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Positional anterior sternoclavicular joint dislocation in the acceleration phase of throwing: a case report

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Positional anterior sternoclavicular joint (SCJ) dislocation is relatively rare and needs careful treatment. We report our course of treatment and tips for surgery in a case. The patient was a 16-year-old male outfield baseball player. Three years ago, he had 3 recurrent episodes of right shoulder dislocation. During these injuries, there were forward dislocations of the proximal right clavicle edge accompanied by a creaking sound during the throw acceleration period. Thereafter, the anterior dislocation of the SCJ occurred during the acceleration phase of throwing, and the SCJ naturally repositioned on the shoulder resting position. This situation lingered and he often felt shoulder apprehension during throws, so he opted for surgical treatment just 1 month after the first injury. We performed a modified version of the figure-of-8 technique reported by Wang et al, using the ipsilateral palmaris longus (PL) tendon. The bilateral edge of the PL was attached to a Krackow suture and passed through the bone tunnels opened at the proximal clavicle and proximal sternum so that it became a figure of 8 on the anterior of the SCJ. The stability of the SCJ was confirmed after the surgery.

The sternoclavicular joint (SCJ) has a 35° forward/backward and 45° forward rotation range of motion (ROM). Because of the degrees of ROM, the SCJ is a relatively stable joint.[2] Dislocation of the joint is rare, comprising only 1% of all joint dislocation cases and 3% of upper limb joint dislocation cases.[4] In the case of a posterior dislocation, surgical treatment is necessary because of patient symptoms and the risk of damage to vital structures underneath the SCJ, such as the neurohemal organs and esophagus. In the case of an anterior dislocation, a previous study has suggested that careful evaluation and judgment is necessary before implementing surgical treatment.[17] Anterior dislocation is more frequent than posterior dislocation, and conservative treatment should improve prognosis without surgery.[12] Here, we report a case of recurrent anterior SCJ dislocations during the acceleration phase of throwing, which was surgically treated with a favorable outcome. We also report the effective surgical technique used in this case.

Case presentation

The subject was a 16-year-old man who was an outfielder on a baseball team. Despite no prior joint pain or instability, the joint near the proximal edge of his right collarbone dislocated in the anterior direction with a crepitus sound during the acceleration phase of throwing. He began to suffer dislocation at the same site repeatedly after the first incident. According to his medical records, he experienced dislocation at the glenohumeral joint (GHJ) 3 times on the same (right) side 3 years before this incident. He has no general joint laxity except for the right GHJ instability. His Beighton hypermobility score[1] was zero points. An initial radiograph demonstrated no apparent abnormalities. For further assessment, computed tomographic images of the SCJ were taken with neutral and elevated positions of the shoulder. The computed tomographic

The Ethical Committee of Mito Kyodo General Hospital approved this study (approval number: 19-39).

