**SYSTEMATIC REVIEW**

# The Impact of Lateral Decubitus vs. Beach Chair Positioning on the Clinical Outcome of the Patients with Isolated SLAP Type II Repair: A Systematic Review and Meta-analysis

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*Received: 05 February 2022* *Accepted: 17 April 2022*

## Abstract

**Background:** A superior labrum from anterior to posterior (SLAP) repairs can be performed in either beach chair (BC) or lateral decubitus (LD). The purpose of this study was to perform a systematic review and meta-analysis to compare the outcomes of surgical repair of type II SLAP injuries between the BC vs. LD positions. We hypothesized no statistically significant differences in the functional, pain, and motion outcomes between the BC vs. LD positions after type II SLAP repair.

**Methods:** A comprehensive literature search was performed using MEDLINE, Scopus, Web of Science, Embase, and Cochrane to identify studies reporting outcomes after type II SLAP repair. Outcome measures consisted of pain using the visual analog score (VAS), range of motion (ROM), and functional scores, including the University of California at Los Angeles Shoulder (UCLA) score, American Shoulder and Elbow Surgeons (ASES), and Constant score. The outcomes were pooled and analyzed for eligibility and stratified into two subgroups for a random-effects model meta-analysis.

**Results:** Of the 8,016 identified studies through a database search, 13 papers (378 patients) were eligible for statistical analysis in the BC and 10 articles (473 patients) were included in the LD group. The mean follow-up for BC and LD was 35 and 44 months, respectively. The SLAP repair in both positions demonstrated improvements in postoperative clinical outcomes and ROM. Comparing the two positions, the LD group demonstrated significantly greater improvements in VAS which contributed to better functional outcomes, while the BC group showed a significantly greater improvement in abduction. No other differences were identified including ASES, UCLA, and Constant score as well as remaining ROM.

**Conclusion:** Based on the findings of this systematic review and meta-analysis, both the BC and LD positions provide patients better outcomes following operative repair of type II SLAPs. While LD represented a better improvement in functional outcome measures, the BC position demonstrated better abduction with no other significant differences between both positions. An individualized approach to position selection concerning the patient's complaint (pain vs. motion) as well as the surgeon's discretion is recommended.

**Level of evidence:** IV

**Keywords:** Beach chair, Lateral decubitus, Shoulder, SLAP repair, SLAP tear

## Introduction

Injury to the superior labrum was first described in 1985 and defined as a superior labrum from anterior to posterior (SLAP) lesion.[1] Reported etiologies include hyperextension, falling on an outstretched arm, heavy lifting, throwing, and overhead activities, as they create traction on the long

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head of the biceps brachii and its labral attachment.[2,3] These injuries may be isolated or be accompanied by other soft tissue and bony lesions, including Bankart and rotator cuff injuries.[4] Originally, SLAP injuries were classified into four types by Snyder et al.,[3] which was further expanded to seven types by Maffet et al.[5] with type II injuries being the most common in which both the superior labrum and biceps tendon detached together from the superior glenoid rim.[2] Surgical repair of the isolated, symptomatic type II SLAP lesions is often performed in younger athletes. An operative SLAP repair can be performed in one of two different positions, including beach chair (BC) and lateral decubitus (LD), depending on the surgeon's preference, comfort, and training.

Both BC and LD have been shown to result in satisfactory outcomes when addressing different shoulder pathologies.[6] A systematic review comparing both positions for arthroscopic capsular release showed no significant difference in recurrence rate, patient-reported outcome scores, and range of motion.[7] Moreover, a systematic review on posterior shoulder stabilization showed no significant difference between the two positions in terms of recurrent instability and return to the sports.[8] However, comparing the number and position of suture anchors during arthroscopic anterior shoulder stabilization LD position was associated with the utilization of more anchors that are more frequently placed in the 6 -o'clock position compared to the BC position.[9] This data suggests that while the two positions are technically different, the outcomes are expected to be comparable. There is no similar data comparing the two positions during type II SLAP repair.

A review of current literature reveals that there is no dominant choice based on objective data, and we speculate that position selection is based almost solely on surgeon preference.[10] The purpose of this study was to perform a systematic review and meta-analysis to compare the outcomes of surgical repair of type II SLAP injuries between the BC and LD positions. We hypothesized no statistically significant differences in the functional, pain, and motion outcomes between the BC and LD positions after type II SLAP repair.

