ORIGINAL RESEARCH PAPER

Orthopaedics

COMPARISON OF FUNCTIONAL OUTCOME OF FIXATION OF TIBIAL SPINE AVULSION FRACTURE BY OPEN REDUCTION AND SCREW FIXATION VERSUS ARTHROSCOPIC SUTURE FIXATION: A PROSPECTIVE COMPARATIVE STUDY

KEY WORDS: Tibial spine avulsion fracture, Arthroscopic suture fixation, Screw fixation, Lysholm Knee Score, IKDC.

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ABSTRACT

Introduction: Tibial spine avulsion fractures are rare intra-articular injuries that need anatomic reduction and secure repair to restore anterior cruciate ligament function and stability of the knee. In the present study, we evaluated the functional and radiological outcomes of the two fixation procedures. **Methods:** We did a prospective comparative analysis of 40 patients with Meyers and McKeever Type II, Type III and reducible Type IV tibial spine avulsion fractures. Twenty patients had open reduction with cannulated screw fixation (Group A) and twenty patients underwent arthroscopic reduction with high strength suture fixation (Group B). The patients were monitored for 6 months. Functional results were examined using the Lysholm Knee assessment and the subjective assessment of the International Knee Documentation Committee (IKDC). **Results:** Baseline demographics and fracture characteristics were comparable between the groups. Both procedures produced 100% radiological union and good stability of the knee. The arthroscopic group had significantly higher Lysholm (95.65 ± 3.18 vs. 90.35 ± 4.92; $p<0.001$) and IKDC (93.40 ± 4.12 vs. 87.80 ± 5.84; $p<0.001$) scores at six months. Arthroscopic fixation was associated with earlier restoration of knee motion, quicker rehabilitation and fewer problems linked to the implant. **Conclusion:** Both fixation techniques resulted in excellent fracture healing and restoration of knee stability. However, arthroscopic suture fixation yielded better functional results, earlier return of knee motion and fewer postoperative complications.

INTRODUCTION

Tibial spine avulsion fractures, also known as tibial eminence fractures, are rare intra-articular injuries in which the anterior cruciate ligament (ACL) is avulsed from its tibial insertion rather than ruptured. These fractures are most common in children and adolescents because the incompletely ossified tibial eminence is biomechanically weaker than the ACL; nonetheless, they are increasingly identified in adults following high-energy trauma and sports-related injuries.[1-3]

The mechanism of damage is generally a forceful hyperextension of the knee with an associated rotational or valgus load leading to avulsion of the ACL insertion. In skeletally immature patients the more weaker tibial eminence gives way before the ligament. In adulthood these injuries are typically seen following road traffic accidents or high impact sports . Associated meniscal tears, chondral injuries and collateral ligament injuries are common and may influence both therapy and prognosis.[3,4] Patients frequently appear with acute knee discomfort, edema, hemarthrosis, difficulty to bear weight, and limited range of motion. On examination there is commonly a knee effusion, discomfort around the tibial eminence, limited movement and different degrees of anterior instability. Standard anteroposterior and lateral radiographs establish the diagnosis in most patients. Magnetic resonance imaging (MRI) is useful to identify concomitant soft tissue injury and to plan surgery.[4,5]

The most common classification system for tibial spine avulsion fractures was described by Meyers and McKeever and subsequently modified by Zaricznyj. Type I fractures are non-displaced and are typically treated conservatively, whereas displaced Type II fractures that are unable to be reduced by closed methods and all Type III and Type IV fractures typically require operative fixation for restoration of knee stability and ACL function.[1,6] The primary aims of treatment are anatomic reduction of the avulsed fragment, restoration of anterior cruciate ligament (ACL) tension, stable fixation, early mobilization, and prevention of complications like residual instability, arthrofibrosis, extension deficit, nonunion and early degenerative osteoarthritis. Several fixation methods have been documented including cannulated screw fixation, pull-out sutures, suture anchors, bioabsorbable implants and high-strength suture constructs.[7,8]

