

Study on the Functional Outcome of the Distal End of Radius Fractures Treated with Buttress PlatingKeyur Rajendrakumar Shah¹, Kamaleshkumar A Patel²¹Associate Professor, Department of Orthopaedic, Nootan Medical College and Research Centre, Visnagar (Gujrat)²Associate Professor, Department of Orthopaedic, Nootan Medical College and Research Centre, Visnagar (Gujrat)

Received:08-05-2023 / Revised: 26-06-2023 / Accepted: 31-07-2023

Corresponding author: Dr. Kamaleshkumar A Patel

Conflict of interest: Nil

Abstract:

Introduction: This following study examines distal radius fracture care, the most common upper extremity injury in the US. More than 300,000 fractures occur annually. Volar buttress plating is a popular method for treating unstable fractures due to its longevity and stability. Both Kirschner-wire and locking plates have pros and cons. The effects of the 2.7-mm volar locking plate have not been extensively studied despite multiple plating operations. Distal radial fracture treatment in the elderly is poorly researched.

Aims and Objectives: This study aims to evaluate the functional results associated with buttress-plated distal radius fractures.

Method: This prospective Study includes 65 patients aged 18–70 with buttress-plated distal radius fractures. The study used Gyaneswar et al.'s sample size ($n = 4pq / d^2$) to get 90% satisfactory-excellent results. Comorbidities, >3-week injuries, poor tissues, complicated fractures excluded. Frykman's categorization used demographic, injury, and radiograph data from surveys. The orthopaedic surgeon uses traditional procedures and Lindstrom's grading for post-op evaluation for ≥ 3 months.

Result: A study used buttress plating to treat 65 distal radius fracture patients aged 18–70. The sample size of Gyaneswar et al.'s study was 90% to reach a satisfactory-excellent result. Comorbidities, injuries lasting more than three weeks, poor tissue quality, and severe fractures are eliminated. Post-operative grading was assessed by Lindstrom. Joint stiffness and infection were reported in Table 4.

Conclusion: In conclusion, buttress plate fixation for distal radius fractures had a positive effect, consistent with other studies that were better constructed.

Keywords: Distal radius fracture care, upper extremity fracture, volar plate fixation.

This is an Open Access article that uses a funding model which does not charge readers or their institutions for access and distributed under the terms of the Creative Commons Attribution License (<http://creativecommons.org/licenses/by/4.0>) and the Budapest Open Access Initiative (<http://www.budapestopenaccessinitiative.org/read>), which permit unrestricted use, distribution, and reproduction in any medium, provided original work is properly credited.

Introduction

The most typical upper extremity fracture in the United States each year, distal radial fractures result in over 300,000 injuries. For displaced, unstable fractures. The recommended technique of therapy for many years has been anatomic reduction and stable fixation. The most effective treatment for unstable injuries has traditionally been a closed reduction combined with percutaneous pin stabilisation and/or external fixation. popular method of care [1]. It has been widely accepted that wrist fusion only slightly affects hand function, allowing the majority of patients to go back to their professional and vocational activities without noticeable issues [2].

In fact, a mobile wrist that can withstand physiologic pressures without giving way is necessary for the hand to conduct the majority of daily tasks efficiently. Full grip strength, for

example, cannot be attained without a concurrent forceful muscle contraction that extends the wrist. One cannot perform everyday tasks like sweeping the floor, taking a back bath, or fastening a brassiere successfully without a pain-free movable wrist [3].