## Materials and Methods

### *Search Strategy*

Five different databases (MEDLINE, Cochrane, Web of Science, Embase, and Scopus) with the following keywords: "SLAP" OR "Superior labrum anterior to posterior" OR "Superior labrum anterior-posterior". The results were exported to the EndNote 9X (Clarivate Analytics, Philadelphia, Pennsylvania) citation manager.

### *Eligibility Criteria*

Inclusion criteria consisted of studies reporting outcomes for isolated type II SLAP repair done in the BC or LD positions. Studies reporting revisions, biceps tenodesis, concomitant rotator cuff lesion repair, Bankart repairs, and posterior labral repairs were excluded. Studies were stratified based on patient positioning for SLAP repair: BC or LD.

### *Study selection*

Two independent reviewers (A.B and S.S) performed a literature search based on the PRISMA guideline (Preferred Reporting Items for Systematic Reviews and Meta-analyses) and reviewed the results. Studies were included if consensus was reached by the reviewers. The senior author (A.L) was consulted to resolve any disagreement on study inclusion. Titles and abstracts were screened in the first stage, followed by the full-text review of the eligible papers. Lastly, the reference lists of the included studies and review papers were manually screened for additional studies that may have been missed by the initial search.

### *Quality Assessment*

The level of evidence of the included studies was assessed using the American Academy of Orthopedic Surgeons classification system for the orthopedic literature. The Methodological Index for Non-Randomized Studies (MINORS) checklist was used to assess the study's methodologic quality.[11]

### *Data Extraction and Statistical Analysis*

Data obtained from the studies included preoperative and postoperative outcomes as means or mean changes, and standard deviations (SD) or *P-values*. We aimed to extract outcomes including the University of California at Los Angeles Shoulder Score (UCLA), Visual Analog Scale (VAS), Constant score, the American Shoulder and Elbow Surgeons Score (ASES), and range of motion (ROM). Each functional outcome measure was analyzed separately. The unit conversion was not necessary. Data were compiled into Comprehensive Meta-Analysis Software version 3 (Biostat Inc, Englewood, New Jersey) to perform the meta-analysis. The studies were grouped by patient positioning of BC versus LD.

This analysis took study effects into account, and a random-effects model was used for statistical analysis to calculate the risk ratio and 95% confidence interval. The null hypothesis was rejected if the *P-value* was less than 0.05. An important consideration in performing a meta-analysis is whether the effects found in the individual studies are similar enough to be confident that a combined estimate will be a meaningful description of the studies' set. Considering the individual estimates of the treatment effects can vary by chance, it is important to evaluate whether there is more variation than expected by chance alone. This excessive variation is called heterogeneity. To address the proportion of sampling error versus the true effect, the heterogeneity was assessed using Q statistics and the degree of freedom to compute the *P-value*. If *P-value* was less than 0.05, the null hypothesis was rejected, indicating the variations in the true effects. The Q statistics were also utilized to compute the $I^2$ which indicates that the proportion of dispersion in the effect sizes is caused by true differences in the effect. If $I^2$ equals zero, it suggests that all dispersion in the effect sizes can be attributed to the random sampling error. The $I^2$ describes the percentage of total variation across studies due to heterogeneity rather than chance. Given that negative values of $I^2$ are put equal to zero, $I^2$ has a range between 0% and 100%. A value of 0% indicates no heterogeneity, and a larger value indicates increasing heterogeneity.

## Results

### *Search Results*

Databases were queried on April 24th, 2021, resulting in 8,010 records (Embase:1698, Scopus:2822, Web of Knowledge:2006, Cochrane:71, Pubmed:1413), and the manual bibliographic search found 16 papers. Duplications were identified and removed, and the records were screened by title and abstract. All articles published in the English language were available and assessed for eligibility. Of the 108 assessed full-texts, 23 papers were included for meta-analysis. Of these, 13 papers 12-24 were included in the BC group, and 10 articles 25-34 were included in the LD group [Figure 1].

### *Study Quality*

The level of evidence of studies and the MINORS scores have been summarized in Table 1.

### *Study Characteristics and Patient Demographics*

Overall, 815 participants were included comprising 378 patients in the BC group and 437 patients in the LD group. The mean follow-up duration was 35 months for the BC group and 44 months for the LD group [Table 1].