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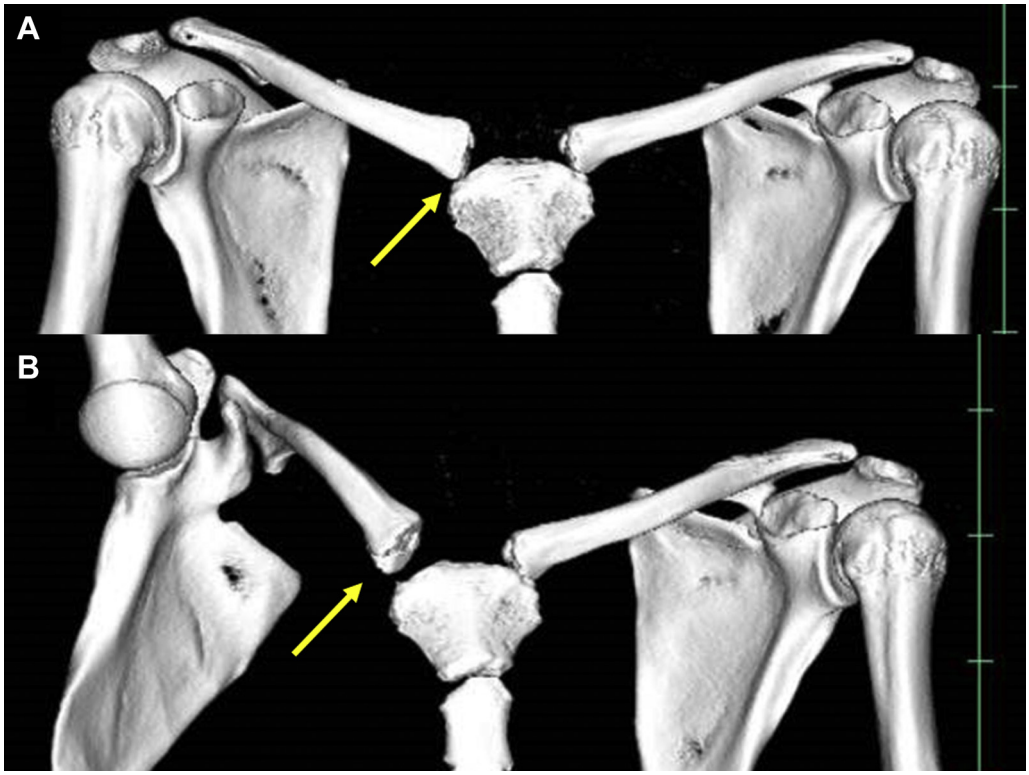

Figure 1 Three-dimensional computed tomography. (**A**) The right upper limb in the neutral position. The sternoclavicular joint (SCJ) is shown in a repositioned state. (**B**) The right upper limb in the elevated position. SCJ is shown in a dislocated state.

images revealed subluxation of the SCJ in the elevated position and repositioning of the joint in the neutral position (Figs. 1 and 2). He experienced mild pain at the site and had a normal ROM in his shoulder. He suffered anterior SCJ dislocation only during the pitching motion. Because the patient had prolonged feelings of anxiety and discomfort because of the fear of another dislocation, he requested surgical treatment 1 month after the initial incident.

In our surgical approach, we modified the figure-of-8 technique of using the gracilis tendon,[7-9,14,16-18] and reconstructed the ligament with the palmaris longus (PL) tendon. We exposed the site using an anterior approach. We observed that there were no evident injuries to the joint capsules and the articular disk (Fig. 3, *A*). There was also no sign of injury to the underlying vital organs. We created 2 pairs of 3.5-mm-diameter bone tunnels each in the cortical bone at the proximal edge of the clavicle and the upper right corner of the manubrium. We harvested an approximately 18-cm-long PL tendon for the graft and fastened both ends with Krackow stitches. The graft tendon was passed through the bone tunnel crossing anterior to the joint (Fig. 4). The suture anchor was placed at the clavicle edge (Fig. 3, *B*, and Fig. 5, *A*). The graft was fixed by suturing at the intersection for the threads at both ends of the graft tendon to overlap. We then guided both ends of the graft again into the bone tunnels with the Krackow stitches. Each graft end was sutured in front of the joint to reinforce the anterior joint capsule (Fig. 3, *C*, and Fig. 5, *B*). We used the triangle bandage fixation for 2 weeks postoperatively; after that, we started rehabilitation with joint ROM exercises. Two months after surgery, the patient was cleared for light pitching exercises, and authorized to perform all activities after 4 months. Six months after the surgery, he experienced a right GHJ dislocation in a head sliding incident; however, there was no recurrence of SCJ dislocation at the surgically treated site. Two years after the treatment, he had a perfect Western Ontario Shoulder Instability Index score[10] of zero points; computed tomographic images indicated a favorable reduction (Fig. 6), and he continues to play baseball without any hindrances.