Undoubtedly, the implications of an injury to the wrist, an important joint of the upper extremities on functionality shouldn't be underestimated illnesses in terms of incidence and morbidity due to trauma. Distal radial fractures make up almost of all fractures in affluent nations, frequently because of the osteoporosis that is underlying. Comparatively, fragility fractures are significantly less common in third-world nations due to, among other things, decreased longevity. Important topics that require discussion include the necessity to implement osteoporosis preventive events, the accessibility of

therapeutic resources, and the surgical morbidity techniques [4]. "Fractures in the distal radius (FDR)", which top the list of wrist diseases both in terms of frequency & morbidity, are the most frequent cause of wrist disability brought on by trauma. In the most prosperous nations, distal radial fractures account for practically all fractures, commonly brought on by underlying osteoporosis. Comparatively, fragility fractures are much less frequent in third-world countries due to, among other things, a shorter lifespan. In the implementation of osteoporosis preventative measures, Important difficulties are the accessibility of therapeutic resources & the seriousness of surgical procedures call for debate [6].

Internal fixation and open reduction have become in important more recently, particularly since the introduction of using a volar locking plate. Supporters assert that inward fixation enables for quick wrist movement while maintaining alignment, resulting in a quick return to function.

Few controlled studies have been performed despite the fact that multiple case series have shown that utilising volar plate fixation and open reduction and internal fixation, unstable fractures provide outstanding results, further investigation is required to see whether this treatment approach is preferable to traditional pin fixation approaches. The current study's objective was to compare two different approaches to treating Internal fixation using a volar plate and open reduction prompt mobilisation are the first two treatments for instability displaced dorsally The distal part of the radius has simple intraarticular and extra-articular fractures. The second treatment involves percutaneous fixation and either external fixation or casting [2].

The two most popular surgical treatment techniques in the UK are volar plate fixation Both Kirschner-wire (K-wire) fastening and (locking plates) are fastened using fixed-angle screws. Each surgical procedure has advantages and drawbacks of its own. K-wire repair is a quick, inexpensive, and minimally intrusive procedure that only needs a little amount of hardware that is working. The fixation is adjustable, though, so patients frequently need to spend at least 4 weeks in plaster casts to keep them immobile. When the cables aren't "buried" below the skin, a second treatment may be necessary to prevent the "wire rash" or K-wire infection. The fracture could also "collapse" when the wires are taken out, resulting in deformity and functional loss [6].

When physiologic stress is exerted Fixation onto a locking plate produces a stiff structure that has been shown to restore stability on par with an undamaged radius [6]. As a result, allowing

patients to flex and utilise their wrists more rapidly may help them feel less stiff Future [3].

The chance of the fracture later collapsing is reduced because the plate and screws could stay within the patient forever. The drawbacks of this method include a lengthier recovery time than the increased likelihood of catastrophic intraoperative problems with K-wire fixation including damage to a nerve or blood artery. Extensor and/or inflammation and rupture of flexor tendon are additional concerns. The gear alone costs more money, highly specialized [3].

It is still difficult to adequately treat distal radius fractures. Holder and Madhok reviewed the findings of several In 2003, the Randomised Controlled Trials for the Treatment for Distal Radial Fractures, a Cochrane Review, identified the grave lack of evidence at that time. They were able to pinpoint important areas for further investigation, such as "when and what type of surgery is indicated" [4].

We present the findings of a concurrent, non-randomized study comparing the effectiveness of volar lock in order to treat fractures that involve the dorsally misplaced distal radius, a plate is fixed before a K-wire is inserted [7].

Many case studies have demonstrated the usefulness of Turn "locking compression plates (LCP)" are used to stabilise distal radius fractures since their introduction. Numerous studies have shown that restoring normal anatomy leads to greater functionality. Despite the lack of a surgical according to biomechanical tests, the volar LCPs were just as rigid and efficient as the gold standard for therapy stable than conventional volar or dorsal plates [2].

There are now more than thirty distinct volar plating technologies in use, which has exponentially boosted the use of LCPs. Studies on the 2.7-mm volar compression locking plate have not yet addressed the gaps in the 2.4-mm and 3.5-mm LCP studies. The study's objective was to analyse factors impacting Linking the Employing a 2.7-mm fixed-angle volar LCP, we prospectively evaluated the postoperative functional and radiological findings, relating the patient's impression of recovery with the radiological outcome systems [8].

