Comparative Study Of The Functional Outcome Of The Clavicle Hook Plate Versus Distal Clavicle Locking Plate In Treatment Of Distal Clavicle Fractures

Dr. Ashwath Ahila Baskar , Dr. Soundarrajan, Dr. Shebin

1. 3rd Year, Postgraduate Resident ,Dept. Of Orthopaedics ,
2. Professor, Dept. Of Orthopaedics , Vinayaka Missions Kirupananda Variyar Medical College Salem
3. Senior Resident ,Dept. Of Orthopaedics, Vinayaka Missions Kirupananda Variyar Medical College Salem

Corresoponding Author : - Dr. Ashwath Ahila Baskar , 3rd Year, Postgraduate Resident ,Dept. Of Orthopaedics , Vinayaka Missions Kirupananda Variyar Medical College Salem

Background: Distal Clavicle Fractures Represent 15–28% Of All Clavicle Fractures And Are Prone To Nonunion, Particularly Unstable Neer Type Ii Fractures, Often Necessitating Surgical Intervention. Two Common Fixation Methods Include The Clavicular Hook Plate And Distal Clavicle Locking Plate, But Their Comparative Efficacy And Safety Remain Debated.

Objective: This Retrospective Study Aimed To Compare Clinical, Radiological, And Functional Outcomes Of Distal Clavicle Fractures Treated With Clavicular Hook Plates Versus Distal Clavicle Locking Plates.

Methods: Forty Patients Aged 18–65 Years With Unstable Distal Clavicle Fractures (Neer Type Ii/Iii) Were Treated Surgically At Vmkv Medical College, Salem. Patients Were Allocated Based On Fracture Morphology. Outcomes Assessed Included Union Rates, Complication Rates, Constant-Murley Scores, And Return To Work Status Over An Average Follow-Up Of ~28 Months.

Results: Union Rates Were High In Both Groups (Hook Plate 93.3%, Locking Plate 97.2%; $P > 0.05$). Functional Outcomes Measured By Constant-Murley Scores Were Comparable (Hook Plate 93.3 Vs. Locking Plate 95.5; $P > 0.05$). However, The Hook Plate Group Experienced Significantly Higher Complication Rates (23.3% Vs. 5.6%; $P < 0.05$) And Slower Return To Work (73.3% Vs. 94.4% At 3 Months; $P < 0.05$).

Conclusion: Both Fixation Methods Provide Effective Union And Good Shoulder Function. Distal Clavicle Locking Plates Demonstrate A Safety Advantage With Fewer Complications And Facilitate Earlier Return To Work, Supporting Their Use As A Preferred Treatment For Unstable Distal Clavicle Fractures.

Introduction

Clavicle Fractures Are Common, Especially In Young, Active Individuals, And Are Typically Classified As Proximal, Midshaft, Or Distal. Although Distal Clavicle Fractures Account For Only 15–28% Of All Clavicle Fractures, They Are Responsible For 30–45% Of Nonunion Cases. As A Result, Surgical Management Is Often Recommended For Unstable Distal Clavicle Fractures.Treatment Options Include Coracoclavicular Fixation (E.G., Tightrope, Endobutton, Or Screws) And Various Internal Fixation Devices, Such As Clavicular Hook Plates, Locking Plates With Lateral Extension, Tension Band Wiring, And Transacromial Pinning With K-Wires. Among These, Clavicular Hook Plates And Locking Plates Are Widely Used, But Their Relative Efficacy And Safety Remain Debated.Some Studies, Like Tan Et Al., Suggest Better Short-Term Outcomes With Locking Plates, While Others, Including Xiong Et Al., Report No Significant Differences In Functional Scores Between The Two Methods. However, Systematic And Quantitative Comparisons Remain Limited.To Address This Gap,

We Conducted A Retrospective Study Comparing The Clinical Outcomes And Safety Of Clavicular Hook Plates And Distal Clavicle Locking Plates In The Treatment Of Distal Clavicle Fractures, Aiming To Inform Clinical Decision-Making.