Open reduction and fixation with cannulated screws has been the traditional surgical method for many years because to the rigid fixation, direct view of the fracture, and excellent compression of big fragments. However, screw fixation may be associated with implant prominence, hardware irritation, minor fracture fragment fragmentation, impingement and the necessity for secondary implant removal.[9,10] Arthroscopic suture fixation has garnered popularity with the advent of arthroscopic surgery because of its less invasive nature, preservation of soft tissue integrity, concurrent treatment of associated intra-articular injuries, and stable fixation even in comminuted fractures. High-strength suture fixation is equivalent or superior than screw fixation without issues connected to implants, according to biomechanical studies.[11,12] Several comparative clinical investigations have shown acceptable functional results with both approaches. Seon et al. observed satisfactory fracture union and restoration of knee stability with both screw and suture fixation, but greater postoperative range of motion and fewer problems with arthroscopic fixation.[10] Similarly, Gans et al. concluded in a systematic study that both methods provide excellent clinical outcomes, while arthroscopic suture fixation lowers the requirement for secondary surgery for implant removal.[13] More recent systematic reviews and meta-analyses have further established that arthroscopic fixation leads to comparable fracture healing and knee stability with better postoperative functional scores, quicker rehabilitation, and reduced complication rates when compared with screw fixation.[14,15]

The available information supports both the fixing approaches although majority of the published studies are from the Western countries and comparison data from the Indian population are scanty. Regional variations in patient population, mechanisms of damage, surgical expertise and rehabilitation procedures demand region-specific investigations. Therefore, the present prospective comparative study was undertaken to compare the functional outcome, radiological union, stability of the knee, range of motion and postoperative complications following open reduction with screw fixation and arthroscopic suture fixation in patients with displaced tibial spine avulsion fractures.

Hence, the present prospective comparative study was conducted to evaluate and compare the functional outcome, radiological healing, knee stability, postoperative range of motion and complications after open reduction with screw fixation and arthroscopic suture fixation in patients with displaced tibial spine avulsion fractures. The results are likely to add to evidence-based surgical management and help orthopedic surgeons choose the best fixation approach for each patient's characteristics.

METHODOLOGY

This prospective comparison study was undertaken in the Department of Orthopaedics at a tertiary care teaching hospital after receiving consent from Institutional Ethics Committee. All individuals provided written informed consent prior to enrolment. From January 2023 to June 2025, the patients presenting with tibial spine avulsion fractures were screened for the eligibility.

A total of forty patients with Meyers and McKeever Type II, Type III, or reducible Type IV tibial spine avulsion fractures were included in the study. Patients were equally divided into two groups according to the surgical approach used. Twenty patients received open reduction and internal fixation with cannulated cancellous screws and they were included in group A. Twenty patients in Group B underwent arthroscopic reduction and high strength nonabsorbable suture fixation.

Eligible patients were between 15 and 50 years of age and had acute closed tibial spine avulsion fractures presenting within three weeks of injury. The exclusion criteria were open fracture, previous ligamentous injury around the knee, pathologic fracture, concomitant neurovascular injury, severe osteoarthritis, and polytrauma that would preclude rehabilitation.

Preoperative assessment comprised thorough history, mechanism of injury, clinical examination, radiographs in anteroposterior and lateral views, and magnetic resonance imaging (MRI) of the affected knee to characterize the fracture morphology, and to identify related meniscal or ligamentous injuries

The Group A patients had open reduction by restricted anterior arthrotomy. Following evacuation of the hematoma and excision of intervening soft tissues, the avulsed fragment was anatomically decreased under direct vision. Kirschner wires were used for temporary fixation and one or two cannulated cancellous screws with washers were used for definitive fixation if needed. Fluoroscopy was used to confirm anatomical reduction and location of the implant before wound closure.

Standard arthroscopic reduction was performed in Group B through anteromedial and anterolateral portals. Arthroscopic debridement of hematoma and fibrous tissue: The fracture fragment was reduced under direct observation. High-strength nonabsorbable sutures were passed through the ACL material using a suture-passing device. Sutures were shuttled through tibial tunnels and fastened over a cortical button on the anteromedial tibial cortex for firm fixation. Associated intraarticular lesions such as meniscal rips or cartilage damage were repaired concomitantly where necessary.

All patients followed the same rehabilitation protocol postoperatively. On the first post-operative day a hinged knee brace was worn and quadriceps strengthening activities were begun. Partial weight bearing with crutches was allowed after two weeks, advancing to complete weight bearing with radiographic indications of fracture healing.

Patients were followed at two weeks, six weeks, three months and six months after operation. Clinical evaluation was done by wound assessment, discomfort, range of motion and complications at each follow-up. Functional results were measured using the Lysholm Knee Score and the IKDC subjective knee evaluation form. Serial anteroposterior and lateral radiographs of the knee were used for radiological assessment of fracture union and maintenance of reduction.