Despite their high incidence, distal radial fractures have an uncharacterized epidemiology, and their management in the senior population is still unclear. The current investigation focused on In order to (1) examine the changing trend in the treatment of distal radial fractures among the Medicare population and (2) evaluate physician speciality encounters within the treatment of these types of fractures, a random sample of United

States Medicare claims over a ten-year period (1996 for 2005) were examined [9].

Method

Research Design

A prospective study was undertaken at our hospital in the Department of Orthopaedics during the period of one Year. There were 65 individuals aged 18–70 who were assigned to this trial. Buttress plating was used to treat distal radius fractures. Patients with comorbidities that prevented surgery, injuries older than three weeks, poor tissue conditions, and complicated distal radius fractures were excluded from the research.

Demographic characteristics, injury, and associated data were collected by questionnaire. Using radiographs, fracture severity was classified using the Frykman technique. The orthopaedic surgeon used conventional, reduction, and fixation methods. Anatomical and functional evaluation utilising Lindstrom's grading approach should be done for at least three months after surgery.

Inclusion and exclusion criteria

Inclusion

- The age range for individuals is between 18 and 70 years.
- Individuals diagnosed with a fracture occur at the distal end of the radius.
- Informed consent was received from the participants before to their involvement in the study.
- Received buttress plating intervention.
- The research findings were showcased at the Department of Orthopaedics, Government Medical College Hospital.

Exclusion

- Comorbid conditions that rule out surgical treatment.
- When an injury lasts longer than three weeks.
- Surgical intervention is not possible due to the poor state of the local tissues.
- Patients with distal radius complex fractures.

Statistical analysis

The statistical analysis was conducted using Microsoft Excel. The presentation of quantitative data included the mean value together with the standard deviation, whereas qualitative variables were represented in terms of proportions.

Ethical approval

The study was conducted in accordance with ethical norms and participants' rights and well-being were protected through the acquisition of ethics permission prior to the commencement of the study.

Result

The functional results of the research on patients with distal end radius fractures treated with buttress plating are presented in Table 1, utilising Lindstrom's anatomical and functional grading method. Out of the total of 65 instances that were examined, the predominant proportion (81.53%) exhibited a functional outcome categorised as "Excellent." A lesser percentage of individuals had a "Good" outcome (10.76%), whilst 7.69% were classified as "Fair."

The results of this study indicate that a significant proportion of patients had positive functional outcomes, highlighting the efficacy of the buttress plating treatment method in facilitating outstanding and good functional results for fractures of the distal end of the radius.

Table 1: Functional Results

Results	Number of Cases (%)
Excellent	53 (81.53)
Good	7 (10.76)
Fair	5 (7.69)
Total	65 (100)

Table 2 presents the anatomical grading achieved by the utilisation of the Lindstorms Anatomical Scoring System for the management of distal end radius fractures with buttress plating. The evaluated parameters and their corresponding criteria are shown, together with the number of examples and their proportional distribution. Among the reported cases, residual dorsal tilt was found to exhibit 0-degree alignment in 43 instances, accounting for 66.15% of the total. Additionally, a mild misalignment ranging from 1 to 10 degrees was discovered in 5 cases, representing 7.69% of the sample. In relation to radial shortening, it was

observed that 42 instances (64.61%) exhibited a decrease of less than 3mm, while 6 cases (9.23%) had a shortening ranging from 3 to 6mm. The assessment of deformity indicated the absence of deformity in 41 instances, accounting for 63.07% of the total. Minimal deformity was observed in 5 cases, representing 7.69% of the sample, while substantial deformity was identified in 4 cases, comprising 6.15% of the total. In 42 instances, the decrease in radial inclination was found to be below 5 degrees, accounting for 64.61% of the cases. Additionally, there were 7 cases (10.76%) where the decrease ranged from 5 to 9 degrees and

4 cases (6.15%) where the decrease ranged from 10 to 14 degrees. This complete assessment offers

valuable insights into the anatomical results resulting from the chosen treatment technique.