Aims And Objectives:

The Aim Of This Study Is To Evaluate The Functional Outcomes Of Distal Radius Fractures Treated Surgically With Anatomical Locking Plates. Specifically

- To Compare The Clinical Outcomes Of The Clavicle Hook Plate And Distal Clavicle Locking Plate In The Treatment Of Distal Clavicle Fractures.
- To Assess The Radiological Outcomes (Union, Alignment, Complications).
- To Evaluate Functional Outcomes Using Standardized Scoring Systems (E.G., Constant-Murley Score, Disabilities Of The Arm, Shoulder, And Hand (Dash) Score).

The Primary Aim Of This Study Is To Compare The Clinical, Radiological, And Functional Outcomes Between Two Surgical Treatment Options For Distal Clavicle Fractures: Clavicle Hook Plate Fixation And Distal Clavicle Locking Plate Fixation. The Study Seeks To Provide A Comprehensive Analysis Of These Two Techniques To Determine Which Offers Better Results In Terms Of Healing, Functional Recovery, And Complication Rates.

Inclusion Criteria

- Age Range: Adults Aged 18 To 65 Years: This Age Range Ensures That The Patient Population Represents A Typical Cohort Of Those Likely To Experience Distal Clavicle Fractures. It Also Ensures That The Patients Are In The Prime Age For Bone Healing And Rehabilitation, Minimizing Age-Related Variations In Healing Capacity.
- Type Ii Or Type Iii Distal Clavicle Fractures: Type Ii (Displaced Fracture Of The Distal Clavicle With Ac Joint Separation): These Fractures Involve The Lateral End Of The Clavicle And Typically Require Surgical Intervention To Restore Proper Alignment And Function.
- Type Iii (Fracture Of The Distal Clavicle With Joint Displacement): Fractures That Involve The Distal End Of The Clavicle But Do Not Completely Disrupt The Ac Joint. These Fractures Are Usually Treated Surgically When Conservative Management Fails.
- Fractures Treated Surgically- This Ensures The Study Focuses On The Comparative Effectiveness Of The Surgical Interventions (Clavicle Hook Plate Vs. Distal Clavicle Locking Plate) Rather Than The Outcomes Of Non-Operative Treatments.
- Clinically Stable Patients:

Exclusion Criteria:

- Open Fractures
- Multi-Fragmentary Fractures
- Severe Comorbidities That May Affect Surgical Outcomes (E.G., Uncontrolled Diabetes)
- Non-Compliant Patients Or Those Unable To Follow Post-Operative Protocols
- Previous Surgeries On The Shoulder

Materials And Methodology:

Study Area: Vinayaka Mission’s Kirupananda Variyar Medical College And Hospital, Salem. Study Period:- 2 Years.Study Group: Individuals Aged 18 Years And Above (Or Pediatric Patients If Relevant), Meeting The Study Criteria..Study Design: Retrospective Analysis Of 40 Cases.

Methodology:

This Study Was Conducted In The Department Of Orthopaedics At Vmkv Medical College And General Hospital, Salem, Over A Two-Year Period. All Eligible Patients Aged 18 Years And Above (Or As Per Study Requirements, Including Pediatric Patients If Applicable) Admitted To The Orthopaedics Department Or Attending The Opd Were Evaluated According

To Inclusion And Exclusion Criteria.Patients Meeting The Inclusion Criteria Were Enrolled After Obtaining Informed Written Consent. Detailed Clinical History And Physical Examination Were Performed For All Participants.

Investigations

1) Clinical Assessment
2) Detailed Patient History (Surgical Details, Comorbidities, Medication Use, Prior Implant Reactions).
3) Physical Examination (Signs Of Infection, Swelling, Pain, Mobility, And Implant Stability).
4) Patient-Reported Outcome Measures (Proms) To Assess Pain, Function, And Quality Of Life.