Data were entered using Microsoft Excel and analysed in SPSS version 26.0. Continuous variables were given as mean ± standard deviation and categorical variables as frequencies and percentages. Continuous variables were compared across groups by the independent Student's t-test and within each group by the paired t-test. Categorical variables were compared using Chi-square test or Fisher's exact test. A p-value of <0.05 was judged statistically significant.

RESULTS

The study comprised forty patients with displaced tibial spine avulsion fractures. Twenty patients were treated with open reduction and screw fixation (Group A) and twenty patients with arthroscopic suture fixation (Group B). All patients completed the scheduled follow-up at 2 weeks, 6 weeks, 3 months and 6 months.

Table 1 shows the demographic and clinical baseline characteristics of the study cohort. The mean age was 24.9 ± 6.3 years in Group A and 23.8 ± 5.8 years in Group B (p=0.58). Males predominated in both groups and the most common mechanism of injury was sports related. form III fractures were the most common form of fracture in both groups. There were no significant differences between the groups regarding age, gender distribution, side of injury, mode of injury, or fracture type (p>0.05), indicating equivalent baseline characteristics.

Comparison of Lysholm Knee Scores during follow up. Both groups improved progressively following surgery. There was no significant difference at two weeks (p=0.081), however the arthroscopic suture fixation group had significantly higher Lysholm ratings at 6 weeks, 3 months and 6 months. At the final follow-up, the mean Lysholm score was 95.65 ± 3.18 in Group B against 90.35 ± 4.92 in Group A (p<0.001), suggesting a greater functional recovery with arthroscopic fixation. (Table 2)

Table 3 shows the comparison of IKDC Subjective Knee Evaluation Scores. Both groups showed similar gains, however the arthroscopic group had considerably higher IKDC ratings from six weeks forward. The mean IKDC score was 93.40 ± 4.12 in Group B and 87.80 ± 5.84 in Group A at six months (p<0.001) .

The surgical complications observed during follow-up are sho-wn in Figure 1. Further complications were noted in the screw fixation group including increased implant prominence, secondary implant removal and postoperative knee stiffness. The arthroscopic group had fewer consequences, including isolated transitory knee stiffness and superficial wound issues.

All patients were radiologically united at 6 months. There were no delayed unions, non-unions, implant failures or loss of reduction. Range of motion and stability of the knee increased gradually in all groups; but patients treated with arthroscopic suture fixation showed early return of knee motion, rapid rehabilitation, and greater total functional recovery. At the last follow-up most of the patients had stable knees with negative Lachman and anterior drawer tests and few had clinically minor Grade I residual laxity. Both methods showed excellent clinical and radiological results in general, with arthroscopic suture fixation showing better functional results and less postoperative problems.

Table 1. Baseline Demographic and Clinical Characteristics of the Study Population

	Variable	Group A (Open Screw) (n=20)	Group B (Arthroscopic Suture) (n=20)	p-value
Mean age (years)		24.9 ± 6.3	23.8 ± 5.8	0.58
Gender	Male	14 (70%)	13 (65%)	0.74
	Female	6 (30%)	7 (35%)	

Side	Right knee	12 (60%)	11 (55%)	0.75
	Left knee	8 (40%)	9 (45%)	
Etiology	Sports injury	11 (55%)	12 (60%)	0.74
	Road traffic accident	7 (35%)	6 (30%)	
	Fall from height	2 (10%)	2 (10%)	
Type of Fracture	Meyers Type II	5 (25%)	4 (20%)	0.88
	Meyers Type III	12 (60%)	13 (65%)	
	Meyers Type IV	3 (15%)	3 (15%)	

Table 2. Comparison of Lysholm Knee Score During Follow-up

Follow-up	Group A Mean ± SD	Group B Mean ± SD	p-value
2 Weeks	48.25 ± 5.84	51.40 ± 5.26	0.081
6 Weeks	65.80 ± 6.12	71.35 ± 5.48	0.006*
3 Months	81.55 ± 5.37	87.70 ± 4.82	<0.001*
6 Months	90.35 ± 4.92	95.65 ± 3.18	<0.001*