Table 2: Anatomical Grading Using Lindstorms Anatomical Scoring System

Parameters	Criteria	Number of Cases (%)
Residual Dorsal Tilt	0 degree	43 (66.15)
	1 to 10 degrees	5 (7.69)
	11 to 14 degrees	5 (7.69)
Radial Shortening	<3mm	42 (64.61)
	3 to 6 mm	6 (9.23)
	7 to 11 mm	5 (7.69)
Deformity	None	41 (63.07)
	Minimal	5 (7.69)
	Moderate	4 (6.15)
Loss of Radial Inclination	<5 degrees	42 (64.61)
	5 to 9 degrees	7 (10.76)
	10 to 14 degrees	4 (6.15)

The results of the anatomical grading procedure are shown in Figure 1. It was found that 53 out of the 65 cases (81.53 %) were classified as Grade 1. It was also shown that 7 patients (10.76%) and five (7.59%) instances were classified as Grade 2, whereas no cases were classified as Grade 3. Patients who have distal end radius fractures

treated with buttress plating can benefit greatly from this grading system since it provides insight into the prevalence and severity of anatomical problems. It draws attention to the frequency with which various grades occur, with a larger proportion of Grade 1 cases indicating superior anatomical results in this patient group.

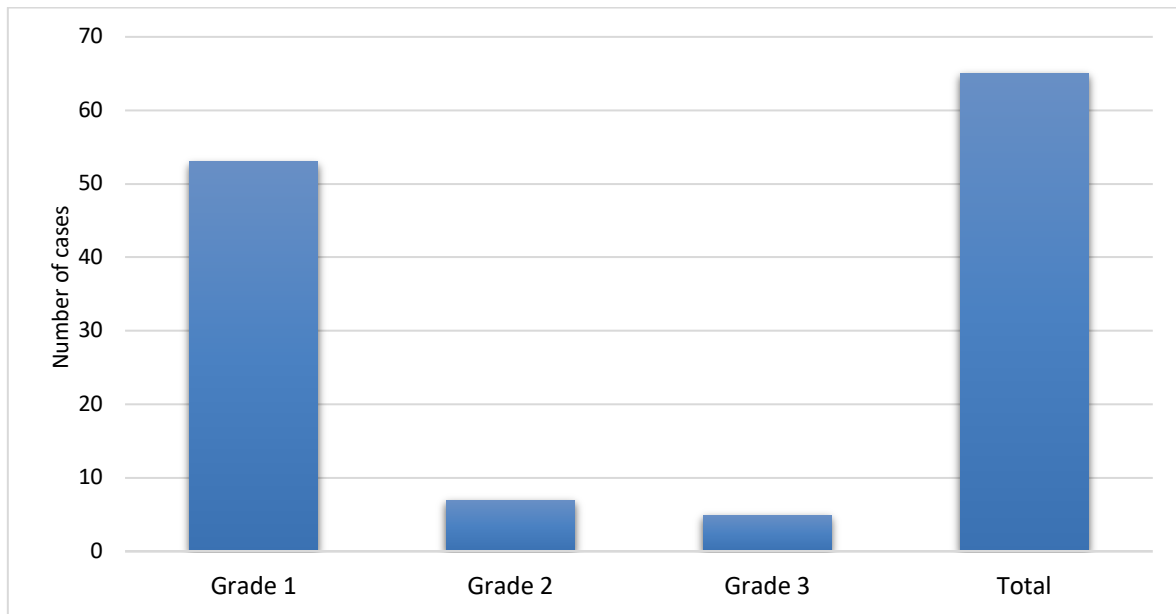


Figure 1: Number of patients with respective anatomical grading

Table 3 presents the difficulties that were noticed throughout the course of the investigation. Among the 65 cases analysed, joint stiffness was seen in 4 instances, accounting for 6.15% of the total. Furthermore, a co-occurrence of infection and joint stiffness was documented in 5 cases, representing 7.69% of the sample. A total of 5 instances (7.69%) of blisters were detected, whereas 2 cases (3.07%)

exhibited paraesthesia associated with the median nerve. Surprisingly, a total of 49 instances, accounting for 75.38% of the sample, demonstrated no problems. The aforementioned data offer valuable insights into the frequency of post-treatment problems in individuals diagnosed with distal end radius fractures who have buttress plating as a therapy method.