Radiological Investigations

5) X-Ray (Ap And Lateral Views)

Source Of Data:

The Study Includes Aged 18 Years And Above (Or As Per Study Requirements, Including Pediatric Patients If Relevant), Coming In Vmkv Medical College And Hospital, Salem, For A Duration Of 2 Years

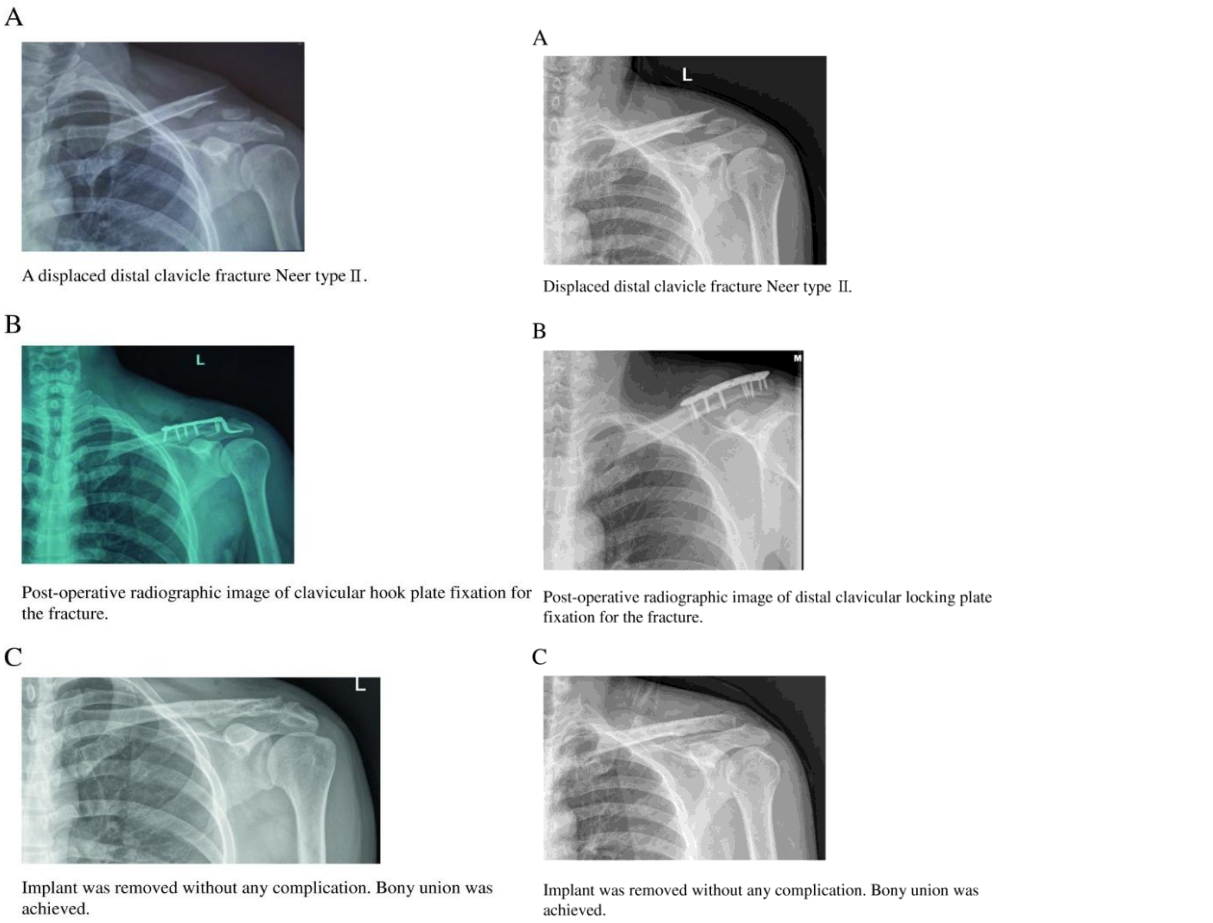
Methods

Surgical Technique

The Choice Of Fixation Method Was Guided By The Fracture Morphology As Assessed By The Operating Surgeon. Highly Fragmented Fractures Located Near The Acromioclavicular (Ac) Joint Were Managed Using A Clavicular Hook Plate Combined With Ligament Reconstruction. Conversely, Fractures Of The Distal Clavicle That Were Displaced But Exhibited Minimal Coracoclavicular (Cc) Ligament Disruption—And Where Radiographic Imaging Showed A Fragment Larger Than 2 Cm—Were Stabilized Using A Distal Clavicle Locking Plate.