### *Clinical Outcomes*

Five studies reported UCLA in the BC group and four studies in the LD group, all showed a significant improvement from preoperative to postoperative. The difference between BC and LD, however, was not statistically significant [95% confidence interval:

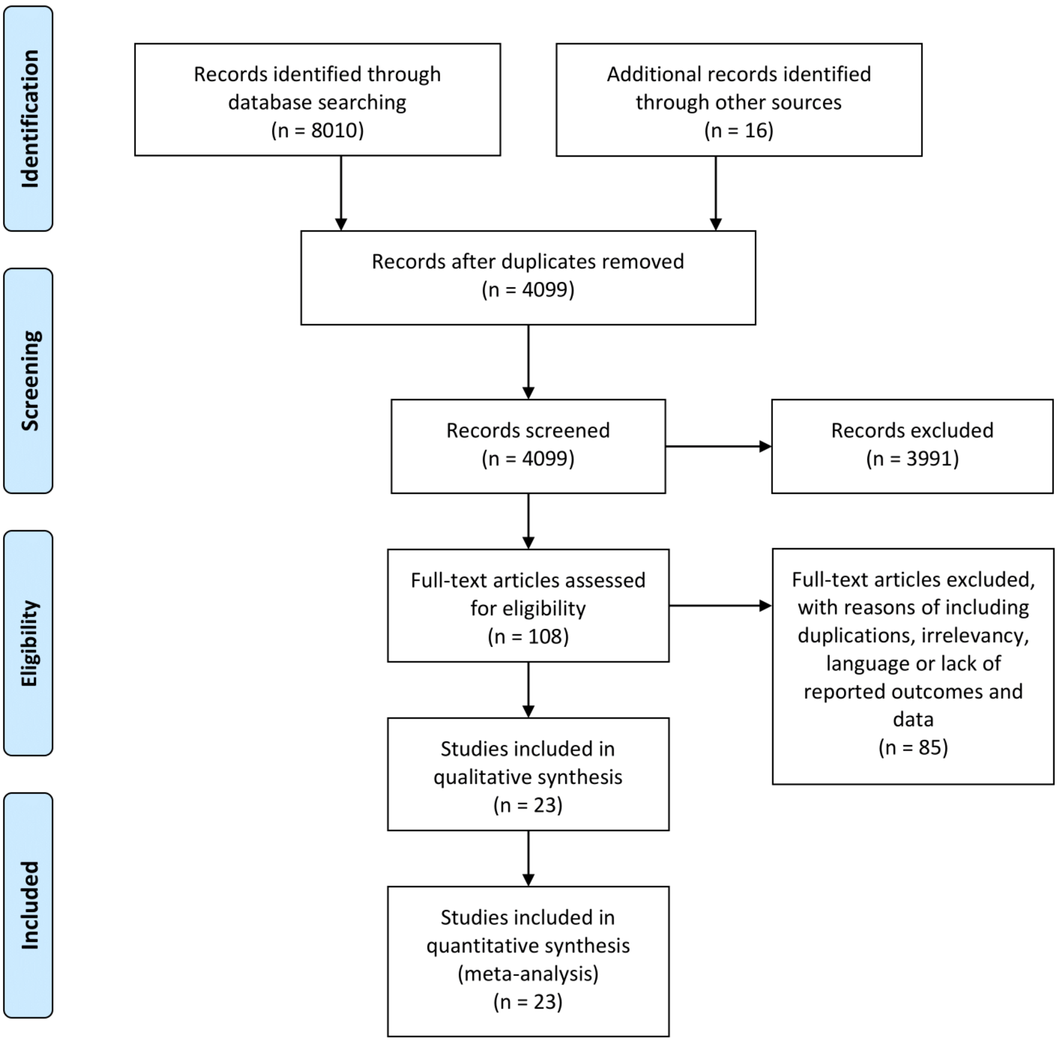


**Figure 1. PRISMA flow diagram.**

**Table 1. Study Characteristics and Patient Demographics.**

| First Author | Journal | Country | Follow-up (months) | Age (years) | Number of Patients | Female:Male | MINORS score | Level of Evidence |
|---|---|---|---|---|---|---|---|---|
| Beach chair | | | | | | | | |
| Kaisidis et al.[15] | Acta Orthopaedica Belgica | Germany | 26 | 35.7 | 20 | 07:13 | 14 | II |
| Boesmueller et al.[5] | BMC Musculoskelet Disord | Austria | 41.9 | 31.8 | 11 | 03:08 | 15 | IV |
| Brockmeier et al.[6] | J Bone Joint Surg Am | USA | 32.3 | 36 | 47 | 08:39 | 9 | IV |
| Coleman et al.[8] | Am J Sports Med | USA | 44.4 | 34 | 34 | N/A | 9 | IV |
| Ek et al.[11] | J Shoulder Elbow Surg | Austria | 35 | 31 | 10 | 00:10 | 12 | III |
| Friel et al.[12] | J Shoulder Elbow Surg | USA | 40.8 | 33.1 | 48 | 09:39 | 10 | IV |
| Levy et al.[21] | Am J Sports Med | USA | 30.5 | 33 | 44 | 11:33 | 9 | III |
| Samani et al.[30] | Arthroscopy | USA | 35 | 36 | 25 | 02:23 | 11 | IV |
| Yang et al.[39] | Knee Surg Sports Traumatol Arthrosc | Korea | 32 | 32.9 | 41 | 10:31 | 11 | III |
| Zhu et al.[41] | J Orthop Surg (Hong Kong) | Singapore | 24 | 28.8 | 16 | 01:15 | 13 | IV |
