

Editorial Commentary: Current Indications for Lateral Acromioplasty Include Patients With Elevated Critical Shoulder Angle Plus Subacromial Impingement With Rotator Cuff Pathology or Previous Rotator Cuff Repair



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Abstract: The critical shoulder angle (CSA) reflects the lateral extent of the acromion and the inclination of the glenoid. In 2013, CSA was first introduced and its association with rotator cuff (RC) tears and glenohumeral osteoarthritis (GHOA) was shown. It was speculated that with a high CSA, there was an increased superior force vector from the deltoid and that this superior force led to RC tears. Conversely, when the CSA was low, there was a greater compressive force from the deltoid and that this compressive force led to GHOA. CSA serves as a further development of 2 previously reported measurements (glenoid inclination and acromial index). A key potential therapeutic aspect of the CSA is the ability to modify it surgically, which theoretically could protect RC repairs or prevent progression. In our current clinical practice, we perform lateral acromioplasty (LA) in patients undergoing treatment of subacromial impingement with an “at-risk” rotator cuff (partial rotator cuff tear and severe tendinopathy on magnetic resonance imaging) with a CSA $> 38^\circ$ or all patients with a CSA $> 35^\circ$ after an RC repair to protect the RC repair construct. The relationships of high and low CSA, the anatomic safe zone, and thus clinical applicability of LA are well established and performed in our daily surgical practice. However, we do not yet have widespread clear clinical evidence on potential benefits regarding the clinical outcome after LA. Finally, at this time, the downsides seem minimal, so we continue to use LA as an adjunct in patients with RC tears and RC tendons that are at risk.

See related article on page 709

The critical shoulder angle (CSA) reflects the lateral extent of the acromion and the inclination of the glenoid. In 2013, Moor et al.¹ first introduced the CSA and showed its association with rotator cuff (RC) tears and glenohumeral osteoarthritis (GHOA). They

speculated that with a high CSA, there was an increased superior force vector from the deltoid and that this superior force led to RC tears.¹ Conversely, when the CSA was low, there was a greater compressive force from the deltoid and that this compressive force led to GHOA.¹ The initial study compared 94 asymptomatic shoulders to 102 full-thickness rotator cuff tears (RCT) and concluded 84% of the patients with a CSA $> 35^\circ$ were in the RCT group.¹ These primary findings were supported by case control studies from our study group by Spiegl et al.² in 2016, as well as by Pandey et al.³ in 2016 and Shinagawa et al.⁴ in 2018. Cohort studies from Chalmers et al.⁵ in 2017 and Heuberger et al.⁶ in 2017 also showed the association. Spiegl et al.² described a decreased CSA of $28.7^\circ \pm 2.2^\circ$ in patients with GHOA, and this was confirmed in multiple subsequent studies.^{7–10} Various study groups have observed high interobserver and intraobserver

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reliability with benefits in conventional radiography to magnetic resonance imaging.^{2,11}

A key potential therapeutic aspect of the CSA is the ability to modify it surgically, which theoretically could protect RC repairs or prevent progression. Ames et al.¹² from our group did show that RC repairs that had higher acromial indexes had slightly worse clinical outcomes. The thought was that perhaps a lateral acromioplasty (LA) could reduce the CSA, change the biomechanics favorably, and improve clinical outcomes. However, the safety of LA was unknown. In 2017, studies performed by our study group demonstrated that the insertion of the deltoid origin and the acromion were not weakened by LA with 5 mm and 10 mm resections using an arthroscopic burr of known dimensions.^{13,14} Later, a clinical study by Gerber et al.¹⁵ reported on patients with RCT and a 6 mm LA and demonstrated significantly fewer re-tears rates and benefits in abduction strength in patients with a CSA $\leq 33^\circ$. We applaud the efforts of Smith and Liu¹⁶ who performed a prospective observational case control study, "High Critical Shoulder Angle Values Are Associated With Full-Thickness Posterosuperior Cuff Tears and Low Values With Primary Glenohumeral Osteoarthritis." The study contains 3 groups: full-thickness RCT, GHOA, and a control group with shoulder instability without RCT, each with 10 patients.¹⁶ Although the primary findings of a CSA distribution $>35^\circ$ is associated with RCT and $<30^\circ$ being associated with GHOA confirms the aforementioned well-known data, it is presented in a sophisticated, prospective Level 2 design with an assessment of the radiographic quality using the Suter-Henninger scapular classification.^{16,17} This is of utmost importance because several studies criticized the image quality-dependent CSA measurements based on scapular angulation.^{18,19}

In our opinion, the main finding of this study is the poor image quality in daily surgical practice leading to the exclusion of 41.2% of the images in this study.¹⁶ In our practice we are deliberate about obtaining highly standardized radiographs of diagnostic quality. Further multicentric studies are needed to verify whether this finding is a general or study center-specific concern.

We commend this study, which unquestionably demonstrates the need for quality control in shoulder imaging used in future studies. The previous lack of comparability in imaging could be a component of ongoing controversy regarding the impact of CSA. The integration of these image assessment tools may lead to more consensus within the field. In our current clinical practice, we implemented a mathematical model to plan before surgery the amount of LA to achieve a CSA $\leq 34^\circ$.²⁰ We do perform LA in patients undergoing treatment either of subacromial impingement with an "at-risk" rotator cuff (partial RCT and severe tendinopathy on magnetic resonance imaging) with a CSA

$>38^\circ$, and in all patients with a CSA $>35^\circ$ after a RC repair to protect the RC repair construct. In summary, the relationships of high and low CSA, the anatomic safe zone and thus clinical applicability of LA is well established and performed in our daily surgical practice. Furthermore, the variability of the CSA depending on image quality is well known, but this study adds a quality control tool by applying the Suter-Henninger scapular classification.^{16,17} As discussed in earlier editorial commentaries of this journal, we do not yet have widespread clear clinical evidence on potential benefits regarding the clinical outcome after LA.^{18,21,22} Hence, further randomized prospective studies in large patient collectives are needed to verify the clinical need for LA in patients with higher CSAs.^{21,22} At this time, the downsides seem minimal, so we continue to use LA as an adjunct in patients with RC tears and RC tendons that are "at risk."

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