Hook Plate Cohort

Under General Anesthesia, Patients Were Positioned In The Beach-Chair Position. For Those Receiving Hook Plate Fixation, An Anterior Clavicular Approach Was Employed. The Fracture Was Visualized And Anatomically Realigned. A Passage Was Then Prepared In The Subacromial Space Just Posterior To The Ac Joint, Allowing Insertion Of The Hook Component. If Required, The Plate Was Contoured Intraoperatively To Conform To The Clavicle’s Native Anatomy.



Locking Plate Cohort

For Patients Treated With Distal Clavicle Locking Plate Fixation, The Procedure Was Carried Out With The Patient In The Beach-Chair Position. A Conventional Anterior Incision Along The Clavicle Was Used To Access The Fracture Site. The Fracture Was Realigned Under Direct Visualization, And Provisional Stabilization Was Achieved Using Kirschner Wires.

Postoperative Management - Patients Treated With Either Hook Plates Or Distal Clavicle Locking Plates Received Standardized Postoperative Care. A Shoulder Sling Was Used Initially For Comfort And Protection. Passive And Assisted Range Of Motion (Rom) Exercises Began Within The First Few Days Postoperatively, As Tolerated, To Reduce Stiffness And Support Recovery Without Compromising Stability.Follow-Up Visits Monitored Progress And Guided Activity Levels. By The Third Or Fourth Postoperative Week, Most Patients Regained Near-Full Rom, Provided Radiographs Confirmed Stable Alignment. Strengthening And Functional Training Were Gradually Introduced Thereafter.Patients Were Advised To Avoid Heavy Lifting Or Strenuous Activity Until Radiographic Confirmation Of Fracture Union To Prevent Implant Failure Or Delayed Healing.

Clinical Assessment

Patients Underwent Structured Follow-Up With Clinical And Radiographic Evaluations At 4, 8, And 12 Weeks, Then At 6 And 12 Months Postoperatively, And Annually If Needed.Radiographs (Shoulder Ap Views) Monitored Bone Healing And Implant Integrity. Union Was Defined As Bridging Trabeculae Without Hardware Loosening Or Migration.Shoulder Function Was Assessed Using The Constant-Murley Score (Max 100), Including Pain (15 Points), Daily Activities (20), Rom (40), And Muscle Strength (25),

Offering A Comprehensive Measure Of Recovery.Hook Plates Were Scheduled For Removal After Confirmed Union, Typically Within A Few Months, Due To Their Subacromial Position And Risk Of Irritation. Locking Plates Were Retained Unless Symptoms Developed Or Removal Was Requested.

Statistical Analysis

All Analyses Were Performed Using Spss Version 13.0 (Spss Inc., Chicago, Il, Usa). Descriptive Statistics Summarized Baseline Characteristics And Outcomes For Each Group.Comparisons Between The Hook Plate And Locking Plate Groups Were Made Using Independent Samples T-Tests For Continuous Variables (E.G., Constant-Murley Scores) And Chi-Square Tests For Categorical Variables (E.G., Union And Complication Rates), Based On Variable Type And Distribution.Statistical Significance Was Set At $P < 0.05$ (Two-Tailed). This Approach Ensured Meaningful Comparison Between Fixation Methods And Supported Clinical Interpretations.In The Locking Plate Group, A Pre-Contoured Distal Clavicle Plate Was Applied And Fixed Using The Maximum Number Of Locking Screws In The Distal Fragment For Stability (Fig. 2a), Taking Care To Avoid Bridging The Acromioclavicular (Ac) Joint.

Results

A Comprehensive Comparison Of Demographic Characteristics, Injury Mechanisms, Clinical Outcomes, And Complications Between The Two Treatment Groups—Distal Clavicular Locking Plate And Clavicular Hook Plate—Is Summarized In Table .