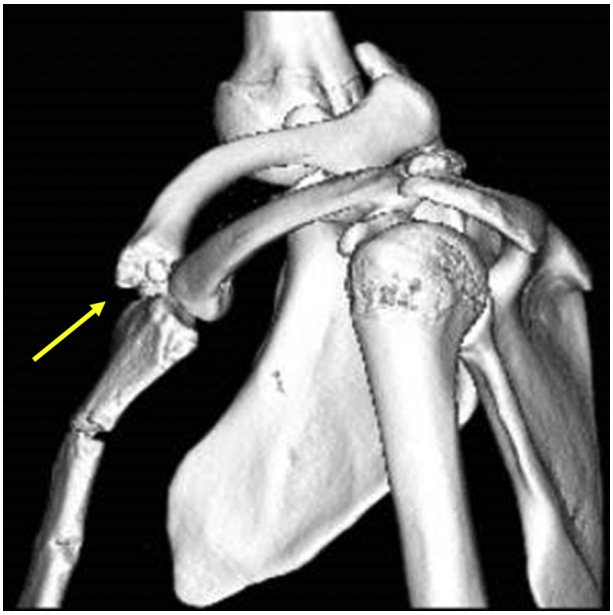

Figure 2 Three-dimensional computed tomography. The clavicle edge is shown in an anteriorly dislocated state.