Table 3: Post-operative Complications found in this study

Complications	Number of Cases; n (%)
Joint Stiffness	4 (6.15)
Infection + Joint Stiffness	5 (7.69)
Blisters	5 (7.69)
Paraesthesia (Median Nerve)	2 (3.07)
No Complications	49 (75.38)
Total	65 (100)

Discussion

One of the most frequent injuries seen in the emergency room is a distal radius fracture, which can occur in people of any age. Road Traffic Accidents (RTA) are the most frequent cause in young patients, whereas falls in older patients are the most frequent cause. To address this damage, there are various surgical procedures available. This investigation compares the results of volar buttress plates and across wrist external fixators for distal radius fractures of the Arbeitsgemeinschaft für Osteosynthesefragen (AO) type C2/C3. For AO C2/C3 type fractures of the distal radius, an across-the-wrist external fixator is a viable option with outcomes comparable to those of a volar buttress plate. In high volume tertiary care hospitals like Gurki Trust Teaching Hospital, it is the preferred procedure since it is quicker, has a similar functional outcome score, doesn't require a second surgery to remove the implant, and has a lower risk of tendon rupture than using a volar buttress plate to treat a distal radius fracture [10].

A distal radius fracture is one of the ailments that orthopaedic surgeons deal with the most frequently in trauma patients. Even so, there is still a great deal of disagreement over how to treat distal radius fractures, specifically what is considered a suitable reduction and whether or not to perform surgery on an individual a distal radius fracture. The functional results from injuries repaired using buttress plates towards the proximal portion of the radius was something we were particularly interested in evaluating. Investigated are the post-operative complications of the surgery as well as the significance of anatomical reduction in reaching a successful functional outcome.

The majority of patients had satisfactory to excellent results following buttress plate fixation of the distal radius, with outcomes and side effects comparable to those reported in other trials in the literature. The results of this study support the idea that superior functional outcomes result from correct identification of unstable lower radial fractures and good anatomical healing [11]. In an investigation on the distal end of the radius treated with volar plating, Gyaneswar et al. [16] discovered that 24 patients (80%) had excellent anatomical restoration, whereas 4 patients (13%) had good restoration [11]. Common injuries like distal radius

fractures can be treated surgically and non-surgically in a number of ways. The best course of action for a certain patient and fracture is still up for dispute. Volar locking plate fixation is a common procedure, however there aren't many long-term or large cohort studies to support it. Our goal was to report the functional results of a significant number of patients who had their distal radius fixed with a volar locking device. A single centre large population series showed that after volar locking plate fixation of the distal radius, the majority of patients experience good to excellent results, with complication rates equivalent to those of other non-surgical and operative treatment techniques. For distal radius fractures requiring surgical intervention, we advise using this form of fixation [12].

In order to treat distal radial fractures effectively, normal or nearly normal alignment and articular congruity must be restored. Twenty patients who were admitted to Government Medical College, Kurnool between September 2018 and September 2020 and with distal radius fractures were chosen. Through a volar approach, open reduction and internal fixation with a volar plate were administered to the patients, who were then monitored until functional recovery and evaluated clinicoradiologically.

Patients for the study ranged in age from 23 to 62, with a mean age of 39.80 years, and included 14 men and 6 women. Follow-up lasted between nine and eighteen months. We had 50% excellent, 40% good, 10% fair, and none terrible scores using Gartland & Werley's demerit scoring system. The treatment of distal end of radius fractures with a volar plate in carefully chosen individuals even in the presence of osteoporosis results in an acceptable result [13].