Patient Demographics And Mechanism Of Injury

The Locking Plate Group Included 36 Patients (Mean Age: 42.5 Years), With Vehicular Trauma Being The Most Common Injury Mechanism (29 Cases; 80.6%). Other Causes Included Low-Energy Falls (5 Cases; 13.9%) And Falls From Height (2 Cases; 5.6%).The Hook Plate Group Had 30 Patients (Mean Age: 41.1 Years), Also Mainly Injured In Vehicular Accidents (22 Cases; 73.3%), Followed By Low-Energy Falls (4; 13.3%), Falls From Height (1; 3.3%), And Sports Injuries (3; 10%).There Were No Significant Differences In Age, Gender, Or Comorbidities Between Groups ($P > 0.05$), Indicating Comparable Baseline Characteristics.

Follow-Up Duration And Bone Healing - Mean Follow-Up Was 28.6 Months For The Locking Plate Group And 27.2 Months For The Hook Plate Group, With No Significant Difference ($P > 0.05$).Time To Union Averaged 3.5 Months (Range 3–6) In The Locking Plate Group And 3.8 Months (Range 3–6) In The Hook Plate Group, Without A Statistically Significant Difference ($P > 0.05$).Union Was Achieved In 97.2% (35/36) Of Patients In The Locking Plate Group, And 93.3% (28/30) In The Hook Plate Group. Although Slightly Higher In The Locking Plate Group, The Difference Was Not Statistically Significant ($P > 0.05$), Indicating Both Methods Are Similarly Effective For Fracture Healing.

Implant Removal And Functional Outcomes

The Mean Time To Implant Removal Was 7.1 Months (Range 6–12) In The Locking Plate Group And 6.5 Months (Range 6–10) In The Hook Plate Group, With No Significant Difference ($P > 0.05$).At Final Follow-Up, Both Groups Showed Excellent Shoulder Function Measured By The Constant-Murley Score: 95.5 Points In The Locking Plate Group And 93.3 Points In The Hook Plate Group. The Difference Was Not Statistically Significant ($P > 0.05$).

Variables	Locking Plate Group	Hook Plate Group	P-Value
Age (Yr)	42.5 ± 10.7	41.1 ± 10.3	0.46
Gender			
Male	20 (55.6 %)	17 (56.7 %)	0.93
Female	16 (44.4 %)	13 (43.3 %)	0.93
Fracture Side			
Right	23 (63.9 %)	16 (53.3 %)	0.39
Left	13 (36.1 %)	14 (46.7 %)	0.39
Follow-Up (Months)	28.6 ± 6.2	27.2 ± 6.1	0.19
Union Rate (%)	97.2 %	93.3 %	0.45
Constant Score (Points)	95.5 ± 5.9	93.3 ± 8.1	0.15
Complications (%)	5.6 %	23.3 %	0.04
Return To Work In Three Months (%)	94.4 %	73.3 %	0.02

Complication Rates

Complications Were Notably Higher In The Hook Plate Group Compared To The Locking Plate Group.Locking Plate Group: 2 Patients (5.6%) Experienced Complications — 1 Partial Loss Of Reduction And 1 Non-Union.Hook Plate Group: 7 Patients (23.3%) Had Complications — 2 Partial Loss Of Reduction, 3 Symptomatic Hardware Irritations, 1 Non-Union, And 1 Hardware Failure Requiring Further Intervention.The Overall Complication Rate Was Significantly Greater In The Hook Plate Group Than In The Locking Plate Group (23.3% Vs. 5.6%, $P < 0.05$), Indicating A Clear Safety Advantage With The Locking Plate Technique.