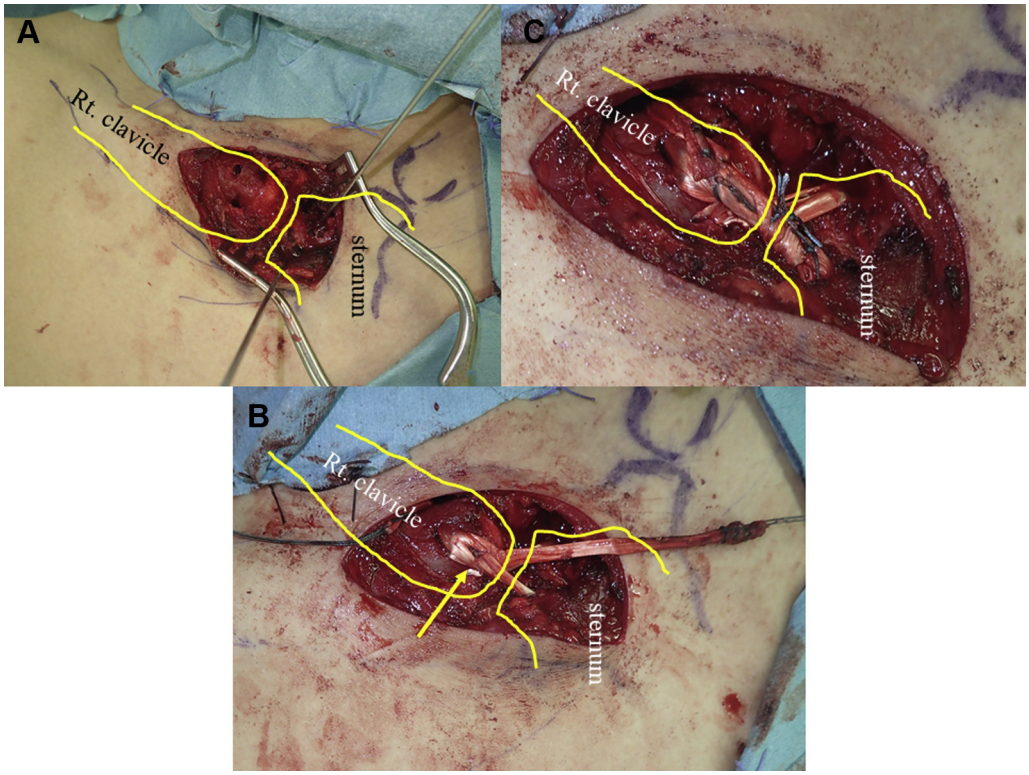

Figure 3 Intraoperative pictures. (**A**) The site was opened using a frontal approach to ensure no rupture of the joint capsules had occurred and that the articular disk was intact. Two 2 pairs of bone tunnels were drilled using a 3.0-mm-diameter drill blade only in the cortical bone at the clavicle edge and frontal manubrium. (**B**) The palmaris longus (PL) tendon was passed through the bone tunnels and crossed over at the area anterior to the joint. The suture anchor was then placed in the area close to the clavicle edge and strung at its crossing point with the thread overlapping both sides of the cross for fixation. (**C**) After that, both ends of the graft were guided again into the bone tunnels with the thread Krackow-sutured to the end of each graft to knot the thread in front of the joint as reinforcement.

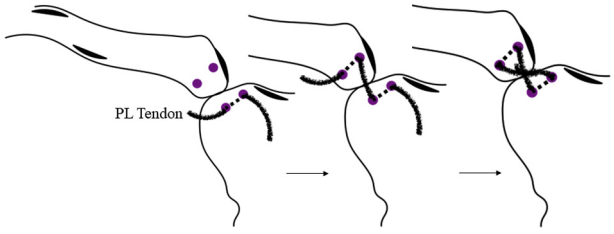

Figure 4 Schema of palmaris longus (PL) tendon transplantation.

Discussion

Rockwood et al[12] have reported that surgical treatment of patients with habitual anterior SCJ dislocations has a poor prognosis and there are few indications for surgical treatment. We tried conservative rehabilitation for this patient, but he could not adapt to throwing techniques or some muscle-strengthening procedures. We considered treatment with a surgical procedure; however, many studies on surgical procedures for SCJ dislocation have been published thus far. Some notable ones are fascia lata transplantation, subclavius tendon transfer, plantar fascia transplantation, clavicle edge resection, and clavicle osteotomy. Each employed technique has its advantages and disadvantages.[5,6,11,17] The figure-of-8 technique using the gracilis tendon has been reported in several recent studies. The technique, proposed by Wang et al,[18] shows relatively robust postsurgical stability because of the graft passing posterior to the joint. However, great care is needed during surgery to prevent damage to the underlying neurovascular structures. There are several similar procedures,[3,7-9,13,14,16,18] and we considered their methods and made some modifications such as how to fix the graft tendon, how to drill a hole, and which tendon to select as a graft tendon. On the other hand, Kawaguchi et al[9] have proposed a technique to drill 2 pairs of tunnels into the anterior bone cortex without penetrating the bones at the clavicle edge and frontal manubrium (2 holes on each), stringing them twice through the bone tunnels, and firmly fixing them with screws. Spencer et al conducted surgical experiments using cadavers to compare subclavius tendon transfer and intramedullary ligament reconstruction and reported that the figure-of-8 reconstructions using the biceps tendon significantly reduced the rate of anterior dislocation.[15] Graft tendons used for the figure-of-8 reconstruction include the gracilis tendon, biceps tendon, plantar fascia, and PL tendon, each of which has its own merits and demerits.[7-9,13,14,16,18] The technique implemented in this study was improved by drilling only into the anterior cortical bone,[7] securing enough stability using a suture anchor, and a Krackow suture (Figs. 4 and 5). In addition, using the PL tendons is practically advantageous because these are harvested from an area close to the target site. However, a disadvantage of this technique is that loosening of the grafted tendon may occur as a result of the force generated during joint motion. Second, the PL tendon may be absent. Thus, the presence of the PL tendon should be confirmed before surgery, and if it is absent, the use of another tendon, such as the gracilis or contralateral PL tendon, should be considered.[7] Furthermore, in this case, there was laxity in the GHJ on the same side, which might have influenced the positional anterior SCJ dislocation, but the patient did not disclose the apprehension of the GHJ or any other disability. There was no laxity in his other joints; however, he suffered another GHJ dislocation 6