Andrew W Beharrie et al., conducted a research to evaluate the functional, clinical, & radiological outcomes of open reduction and internal fixation with screws and plates in patients 60 years old age and older with displaced and compressed distal radius fractures. The study is based on 18 individuals having a 60–86 age range, and a median age of 71. A tertiary care facility's two hand surgeons' surgical database was used to find patients. Fixation inside using metal screws and plates and open reduction designed for this purpose

are used to treat distal radius fractures purpose [11]. Clinical evaluations Plain radiography, functional assessments, and (history and physical examination) were carried out on average every 26 months (with a range of 12 to 40 months). The Gartland, Werley, and Disabilities for the Arm, Shoulder, and Hand grading systems were used to evaluate functional results. Each of the 18 fractures had a good reduction by the time before surgical fixation. and there were no occurrences of fracture reduction loss throughout the research period. Malunion, nonunion, or device failure cases were nonexistent. They discovered 4 minor issues. No patients needed to have surgery again. 15 patients earned good scores on the Gartland & Werley evaluation method (83%) results, while 3 had good (17%) results. The average score for deficits of the hand, arm, and shoulder were 4.4 (with a range of 0 to 14), out of a possible 100. According to the research, an alternative to traditional therapy for Patients 60 years of age and older with displaced and comminuted fractures of the distal radius are treated with open reduction and internal fixation using screws and plates [14].

M Al Rashid et al., Volar locking compression plates are recommended for the treatment of distal radius fractures because to their strong biomechanical design, reduced risk of soft-tissue damage, and early wrist mobilisation mobility growing in popularity. A few studies have documented problems such flexor tendon rupture. The stud discussed three instances where extensor tendon ruptures occurred immediately after compression plates with a volar lock are employed. To avoid harming the extensor tendons, they advise using the utmost caution the distal radial bolts should be drilled and installed [15].

David M Lichtman et al., A thorough analysis of literature on the management of distal radius fractures in adults that have been published served as the foundation for the clinical practise guideline. None of the work group's 29 recommendations received a strong rating; the majority received an inconclusive or consensus rating, and seven received a weak rating. The other Use rigid immobilisation instead of Take a true lateral radiograph of the carpus after reduction to evaluate the alignment of the dorsal radial ulnar joint, use removable splints for nonsurgical treatment, and use surgical fixation rather than cast fixation for fractures with postreduction axial shortening >3 mm, dorsal tilt >10 degrees, as well as intra-articular displacement or step-off >2 mm [16].

Conclusion

The study has concluded that the majority of patients in this research who had buttress plate fixation for distal radius fractures saw satisfactory to outstanding results. These findings were in line

with those from research with better methodology. Common unstable distal radius fractures are effectively treated with volar buttress plating in patients of all ages. Due to its durability, early mobilisation is encouraged, which increases the likelihood of a successful union and decreases the possibility of malunion. Bone grafting is unnecessary because of the method's ease of use, flexibility in adjusting to the intricacy of the fracture, and biomechanical benefits. Modern palmar plates further reduce the risk of subsequent displacement, demonstrating the technique's continued usefulness. The study needs to consider the long-term follow-up necessary to evaluate the lasting effectiveness of functional results and the avoidance of degenerative changes. This omission has the potential to impact the assessment of obtaining near-anatomic placement for maintained wrist function.