Return To Work - At Three Months Postoperatively:

Table 1 -Patient Profiles And Clinical Results

In The Locking Plate Group, 34 Of 36 Patients (94.4%) Had Resumed Their Pre-Injury Occupational Activities.In The Hook Plate Group, Only 22 Of 30 Patients (73.3%) Had Returned To Work By The Same Time Point.This Difference In Early Return To Work Was Statistically Significant ($P < 0.05$), Suggesting That Patients Treated With Distal Clavicular Locking Plates Experienced Faster Functional Recovery And Earlier Reintegration Into Daily Activities

Discussion

Distal Clavicle Fractures, Especially Unstable Neer Type Ii, Are Prone To Non-Union Due To Opposing Biomechanical Forces: Upward Pull From The Sternocleidomastoid Muscle Versus Downward Traction From The Upper Limb Weight And Pectoralis Major. This Imbalance Worsens When The Medial Fragment Detaches From The Coracoclavicular (Cc) Ligaments, Increasing Instability.Neer's Classification Guides Treatment By Distinguishing Types I, Ii, And Iii Fractures, With Type Ii Being The Most Unstable And Controversial, Often Requiring Open Reduction And Internal Fixation (Orif) To Improve Outcomes.

Implant Selection And Clinical Implications

Two Common Fixation Methods Are The Clavicular Hook Plate And The Distal Clavicle Locking Plate. The Hook Plate Stabilizes By Anchoring Under The Acromion, Counteracting Vertical Forces, But Is Associated With Complications Such As Subacromial Impingement, Rotator Cuff Irritation, Acromial Osteolysis, And Hardware Failure. Timely Removal After Union Is Crucial To Minimize These Risks. Prior Studies Report High Rates Of Shoulder Pain And Complications Linked To Hook Plates.In This Study, 23.3% Of Hook Plate Patients Had Complications, Including Hardware Issues And Non-Union. All Hook Plates Were Removed Within 6.5 Months On Average, Consistent With The Literature Suggesting Subacromial Contact Provokes Inflammation And Discomfort.

Advantages Of Locking Plate Fixation -Locking Plates Are Anatomically Contoured To Avoid The Subacromial Space, Providing Stable Fixation With Less Soft Tissue Disruption And Usually Do Not Require Routine Removal.Studies Report Excellent Union Rates And Functional Outcomes With Locking Plates. Our Study Showed A 97.2% Union Rate, A Low Complication Rate (5.6%), And A Mean Constant Score Of 95.5. Patients With Locking Plates Returned To Work Earlier (94.4% Within 3 Months) Compared To The Hook Plate Group (73.3%), Indicating Faster Recovery Despite Similar Final Functional Scores.About One-Third Of Locking Plate Patients Elected Hardware Removal For Non-Medical Reasons (Cultural Preference, Airport Security, Mri Concerns), Suggesting Removal Is Optional.

Comparison With Literature - A Systematic Review (Table 2) Supports Our Results: Non-Union Rates Were Similarly Low In Locking Plate (0.16%) And Hook Plate Groups (0.02%) With No Significant Difference (Table 3). Complication Rates Were Significantly Lower For Locking Plates (7.5%) Compared To Hook Plates (30.4%) (Table 4), Consistent With Our Findings (5.6% Vs. 23.3%). Functional Outcomes Assessed By Constant Scores Showed No Significant Difference: Hook Plate Mean 91.9 (9 Studies) Vs. Locking Plate Mean 93.6 (8 Studies) (Table 5). Both Groups Had High Scores, Though Locking Plates Favored Earlier Mobility And Return To Function.

Conclusion Of Discussion - Both Fixation Methods Effectively Achieve Union And Good Shoulder Function For Unstable Distal Clavicle Fractures. However, Locking Plates Offer Advantages Including: - Lower Complication Rates,Less Frequent Implant Removal, Earlier Return To Work, Reduced Risk To Subacromial Structures

These Benefits Support The Growing Preference For Locking Plates, Particularly When Early Rehabilitation And Long-Term Function Are Priorities.