| Kim et al.[17] | J Shoulder Elbow Surg | Korea | 31.4 | 34.2 | 14 | 06:08 | 17 | II |
| Park et al.[26] | Am J Sports Med | Korea | 45.8 | 22.7 | 24 | 06:18 | 9 | IV |
| Rhee et al.[29] | Arthroscopy | USA | 33 | 24 | 41 | 01:40 | 11 | IV |
| Lateral Decubitus | | | | | | | | |
| Castagna et al.[7] | Knee Surg Sports Traumatol Arthrosc | Italy | 12.7 | 28.4 | 14 | 05:09 | 8 | IV |
| Denard et al.[9] | Arthroscopy | USA | 77 | 39.7 | 55 | 12:43 | 7 | IV |
| Denard et al.[10] | Orthopedics | USA | 63.2 | 45.2 | 22 | 06:14 | 11 | IV |
| Trantalis et al.[38] | Int J Shoulder Surg | Canada | 54 | 40 | 25 | 07:18 | 13 | IV |
| Kanatli et al.[16] | Arch Orthop Trauma Surg | Turkey | 29 | 58 | 15 | N/A | 15 | II |
| Neri et al. (<40)[24] | Am J Sports Med | USA | 36.4 | 23 | 25 | 00:25 | 13 | III |
| Neri et al. (≥40)[24] | Am J Sports Med | USA | 40.5 | 36.4 | 25 | 01:24 | 13 | III |
| Ok et al. (new)[25] | Knee Surg Sports Traumatol Arthrosc | Korea | 30.4 | 43.4 | 14 | 02:12 | 13 | II |
| Ok et al. (old)[25] | Knee Surg Sports Traumatol Arthrosc | Korea | 29.7 | 41.6 | 15 | 02:13 | 13 | II |
| Provencher et al.[28] | Am J Sports Med | USA | 40.4 | 31.6 | 179 | 35:144 | 7 | III |
| Silberberg et al. (1)[32] | Arthroscopy | Spain | 37 | 29.66 | 15 | 04:11 | 18 | I |
| Silberberg et al. (2)[32] | Arthroscopy | Spain | 37 | 28.83 | 17 | 05:12 | 18 | I |
| Yung et al.[40] | Knee Surg Sports Traumatol Arthrosc | China | 27.6 | 24.2 | 16 | 03:13 | 9 | IV |

