair of a Medial Meniscal Posterior-Root Tear. *JBJS Essential Surgical Techniques*, **11**, e20.00031. <https://doi.org/10.2106/jbjs.st.20.00031>
- [3] Balke, M., Metzloff, S., Faber, S., Niethammer, T., Roessler, P.P., Henkelmann, R., *et al.* (2021) Posteriore wurzelverletzungen der menisken. *Der Orthopäde*, **50**, 1039-1050. <https://doi.org/10.1007/s00132-021-04192-8>
- [4] Gerhold, C., Dave, U., Bi, A.S. and Chahla, J. (2025) Medial Meniscus Root Tears: Anatomy, Repair Options, and Outcomes. *Arthroscopy*, **41**, 871-873.
<https://doi.org/10.1016/j.arthro.2025.01.005>
- [5] Shah, I., S Majeed, I. and Kurian, N.P. (2025) Medial Meniscus Root Tears: Management with Single-Tunnel Repair and Meniscus Centralization. *Cureus*, **17**, e84425.
<https://www.cureus.com/articles/360325>
- [6] Tao, Y.L., Liu, W., Wang, Y.H., *et al.* (2026) Tibial High Osteotomy for Medial Meniscus Posterior Root Tears in Middle Aged and Elderly Patients with Knee Varus: Early Efficacy and Finite Element Analysis. *Chinese Journal of Reparative and Reconstructive Surgery*, **40**, 563-570.
<https://www.rrsurg.com/article/10.7507/1002-1892.202512056>
- [7] Han, D.D. (2023) Short-Term Clinical Efficacy Analysis of Arthroscopic Transtibial Pullout Fixation versus Anchor Fixation for Medial Meniscus Posterior Root Tears Master's Thesis, Xinjiang Medical University.
https://med.wanfangdata.com.cn/Paper/Detail?id=DegreePaper_D03059784
- [8] Qi, Y.S., Wu, H.H., Zhou, H.W., *et al.* (2023) Comparison of Short-Term Efficacy of Two Arthroscopic Procedures for Lateral Meniscus Posterior Root Injury. *Chinese Journal of Minimally Invasive Surgery*, **23**, 462-468. (in Chinese)
https://med.wanfangdata.com.cn/Paper/Detail?id=PeriodicalPaper_zhonggwckz202306010&dbid=WF_OK
- [9] Day, M. and Wolf, B.R. (2019) Medial Opening-Wedge High Tibial Osteotomy for Medial Compartment Arthritis/Overload. *Clinics in Sports Medicine*, **38**, 331-349.
<https://doi.org/10.1016/j.csm.2019.02.003>

- [10] Pullen, W.M., Slone, H., Abrams, G. and Sherman, S.L. (2024) High Tibial Osteotomy in Knee Reconstruction and Joint Preservation. *Journal of the American Academy of Orthopaedic Surgeons*, **32**, 577-586. <https://doi.org/10.5435/jaaos-d-23-00323>
- [11] Ishii, Y., Ishikawa, M., Kamei, G., Nakashima, Y., Iwamoto, Y., Takahashi, M., *et al.* (2023) Effect of Limb Alignment Correction on Medial Meniscus Extrusion under Loading Condition in High Tibial Osteotomy. *Asia-Pacific Journal of Sports Medicine, Arthroscopy, Rehabilitation and Technology*, **34**, 1-8. <https://doi.org/10.1016/j.asmart.2023.08.010>
- [12] Lee, C., Yang, H. and Seon, J. (2023) Increased Medial Meniscus Extrusion Led to Worse Clinical Outcomes after Medial Opening-Wedge High Tibial Osteotomy. *Knee Surgery, Sports Traumatology, Arthroscopy*, **31**, 1614-1622. <https://doi.org/10.1007/s00167-022-07148-3>
- [13] Hantouly, A.T., Aminake, G., Khan, A.S., Ayyan, M., Olory, B., Zikria, B., *et al.* (2024) Meniscus Root Tears: State of the Art. *International Orthopaedics*, **48**, 955-964. <https://doi.org/10.1007/s00264-024-06092-w>
- [14] Nammour, M.A., James, M., Arner, J.W. and Bradley, J.P. (2023) Arthroscopic Trans-tibial Repair of Acute Traumatic Posterior Medial Meniscus Root Tear. *Video Journal of Sports Medicine*, **3**.
- [15] Li, A.X., Tan, H.B., Qiu, X., *et al.* (2022) Research Progress of Medial Meniscus Posterior Root Tear (MMPRT): Autologous Tendon Reconstruction May be a Better Option. *Chinese Journal of Clinical Anatomy*, **40**, 627-630. (in Chinese) https://med.wanfangdata.com.cn/Paper/Detail?id=PeriodicalPaper_zglcjpzz202205024&dbid=WF_QK
- [16] Jing, L., Liu, K., Wang, X., Wang, X., Li, Z., Zhang, X., *et al.* (2020) Second-Look Arthroscopic Findings after Medial Open-Wedge High Tibial Osteotomy Combined with All-Inside Repair of Medial Meniscus Posterior Root Tears. *Journal of Orthopaedic Surgery*, **28**, 1-8.