The Retrospective Series That Used Locking Plates And Hook Plate For Fixation Are Compared (Table 2)

Table 2

Author	Number Of Patients	Average Follow - Up	Fixation Method	Union Rate	Complications	Functional Result	Implant Removal
Klein Et Al. [29]	13	12 Months	Locking Plate	100 %	One Infection	Ases 77.1	5
Kalamaras Et Al. [15]	8	13.6 Months	Locking Plate	100 %	One Superficial Infection One Malreduction	Constant 96	0
Herrmann Et Al. [17]	7	8.3 Months	Locking Plate	100 %	None	Constant 93.3 Dash 15.3	2
Kaipel Et Al. [18]	11	4 Months	Locking Plate	100 %	Two Screw Loosening	Constant 89.8 Rowe 99.4	3
Yu Et Al. [30]	6	17 Months	Locking Plate	100 %	None	Constant 97.5	Na
Andersen Et Al. [14]	20	30.7 Months	Locking Plate	95 %	One Infected Nonunion One Peri-Implant Fracture	Ases 79.0	4
Largo Et Al. [20]	19	5.3 Years	Locking Plate	95 %	One Breakage Of Plate One Delayed Union	Constant 91.5 Dash 1.4	10
Martetsch-Lager Et Al. [16]	30	12.2 Months	Locking Plate	100 %	None	Constant 92.3 Dash 6.2	Na
Tan Et Al. [26]	19	22.4 Months	Locking Plate	100 %	None	Ucla 34.11	Na
Schliemann Et Al. [19]	14	38 Months	Locking Plate	100 %	Three Calcifications Of The Cc Ligaments	Constant 93.5 Taft 11.2	7
Huang Et Al. (Present Study)	36	26.6 Months	Locking Plate	97 %	One Partial Losses Of Reduction One Delayed Union	Constant 95.5	12
Lee Et Al. [12]	32	24.3 Months	Hook Plate	100 %	One Screw Loosening	Constant 90	32
Haidar Et Al. [10]	22	39 Months	Hook Plate	95 %	1 Plate Disengaged From Clavicle,1 Delayed Union And Malunion, 1 Minor Wound Breakdown,1 Non-Union ,1 Plate Unhooked Of	Constant 89 Dash 4.6	21

Author	Number Of Patients	Average Follow-Up	Fixation Method	Union Rate	Complications	Functional Result	Implant Removal
					Acromion, 1clavicular Stress Fracture		
Kashii Et Al. [8]	34	12.4 Months	Hook Plate	100 %	One Plate Displacement One Acromial Fracture One Rotator Cuff Tear	Joa Score 98.3 (90–100)	34
Muramatsu Et Al. [6]	15	15.5 Months	Hook Plate	100 %	13 (Some Migration Of The Plate Including 4 Severe Migration)	Constant 89 (75–95)	12
Renger Et Al. [9]	44	27.4 Months	Hook Plate	95 %	37 (2 Infection, 3 Acromial Osteolysis, 2 Hypertrophic Scar, 30 Impingement)	Constant 92.4 (74–100)	Na
Tambe Et Al. [7]	18	25 Months	Hook Plate	93 %	One Deep Infection One Fracture Of The Clavicle Five Asymptomatic Acromial Osteolysis	Constant 88.5 (63–100)	17

Table 3

Nonunion Rate Between Hook Plate Fixation And Locking Plate Fixation

Group	Non-Union	Union	Total
Hook Plate Group	7 (0.02 %)	315 (98 %)	322
Locking Plate Group	3 (0.16 %)	183 (98.4 %)	186
Total	10 (2.0 %)	498 (98 %)	508

Chi Square Test $P > 0.05$

Table 4.

Complication Rate Between Hook Plate Fixation And Locking Plate Fixation

Group	Complication (+)	Complication (−)	Total
Hook Plate Group	98 (30.4 %)	224 (69.6 %)	322
Locking Plate Group	14 (7.5 %)	172 (92.5 %)	186
Total	112 (22 %)	396 (78 %)	508

Chi Square Test $P < 0.05$

Table 5

Constant Score Between Hook Plate Fixation And Locking Plate Fixation

Clinical Results	Hook Plate Group	Locking Plate Group	P Value
Constant Score (Points)	91.9	93.6	P > 0.05

Limitations - The Main Limitations Of This Study Are The Small Sample Size And Its Retrospective, Non-Randomized Design, Which May Introduce Selection Bias. Larger, Multicenter Randomized Studies Are Needed To Better Evaluate The Efficacy Of Distal Clavicular Locking Plates Versus Hook Plates And To Establish Treatment Guidelines For Unstable Distal Clavicle Fractures. **Conclusion** - Both Distal Clavicular Locking Plates And Hook Plates Yield Good Outcomes For Unstable Distal Clavicle Fractures. However, Locking Plates Result In Fewer Complications And Allow Earlier Return To Work Within Three Months Post-Surgery. Given These Advantages, Locking Plate Fixation Is A Suitable And Promising Treatment Option For Unstable Distal Clavicle Fractures.