Reference

1. Khan, J. I., Hussain, F. N., Mehmood, T., & Adil, O. A comparative study of functional outcome of treatment of intra articular fractures of distal radius fixed with percutaneous Kirschner's wires vs T-plate. *Pakistan journal of medical sciences*, 2017;33(3): 709–713.
2. Rozental, T. D., Blazar, P. E., Franko, O. I., Chacko, A. T., Earp, B. E., & Day, C. S. Functional outcomes for unstable distal radial fractures treated with open reduction and internal fixation or closed reduction and percutaneous fixation. A prospective randomized trial. *The Journal of bone and joint surgery. American volume*, 2009;91(8): 1837–1846.
3. Garcia-Elias, M., & Folgar, M. A. The management of wrist injuries: an international perspective. *Injury*, 2006;37(11): 1049–1056.
4. Koval, K. J., Harrast, J. J., Anglen, J. O., & Weinstein, J. N. Fractures of the distal part of the radius. The evolution of practice over time. Where's the evidence?. *The Journal of bone and joint surgery. American volume*, 2008;90(9): 1855–1861.
5. Hull, P., Baraza, N., Gohil, M., Whalley, H., Mauffrey, C., Brewster, M., & Costa, M. L. Volar locking plates versus K-wire fixation of dorsally displaced distal radius fractures--a functional outcome study. *The Journal of trauma*, 2011;70(6): E125–E128.
6. Beharrie, A. W., Beredjiklian, P. K., & Bozentka, D. J. Functional outcomes after open reduction and internal fixation for treatment of displaced distal radius fractures in patients over 60 years of age. *Journal of Orthopaedic Trauma*, 2004;18(10): 680–686.
7. Al-Rashid, M., Theivendran, K., & Craigen, M. A. Delayed ruptures of the extensor tendon

- secondary to the use of volar locking compression plates for distal radial fractures. *The Journal of bone and joint surgery. British volume*, 2006;88(12): 1610–1612.
8. Chung, K. C., Shauver, M. J., & Birkmeyer, J. D. Trends in the United States in the treatment of distal radial fractures in the elderly. *The Journal of bone and joint surgery. American volume*, 2009;91(8): 1868–1873.
 9. Lichtman, D. M., Bindra, R. R., Boyer, M. I., Putnam, M. D., Ring, D., Slutsky, D. J., Taras, J. S., Watters, W. C., 3rd, Goldberg, M. J., Keith, M., Turkelson, C. M., Wies, J. L., Haralson, R. H., 3rd, Boyer, K. M., Hitchcock, K., & Raymond, L. Treatment of distal radius 1. Fractures. *The Journal of the American Academy of Orthopaedic Surgeons*, 2010;18(3): 180–189.
 10. Ali R, Ilyas A, Riaz H, Faheem U, Khan J, Ahmed N, Aziz A. Outcome Of The Distal Radius Fractures Managed With Across Wrist External Fixator Vs Buttress Plates. *J Ayub Med Coll Abbottabad*. 2023 Feb-Mar; 35(1):32-36.
 11. John, G. A., & Antony, D. Functional Outcome of Distal End of Radius Fractures Treated with Buttress Plating at a Tertiary Care Centre in Central Kerala, India. *Journal of Evidence Based Medicine and Healthcare*, 2021;8(32): 3006–3011.
 12. Phadnis, J., Trompeter, A., Gallagher, K., Bradshaw, L., Elliott, D. S., & Newman, K. J. (2012). Mid-term functional outcome after the internal fixation of distal radius fractures. *Journal of Orthopaedic Surgery and Research*, 7(1), 4.
 13. Nagaraju, Nagaraju & Jose, Midhun. Functional Outcome Of Surgical Management Of Fractures Of Distal End Radius With Buttress Plate. *Indian Journal Of Applied Research*. 2021;34-36.
 14. Kazuki, K., Kusunoki, M., Yamada, J., Yasuda, M., & Shimazu, A. Cineradiographic study of wrist motion after fracture of the distal radius. *The Journal of hand surgery*, 1993;18(1): 41–46.
 15. Porter, M., & Stockley, I. Fractures of the distal radius. Intermediate and end results in relation to radiologic parameters. *Clinical orthopaedics and related research*, 1987;(220): 241–252.
 16. Rozental, T. D., Blazar, P. E., Franko, O. I., Chacko, A. T., Earp, B. E., & Day, C. S. Functional outcomes for unstable distal radial fractures treated with open reduction and internal fixation or closed reduction and percutaneous fixation. A prospective randomized trial. *The Journal of bone and joint surgery. American volume*, 2009;91(8): 1837–1846.