**Student's t-test; p < 0.05 considered statistically significant.*

Table 3. Comparison of IKDC Subjective Knee Evaluation Score During Follow-up

Follow-up	Group A Mean ± SD	Group B Mean ± SD	p-value
2 Weeks	46.90 ± 6.41	49.15 ± 5.98	0.246
6 Weeks	62.75 ± 6.08	68.45 ± 5.62	0.004*
3 Months	78.90 ± 5.69	85.10 ± 4.93	<0.001*
6 Months	87.80 ± 5.84	93.40 ± 4.12	<0.001*

**Student's t-test; p < 0.05 considered statistically significant.*

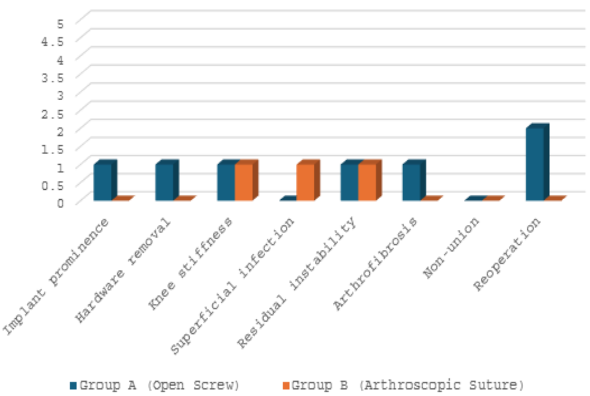

Fig 1:- Postoperative Complications

DISCUSSION

This prospective comparative study assessed the functional effects of open reduction with cannulated screw fixation and arthroscopic suture repair in displaced tibial spine avulsion fractures. Both methods led to full fracture union and acceptable stability of the knee, however arthroscopic suture fixation yielded considerably greater functional recovery, faster knee motion and fewer postoperative problems. These results imply that both fixation techniques are effective, and arthroscopic fixation provides better short-term clinical outcomes.

The bulk of the patients were young males and the most common mechanism of injury was sports-related trauma, followed by road traffic accidents. Similar demographic features have also been described by Aderinto and Keating where tibial spine avulsion fractures are seen mostly in young energetic individuals involved in sports or high energy activities.[16] Gans et al. also found that displaced tibial spine fractures are common in adolescents and young adults and usually require surgical treatment to restore knee stability and function.[17] In our analysis, type III fractures accounted for the bulk of the injuries. Edmonds et al. reported that displaced Type III fractures were the most common injuries that required sur-gical treatment, while Bogunovic et al. noted that fracture displacement is the main indication for operative fixation, beca-use conservative management of displaced fractures may lead to residual instability and poor functional results.[18,19]

Radiological union was established in all patients by six months. There were no occurrences of delayed union, non-union, implant failure or loss of reduction. Similar union rates were reported by Edmonds et al. who saw satisfactory fracture healing following both arthroscopic and open fixation if anatomical reduction was achieved. [19] Jaseel et al. also determined that correct reduction and stable fixation are more important factors of successful union than the choice of fixation device.[20]

The functional examination demonstrated steady improvement in both groups, although patients treated with arthroscopic suture fixation attained significantly better Lysholm and IKDC scores at six months. Similar results were also reported by Seon et al., and better functional outcomes were revealed in arthroscopic fixation with comparable fracture union and knee stability.[21] Gans et al. have reported that arthroscopic fixation leads to good clinical outcomes and fewer secondary procedures compared with screw fixation.[17]

The biomechanical advantage of suture fixation may be responsible for the higher functional results in the arthroscopic group. Bong et al. showed that high strength sutures give fixation strength equivalent to screw fixation with less chance of fragment fragmentation.[22] Mahar et al further demonstrated that suture constructions are more resistant to cyclic loading, providing permanent fixation even in small or comminuted fragments.[23] These biomechanical properties allow early recovery without affecting fracture stability.

Patients treated arthroscopically also had earlier recovery of knee range of motion than screw fixation. Postoperative arthrofibrosis has been reported by Vander Have et al. as an important consequence after fixation of tibial spine fractures and stressed the importance of early rehabilitation to reduce stiffness.[24] Patel et al. also showed that early mobilization following stable fixation improved postoperative knee motion and functional recovery without an increased risk of fixation failure.[25]

The rate of postoperative complications was lower in the arthroscopic group. Screw fixation was related with greater cases of implant prominence, postoperative stiffness and subsequent implant removal, while arthroscopy fixation resulted in only minimal transitory problems. Similar findings were reported by Bogunovic et al. and Jassel et al. who concluded that arthroscopic suture fixation provides excellent fracture healing and knee stability with little problems associated to the implant.[19, 20]

Screw fixation is still a reliable method for large non-comminuted fracture fragments, but arthroscopic suture fixation has several advantages: minimal soft tissue disruption, preservation of the vascularity of the fragment, treatment of associated intra-articular injuries, and elimination of implant-related morbidity. These benefits translate into earlier rehabilitation, better patient satisfaction and reduced need for additional surgery.

