



Is bending the hook plate necessary in acromioclavicular joint dislocation?

Kyu-Hak Jung

Department of Orthopedic Surgery, Gil Medical Center, Gachon University College of Medicine, Incheon, Korea

Hook plate placement to treat acromioclavicular joint dislocation has been used widely since the 1980s despite the inconvenience of having to remove the plate several months after surgery [1]. The reason for its continued use is that the operation is simple, and the effect is satisfactory [2,3]. However, several complications of this procedure are controversial.

One of them is subacromial erosion/osteolysis due to use of a plate hook [4,5]. The study, “The clinical outcomes of bending versus non-bending of the plate hook in acromioclavicular joint dislocation,” by Joo et al. [6] in the issue focuses on subacromial osteolysis of the hook plate and its associated deterioration of clinical outcomes. Several papers have demonstrated that friction pain and osteolysis are caused by compression of the subacromial area of the hook plate [7-10]. There also are reports of other complications, such as postoperative acromial fracture with severe osteolysis [11-15].

In a study by Joo et al. [6], the hook plate was bent with the angle of the plate hook an average of 21°, and patient outcomes were compared with those of the non-bending group. The results showed that the incidence of subacromial osteolysis was significantly reduced, and the clinical outcome prior to plate removal had improved considerably. Since then, several studies have described the effects of the bending of hook plates. Li et al. [16] reported improved clinical results by bending the hook by 15°.

They observed that the patients’ clinical outcomes were improved by reducing the amount of hook compression applied to the subacromial area by bending the hook plate. Hyun et al. [17] applied hook plate bending that followed the patient’s unique acromial arch through a modified fluoroscopic technique (hook view) and obtained better results than those in patients who underwent non-bending procedures.

As reported by Li et al. [16], bending the hook plate reduces the transmission of excessive compressive force from the clavicle to the subacromial area by decreasing the clavicle angle [18,19]. However, according to a finite analysis by Hung et al. [20], increasing the bending angle can shorten the lever arm of the hook and increase the stress applied to the contact surface between the acromion and the plate. Even though the maximum stress was lower than the yield strength of the hook plate, there were no reports of deformity or hook fracture after hook plate bending. However, compared to the small number of clinical studies on bending plates, there is a large number of studies on non-bending plates. This makes it difficult to conclude that there are no problems with bending the hooks because they simply might not have been discovered yet.

Despite these studies, design of the hook plate has not changed much for 30 years. There could be many reasons for this lack of redesign. In most cases, the hook plate is removed within a few

Received: November 5, 2021 Accepted: November 9, 2021

Correspondence to: Kyu-Hak Jung

Department of Orthopedic Surgery, Gil Medical Center, Gachon University College of Medicine, 21 Namdong-daero 774beon-gil, Namdong-gu, Incheon 21565, Korea

Tel: +82-32-460-3384, Fax: +82-32-423-3384, E-mail: fantasia21@gilhospital.com, ORCID: <https://orcid.org/0000-0003-0211-8005>

Financial support: None.

Conflict of interest: None.

Copyright© 2021 Korean Shoulder and Elbow Society.

This is an Open Access article distributed under the terms of the Creative Commons Attribution Non-Commercial License (<http://creativecommons.org/licenses/by-nc/4.0/>) which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.

months, and the induced complications do not worsen after removal, and the clinical results improve in most cases [21,22]. Many studies recommend early removal of the hook plate to prevent complications and aggravation of clinical outcomes [8,19]. In a study of Joo et al. [6], there was a significant difference in osteolysis between the bending and non-bending groups. However, the difference in clinical results was resolved after metal removal. Even if there are only minor complications caused by a non-bending hook plate, it is important not to induce a severe complication by proceeding with early removal [15,23]. In the study of Oh et al. [24], 38% of subacromial erosion cases were confirmed in the group where the hook plate was removed at 5.31 months, but 67% of the group who had the hook plate removed at 9.65 months demonstrated the same type of erosion.

Because a randomized controlled trial or meta-analysis has not been published, a conclusion cannot be made about this issue. The hook plate bending technique is thought to be worth considering in surgeries that use a hook plate. Hook plates can be bent at an appropriate angle to match the patient's unique anatomy or shaped according to the patient's specific acromial curve. The results of additional future studies are needed to determine the best method.