Acknowledgments - Conflict Of Interest Statement . None Declared.Irb Approval/Research Ethics Committee, Or Local Equivalent State. This Study Was Approved By The Ethics Committee Of Our Institutes. Informed Consent Was Obtained From All Patients.

References

- 1.Edwards Dj, Kavanagh Tg, Flannery Mc. Fractures Of The Distal Clavicle: A Case For Fixation. Injury. 1992;23:44–46. Doi: 10.1016/0020-1383(92)90125-C. [Doi] [Pubmed] [Google Scholar]
- 2.Van Der Meijden Oa, Gaskill Tr, Millett Pj. Treatment Of Clavicle Fractures: Current Concepts Review. J Should Elb Surg. 2012;21:423–429. Doi: 10.1016/J.Jse.2011.08.053. [Doi] [Pubmed] [Google Scholar]
- 3.Kao Fc, Chao Ek, Chen Ch, Et Al. Treatment Of Distal Clavicle Fracture Using Kirschner Wires And Tension-Band Wires. J Trauma. 2001;51:522–525. Doi: 10.1097/00005373-200109000-00016. [Doi] [Pubmed] [Google Scholar]
- 4.Macheras G, Kateros Kt, Savvidou Od, Et Al. Coracoclavicular Screw Fixation For Unstable Distal Clavicle Fractures. Orthopedics. 2005;28:693–696. Doi: 10.3928/0147-7447-20050701-18. [Doi] [Pubmed] [Google Scholar]
- 5.Chen Ch, Chen Wj, Shih Ch. Surgical Treatment For Distal Clavicle Fracture With Coracoclavicular Ligament Disruption. J Trauma. 2002;52:72–78. Doi: 10.1097/00005373-200201000-00013. [Doi] [Pubmed] [Google Scholar]
- 6.Muramatsu K, Shigetomi M, Matsunaga T, Et Al. Use Of The Ao Hook-Plate For Treatment Of Unstable Fractures Of The Distal Clavicle. Arch Orthop Trauma Surg. 2007;127:191–194. Doi: 10.1007/S00402-006-0284-5. [Doi] [Pubmed] [Google Scholar]
- 7.Tambe Ad, Motkur P, Qamar A, Et Al. Fractures Of The Distal Third Of The Clavicle Treated By Hook Plating. Int Orthop. 2006;30:7–10. Doi: 10.1007/S00264-005-0019-1. [Doi] [Pmc Free Article] [Pubmed] [Google Scholar]
- 8.Kashii M, Inui H, Yamamoto K. Surgical Treatment Of Distal Clavicle Fractures Using The Clavicular Hook Plate. Clin Orthop Relat Res. 2006;447:158–164. Doi: 10.1097/01.Blo.0000203469.66055.6a. [Doi] [Pubmed] [Google Scholar]
- 9.Renger Rj, Roukema Gr, Reurings Jc, Et Al. The Clavicle Hook Plate For Neer Type Ii Lateral Clavicle Fractures. J Orthop Trauma. 2009;23:570–574. Doi: 10.1097/Bot.0b013e318193d878. [Doi] [Pubmed] [Google Scholar]

- 10.Haidar Sg, Krishnan Km, Deshmukh Sc. Hook Plate Fixation For Type Ii Fractures Of The Lateral End Of The Clavicle. J Shoulder Elbow Surg. 2006;15:419–423. Doi: 10.1016/J.Jse.2005.11.012. [Doi] [Pubmed] [Google Scholar]