Strengths of the present study include prospective design, standardized rehabilitation program, thorough follow-up, and use of validated functional outcome measures. However, important limitations are the relatively small sample size, single-centre setting and 6-month follow-up. Larger, multicenter trials with extended follow-up are needed to assess long-term knee stability, return to sport and development of post traumatic osteoarthritis.

CONCLUSION

Both fixation methods result in excellent fracture union and restoration of knee stability. But arthroscopic suture fixation yielded better functional outcomes, faster recovery of knee motion, fewer implant-related problems, and more patient satisfaction. The results suggest the use of arthroscopic suture repair as the optimum surgical technique for displaced tibial spine avulsion fractures when competence and arthroscopic resources are available.

REFERENCES

1. Meyers MH, McKeever FM. Fracture of the intercondylar eminence of the tibia. J Bone Joint Surg Am. 1959 Mar;41-A(2):209-20.
2. Zaricznyj B. Avulsion fracture of the tibial eminence: treatment by open reduction and pinning. J Bone Joint Surg Am. 1977 Dec;59(8):1111-4.
3. Green D, Tuca M, Luderowski E, Gausden E, Goodbody C, Konin G. A new, MRI-based classification system for tibial spine fractures changes clinical treatment recommendations when compared to Myers and Mckeever. Knee Surg Sports Traumatol Arthrosc. 2019 Jan;27(1):86-92. doi: 10.1007/s00167-018-5039-7.
4. Limone B, Zambianchi F, Cacciola G, Seracchioli S, Catani F, Tarallo L. Management and Outcomes of Tibial Eminence Fractures in the Pediatric Population: A Systematic Review. Children (Basel). 2023 Aug 13;10(8):1379. doi: 10.3390/children10081379.
5. Jääskelä M, Turati M, Lempainen L, Bremond N, Courvoisier A, Henri A, Accadbled F, Sinikumpu J. Long-term Outcomes of Tibial Spine Avulsion Fractures After Open Reduction With Osteosuturing Versus Arthroscopic Screw Fixation: A Multicenter Comparative Study. Orthop J Sports Med. 2023 Jun 20; 11(6):23259671231176991. doi: 10.1177/23259671231176991.
6. Li C, Huang X, Yang Q, Luo Y, Li J, Ye S, Lu W, Zhang X, You T. Arthroscopic fixation techniques for tibial eminence fractures in pediatric patients: a review. Front Pediatr. 2024 Mar 26;12:1347637. doi: 10.3389/fped.2024.1347637.
7. Alakkas E, Drager J, Kerrigan A, Carsen S. Arthroscopic suture fixation of tibial spine fractures. J ISAKOS. 2024 Jun;9(3):415-417. doi: 10.1016/j. jisako. 2024.02.012.
8. Chandanani, Mehak, Raian Jaibaji, Monketh Jaibaji, and Andrea Volpin. "Tibial Spine Avulsion Fractures in Paediatric Patients: A Systematic Review and Meta-Analysis of Surgical Management" *Children* 2024;11(3): 345. https://doi.org/10.3390/children11030345
9. Si Heng Sharon T, Fadzil K, Andrew Kean Seng L, James Hoipo H. Surgical management of tibial eminence avulsion fractures: a systematic review and meta-analysis. Arch Orthop Trauma Surg. 2024 Jul;144(7):3153-3159. doi: 10.1007/s00402-024-05318-1.
10. Li J, Liu C, Li Z, Fu Y, Yang Y, Zhang Q. Arthroscopic Fixation for Tibial Eminence Fractures: Comparison of Double-Row and Transosseous Anchor Knot Fixation Techniques with Suture Anchors. Med Sci Monit. 2018 Oct 15;24:7348-7356. doi: 10.12659/MSM.912961.