| Group by Position | Study name | Std diff in means | Standard error | Variance | Lower limit | Upper limit | Z-Value | p-Value | Relative weight |
|---|---|---|---|---|---|---|---|---|---|
| BC | Nicole A. Friel, 2010 | 4.385 | 0.364 | 0.133 | 3.671 | 5.098 | 12.038 | 0.000 | 19.69 |
| BC | John E. Samani, 2001 | 0.931 | 0.239 | 0.057 | 0.462 | 1.400 | 3.888 | 0.000 | 20.30 |
| BC | Hyuk Jae Yang, 2014 | 0.555 | 0.168 | 0.028 | 0.226 | 0.883 | 3.306 | 0.001 | 20.55 |
| BC | Meng Zhu, 2018 | 2.800 | 0.430 | 0.185 | 1.958 | 3.642 | 6.519 | 0.000 | 19.29 |
| BC | Yong Girl Rhee, 2005 | 2.967 | 0.271 | 0.074 | 2.435 | 3.499 | 10.932 | 0.000 | 20.17 |
| BC | Overall | 2.305 | 0.703 | 0.495 | 0.927 | 3.683 | 3.277 | 0.001 | |
| LD | Patrick J. Denard, 2012 | 2.595 | 0.218 | 0.048 | 2.167 | 3.022 | 11.889 | 0.000 | 27.55 |
| LD | Patrick J. Denard, 2014 | 1.020 | 0.263 | 0.069 | 0.505 | 1.535 | 3.880 | 0.000 | 27.26 |
| LD | Ulunay Kanatli, 2010 | 5.780 | 0.842 | 0.708 | 4.131 | 7.429 | 6.868 | 0.000 | 20.72 |
| LD | Patrick Shu-Hang YUNG, 2008 | 3.737 | 0.547 | 0.299 | 2.665 | 4.809 | 6.830 | 0.000 | 24.47 |
| LD | Overall | 3.105 | 0.743 | 0.551 | 1.649 | 4.560 | 4.181 | 0.000 | |

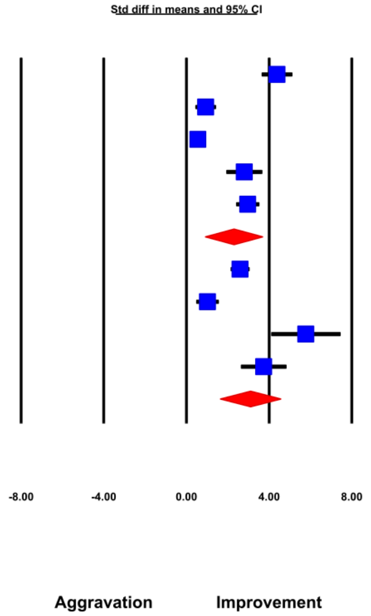


**Figure 2. Forest plot of UCLA using a random-effects model (Cochran's Q: 0.612, *P-value*: 0.434).**

BC=0.927-3.683, LD=1.649-4.560, Figure 2].

### *Visual analog scale (VAS)*

Eight studies in the BC group and five studies in the LD group reported pain VAS. All studies showed a significant reduction in the VAS score. However, the results were significantly better in the LD group [95% confidence interval: BC=0.542-1.447, LD=1.524-2.726, Figure 3].

| Group by Position | Study name | Std diff in means | Standard error | Variance | Lower limit | Upper limit | Z-Value | p-Value | Relative weight |
|---|---|---|---|---|---|---|---|---|---|
| BC | Sandra Boesmueller, 2017 | 0.789 | 0.267 | 0.072 | 0.265 | 1.313 | 2.950 | 0.003 | 12.37 |
| BC | Eugene T.H. Ek, 2013 | 1.512 | 0.463 | 0.214 | 0.605 | 2.419 | 3.266 | 0.001 | 9.29 |
| BC | Nicole A. Friel, 2010 | 0.614 | 0.157 | 0.025 | 0.305 | 0.922 | 3.900 | 0.000 | 13.88 |
| BC | Hyuk Jae Yang, 2014 | 0.555 | 0.168 | 0.028 | 0.226 | 0.883 | 3.306 | 0.001 | 13.76 |
| BC | Meng Zhu, 2018 | 0.835 | 0.225 | 0.051 | 0.394 | 1.276 | 3.714 | 0.000 | 13.01 |
| BC | Doo-Sup Kim, 2012 | 0.805 | 0.308 | 0.095 | 0.202 | 1.408 | 2.618 | 0.009 | 11.75 |
| BC | Jin-Young Park, 2013 | 0.573 | 0.220 | 0.049 | 0.141 | 1.005 | 2.602 | 0.009 | 13.07 |
| BC | Yong Girl Rhee, 2005 | 2.464 | 0.235 | 0.055 | 2.004 | 2.923 | 10.503 | 0.000 | 12.87 |
| BC | Overall | 0.995 | 0.231 | 0.053 | 0.542 | 1.447 | 4.308 | 0.000 | |
| LD | Alessandro Castagna, 2014 | 1.405 | 0.292 | 0.085 | 0.833 | 1.977 | 4.815 | 0.000 | 15.19 |
| LD | Patrick J. Denard, 2012 | 2.433 | 0.208 | 0.043 | 2.025 | 2.840 | 11.706 | 0.000 | 16.29 |
| LD | Patrick J. Denard, 2014 | 1.020 | 0.263 | 0.069 | 0.505 | 1.535 | 3.880 | 0.000 | 15.59 |
| LD | Ji-Hoon Ok, 2012 (new) | 2.429 | 0.411 | 0.169 | 1.622 | 3.235 | 5.903 | 0.000 | 13.37 |
| LD | Ji-Hoon Ok, 2012 (old) | 1.627 | 0.305 | 0.093 | 1.029 | 2.224 | 5.337 | 0.000 | 15.00 |
| LD | Jose María Silberberg, 2011 (1) | 2.793 | 0.443 | 0.196 | 1.925 | 3.661 | 6.308 | 0.000 | 12.88 |
| LD | Jose María Silberberg, 2011 (2) | 3.663 | 0.522 | 0.272 | 2.641 | 4.686 | 7.023 | 0.000 | 11.67 |
| LD | Overall | 2.125 | 0.307 | 0.094 | 1.524 | 2.726 | 6.930 | 0.000 | |