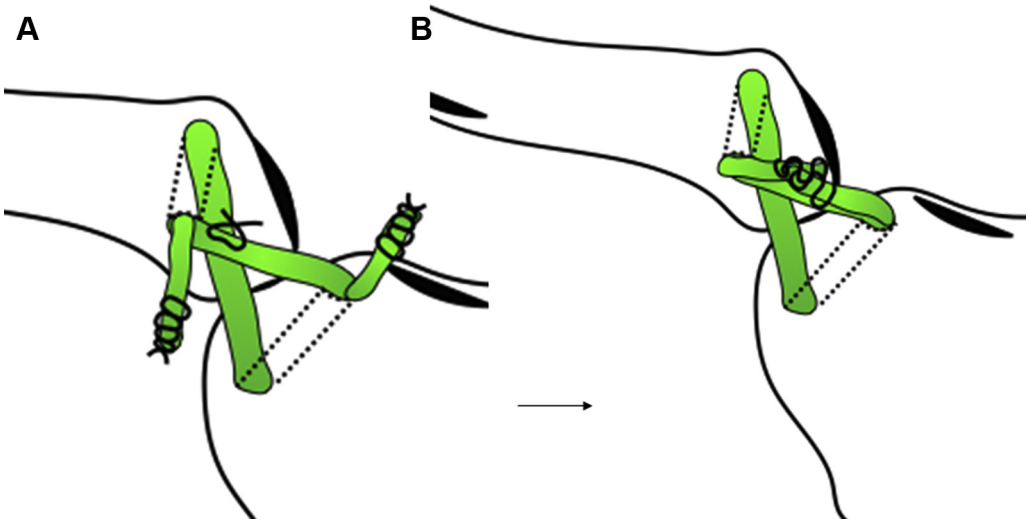

Figure 5 Schema. (A) The suture anchor was inserted in the clavicle and strung at the crossing point. (B) The remaining part of the graft was passed through the bone tunnel again to knot with Krackow-sutured ends on both sides for reinforcement.

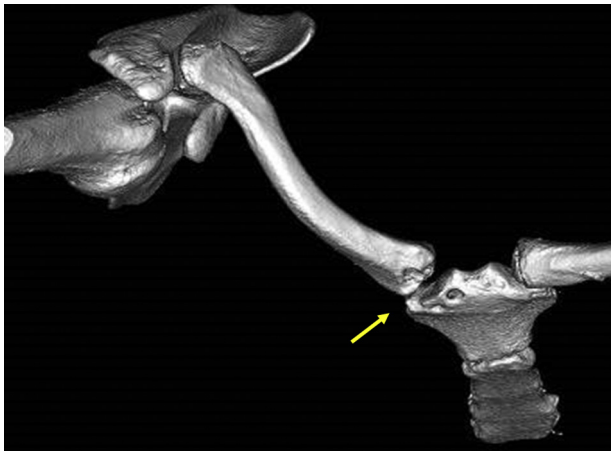

Figure 6 Three-dimensional computed tomography. Two years after treatment, the site shows a favorable reduction with the right upper limb in the elevated position.

months after this surgery. Therefore, we must perform careful assessment and diagnosis regarding joint laxity in cases of recurrent dislocation before considering surgical intervention, and careful follow-up after the surgery is also warranted.

The most notable aspect of our procedure is that it was performed at the anterior part of the SCJ by drilling only into the anterior cortical bone and passing the PL tendon through the intramedullary to prevent injury to posterior structures.