11. Carey EG, LaPrade CM, Graham GD, Riboh JC. Arthroscopic-Assisted Fixation of Tibial Spine Avulsion Fracture Using a Tensionable Suture Construct With Dual Transtibial Tunnels and Suture Buttons. Arthrosc Tech. 2025 May 31;14(7):103613. doi: 10.1016/j.eats.2025.103613.
12. Manaf F, Widhiyanto L, Hernugrahanto KD. Arthroscopic screw versus suture fixation in tibial eminence fractures: a systematic review and meta-analysis. Knee Surg Relat Res. 2025 Jul 24;37(1):31. doi: 10.1186/s43019-025-00282-5.
13. Shankar R, Sherawat R, Sengupta A, Verma N, Garg H, Buddhist H. Clinical Outcome of Arthroscopic Reduction and Fixation by Pull Through Suture Technique in Tibial Spine Fractures. Cureus. 2025 Mar 1;17(3):e79902. doi: 10.7759/cureus.79902.
14. Fazal Amin, Wasim Anwar, Muhammad Ihtisham Khattak, Zarar Ahmad, Hamza Rafi, Muhammad Dayan Khan. Functional Outcome of Arthroscopic Fixation of Tibial Spine Avulsion Fracture with Cortical Screw. JHWCR [Internet]. 2025 Jul. 18;3(9):e612. Available from: https://jhwcr.com/index.php/jhwcr/article/view/612
15. Khela HS, Khela MS, Jose J, Madi R, Kelly JD 4th, Miller L. Treatment and Clinical Outcomes of Tibial Spine Fractures in Adults: A Systematic Review and Meta-Analysis. Orthopedics. 2025 May-Jun;48(3):174-187. doi: 10.3928/01477447-20250415-01.
16. Aderinto J, Walmsley P, Keating JF. Fractures of the tibial spine: epidemiology and outcome. Knee. 2008 Jun;15(3):164-7. doi: 10.1016/j.knee.2008.01.006.
17. Gans I, Baldwin KD, Ganley TJ. Treatment and Management Outcomes of Tibial Eminence Fractures in Pediatric Patients: A Systematic Review. Am J Sports Med. 2014 Jul;42(7):1743-50. doi: 10.1177/0363546513508538.
18. Edmonds EW, Fornari ED, Dashe J, Roocroft JH, King MM, Pennock AT. Results of Displaced Pediatric Tibial Spine Fractures: A Comparison Between Open, Arthroscopic, and Closed Management. J Pediatr Orthop. 2015 Oct-Nov;35(7):651-6. doi: 10.1097/BPO.0000000000000356.
19. Bogunovic L, Tarabichi M, Harris D, Wright R. Treatment of tibial eminence fractures: a systematic review. J Knee Surg. 2015 Jun;28(3):255-62. doi: 10. 1055/s-0034-1388657.
20. R R, Jaseel M, Murugan C, Kumaran CM. Arthroscopic tibial spine fracture fixation: Novel techniques. J Orthop. 2018 Feb 14;15(2):372-374. doi: 10.1016/j.jor.2018.01.056.
21. Seon JK, Park SJ, Lee KB, Gadikota HR, Kozanek M, Oh LS, Hariri S, Song EK. A clinical comparison of screw and suture fixation of anterior cruciate ligament tibial avulsion fractures. Am J Sports Med. 2009 Dec;37(12):2334-9. doi: 10.1177/0363546509341031.
22. Bong MR, Romero A, Kubiak E, Iesaka K, Heywood CS, Kummer F, Rosen J, Jazrawi L. Suture versus screw fixation of displaced tibial eminence fractures: a biomechanical comparison. Arthroscopy. 2005 Oct;21(10):1172-6. doi: 10. 1016/j.arthro.2005.06.019.
23. Mahar AT, Duncan D, Oka R, Lowry A, Gillingham B, Chambers H. Biomechanical comparison of four different fixation techniques for pediatric tibial eminence avulsion fractures. J Pediatr Orthop. 2008 Mar;28(2):159-62. doi: 10.1097/BPO.0b013e318164ee43.
24. Vander Have KL, Ganley TJ, Kocher MS, Price CT, Herrera-Soto JA. Arthrofibrosis after surgical fixation of tibial eminence fractures in children and adolescents. Am J Sports Med. 2010 Feb;38(2):298-301. doi: 10.1177/ 0363546509348001.
25. Patel NM, Park MJ, Sampson NR, Ganley TJ. Tibial eminence fractures in children: earlier posttreatment mobilization results in improved outcomes. J Pediatr Orthop. 2012 Mar;32(2):139-44. doi: 10.1097/BPO.0b013e318242310a.