ORCID

Kyu-Hak Jung <https://orcid.org/0000-0003-0211-8005>

REFERENCES

- Henkel T, Oetiker R, Hackenbruch W. Die treatment of fresh Tossy III acromioclavicular joint dislocation by ligament suture and temporary fixation with the clavicular hooked plate. *Swiss Surg* 1997;3:160-6.
- Chen CH, Dong QR, Zhou RK, Zhen HQ, Jiao YJ. Effects of hook plate on shoulder function after treatment of acromioclavicular joint dislocation. *Int J Clin Exp Med* 2014;7:2564-70.
- Steinbacher G, Sallent A, Seijas R, Boffa JM, Espinosa W, Cugat R. Clavicular hook plate for grade-III acromioclavicular dislocation. *J Orthop Surg (Hong Kong)* 2014;22:329-32.
- Kim YS, Yoo YS, Jang SW, Nair AV, Jin H, Song HS. In vivo analysis of acromioclavicular joint motion after hook plate fixation using three-dimensional computed tomography. *J Shoulder Elbow Surg* 2015;24:1106-11.
- Sim E, Schwarz N, Höcker K, Berzlanovich A. Repair of complete acromioclavicular separations using the acromioclavicular-hook plate. *Clin Orthop Relat Res* 1995;(314):134-42.
- Joo MS, Kwon HY, Kim JW. Clinical outcomes of bending versus non-bending of the plate hook in acromioclavicular joint dislocation. *Clin Shoulder Elbow* 2021;24:202-8.
- Eskola A, Vainionpää S, Päätiälä H, Rokkanen P. Outcome of operative treatment in fresh lateral clavicular fracture. *Ann Chir Gynaecol* 1987;76:167-9.
- Faraj AA, Ketzner B. The use of a hook-plate in the management of acromioclavicular injuries: report of ten cases. *Acta Orthop Belg* 2001;67:448-51.
- Charity RM, Haidar SG, Ghosh S, Tillu AB. Fixation failure of the clavicular hook plate: a report of three cases. *J Orthop Surg (Hong Kong)* 2006;14:333-5.
- Salem KH, Schmelz A. Treatment of Tossy III acromioclavicular joint injuries using hook plates and ligament suture. *J Orthop Trauma* 2009;23:565-9.
- Kashii M, Inui H, Yamamoto K. Surgical treatment of distal clavicle fractures using the clavicular hook plate. *Clin Orthop Relat Res* 2006;447:158-64.
- Koh KH, Shin DJ, Hwang SM. Crossbar technique for the failed clavicular hook plate fixation in an acute acromioclavicular joint dislocation: salvage for acromial fracture after clavicular hook plate. *Clin Shoulder Elb* 2019;22:149-53.
- Chiang CL, Yang SW, Tsai MY, Kuen-Huang Chen C. Acromion osteolysis and fracture after hook plate fixation for acromioclavicular joint dislocation: a case report. *J Shoulder Elbow Surg* 2010;19:e13-5.
- Hoffler CE, Karas SG. Transacromial erosion of a locked subacromial hook plate: case report and review of literature. *J Shoulder Elbow Surg* 2010;19:e12-5.
- Kienast B, Thietje R, Queitsch C, Gille J, Schulz AP, Meiners J. Mid-term results after operative treatment of rockwood grade III-V acromioclavicular joint dislocations with an AC-hook-plate. *Eur J Med Res* 2011;16:52-6.
- Li G, Liu T, Shao X, et al. Fifteen-degree clavicular hook plate achieves better clinical outcomes in the treatment of acromioclavicular joint dislocation. *J Int Med Res* 2018;46:4547-59.
- Hyun YS, Kim GL, Choi SM, Shin WJ, Seo DY. A novel fluoroscopic view for positioning the AO clavicle hook plate decreases its associated in situ complications. *Clin Shoulder Elbow* 2016; 19:25-32.
- Domos P, Sim F, Dunne M, White A. Current practice in the management of Rockwood type III acromioclavicular joint dislocations-National survey. *J Orthop Surg (Hong Kong)* 2017; 25:2309499017717868.
- Mah JM; Canadian Orthopaedic Trauma Society (COTS). General health status after nonoperative versus operative treatment for acute, complete acromioclavicular joint dislocation: results of a multicenter randomized clinical trial. *J Orthop Trauma*

- 2017;31:485-90.
20. Hung LK, Su KC, Lu WH, Lee CH. Biomechanical analysis of clavicle hook plate implantation with different hook angles in the acromioclavicular joint. *Int Orthop* 2017;41:1663-9.
 21. Meda PV, Machani B, Sinopidis C, Braithwaite I, Brownson P, Frostick SP. Clavicular hook plate for lateral end fractures: a prospective study. *Injury* 2006;37:277-83.
 22. Renger RJ, Roukema GR, Reurings JC, Raams PM, Font J, Verleisdonk EJ. The clavicle hook plate for Neer type II lateral clavicle fractures. *J Orthop Trauma* 2009;23:570-4.
 23. Lin HY, Wong PK, Ho WP, Chuang TY, Liao YS, Wong CC. Clavicular hook plate may induce subacromial shoulder impingement and rotator cuff lesion—dynamic sonographic evaluation. *J Orthop Surg Res* 2014;9:6.
 24. Oh JH, Min S, Jung JW, et al. Clinical and radiological results of hook plate fixation in acute acromioclavicular joint dislocations and distal clavicle fractures. *Clin Shoulder Elb* 2018;21:95-100.