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References

1. Beighton P, Solomon L, Soskolne CL. Articular mobility in an African population. Ann Rheum Dis 1973;32:413–8.
2. Bois AJ, Wirth MA, Rockwood CA Jr. Disorders of the sternoclavicular joint. In: Rockwood Jr CA, editor. Rockwood and Matsen's the Shoulder. 5th ed. Philadelphia, PA: Elsevier; 2018. p. 454–60.
3. Castropil W, Ramadan LB, Bitar AC, Schor B, de Oliveira D'Elia C. Sternoclavicular dislocation-reconstruction with semitendinosus tendon autograft: a case report. Knee Surg Sports Traumatol Arthrosc 2008;16:865–8. https://doi.org/10.1007/s00167-008-0527-9.
4. Cave EF. Shoulder girdle injuries. In: Cave EF, editor. Fractures and other injuries. Chicago: Yearbook Medical Publishers; 1958. p. 258–9.
5. Eskola A, Vainauonpaa S, Vastamaki M, Slatis P, Rokkanen P. Operation for old sternoclavicular dislocation. Results in 12 cases. J Bone Joint Surg Br 1989;71:63–5.
6. Friedrich L, Afifi FK, Skarvan J, Friederich NF, Hirschmann MT. Combined gracilis tendon autograft reconstruction and discus repair of a chronic anterior-superior sternoclavicular joint dislocation. Knee Surg Sports Traumatol Arthrosc 2012;20:1978–82. https://doi.org/10.1007/s00167-011-1852-y.
7. Gowd AK, Liu JN, Garcia GH, Cabarcas BC, Agarwalla A, Nicholson GP, et al. Figure of eight reconstruction of the sternoclavicular joint: outcomes of sport and work. Orthopedics 2019;42:205–10. https://doi.org/10.3928/01477447-20190523-03.
8. Guan JJ, Wolf BR. Reconstruction for anterior sternoclavicular joint dislocation and instability. J Shoulder Elbow Surg 2013;22:775–81. https://doi.org/10.1016/j.jse.2012.07.009.
9. Kawaguchi K. Double figure-of-eight reconstruction technique for chronic anterior sternoclavicular joint dislocation. Knee Surg Sports Traumatol Arthrosc 2015;23:1559–62. https://doi.org/10.1007/s00167-014-2979-4.
10. Kirkley A1, Griffin S, Dainty K. Scoring systems for the functional assessment of the shoulder. Arthroscopy 2003;19:1109–20. https://doi.org/10.1016/j.arthro.2003.10.030.
11. Rockwood CA Jr, Groh GI, Wirth MA, Grassi A. Resection arthroplasty of the sternoclavicular joint. J Bone Joint Surg 1997;79:387–93.
12. Rockwood CA Jr. Spontaneous atraumatic anterior subluxation of the sternoclavicular joint. J Bone Joint Surg Am 1989;71:1280–8.
13. Sabatini JB, Shung JR, Clay B, Oladeji LO, Minnich DJ, Ponce BA. Outcomes of augmented allograft figure-of-eight sternoclavicular joint reconstruction. J Shoulder Elbow Surg 2015;24:902–7. https://doi.org/10.1016/j.jse.2014.10.001.
14. Singer G, Ferlic P, Kraus T, Eberl R. Reconstruction of sternoclavicular joint in active patients with the figure-of-eight technique using hamstring. J Shoulder Elbow Surg 2013;22:64–9. https://doi.org/10.1016/j.jse.2012.02.009.
15. Spencer EE, Kuhn JE. Biomechanical analysis of reconstruction for sternoclavicular joint instability. J Bone Joint Surg Am 2004;86:98–105. https://doi.org/10.2106/00004623-200401000-00015.
16. Spencer EE, Kuhn JE, Huston LJ, Carpenter JE, Hughes RE. Ligamentous restraints to anterior and posterior translation of the sternoclavicular joint. J Shoulder Elbow Surg 2002;11:43–7. https://doi.org/10.1067/mse.2002.119394.
17. Thut D, Hergan D, Dukas A, Day A, Phil M, Sherman OH. Sternoclavicular joint reconstruction—a systematic review. Bull NYU Hosp Jt Dis 2011;69:128–35.
18. Wang D, Camp CL, Werner BC, Dines JS, Altchek DW. Figure-of-8 reconstruction technique for chronic posterior sternoclavicular joint dislocation. Arthrosc Tech 2017;6:e1749–53. https://doi.org/10.1016/j.eats.2017.06.046.