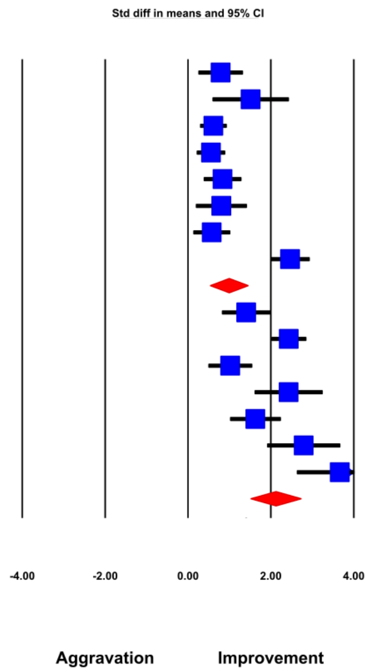


**Figure 3. Forest plot of VAS using a random-effects model (Cochran's Q:8.67, *P-value*:0.003).**

| Group by Position | Study name | Std diff in means | Standard error | Variance | Lower limit | Upper limit | Z-Value | p-Value | Relative weight |
|---|---|---|---|---|---|---|---|---|---|
| BC | Aristotelis Kaisidis, 2011 | 1.095 | 0.283 | 0.080 | 0.541 | 1.649 | 3.872 | 0.000 | 18.22 |
| BC | Sandra Boesmueller, 2017 | 1.098 | 0.296 | 0.087 | 0.518 | 1.677 | 3.713 | 0.000 | 17.32 |
| BC | Hyuk Jae Yang, 2014 | 0.555 | 0.168 | 0.028 | 0.226 | 0.883 | 3.306 | 0.001 | 28.53 |
| BC | Meng Zhu, 2018 | 1.342 | 0.267 | 0.071 | 0.819 | 1.866 | 5.027 | 0.000 | 19.40 |
| BC | Doo-Sup Kim, 2012 | 0.805 | 0.308 | 0.095 | 0.202 | 1.408 | 2.618 | 0.009 | 16.54 |
| BC | Overall | 0.941 | 0.162 | 0.026 | 0.624 | 1.258 | 5.822 | 0.000 | |
| LD | Alessandro Castagna, 2014 | 2.139 | 0.375 | 0.141 | 1.403 | 2.875 | 5.698 | 0.000 | 33.53 |
| LD | Ji-Hoon Ok, 2012 (new) | 2.966 | 0.481 | 0.231 | 2.023 | 3.908 | 6.166 | 0.000 | 28.94 |
| LD | Ji-Hoon Ok, 2012 (old) | 1.417 | 0.283 | 0.080 | 0.862 | 1.972 | 5.005 | 0.000 | 37.53 |
| LD | Overall | 2.107 | 0.437 | 0.191 | 1.250 | 2.964 | 4.820 | 0.000 | |

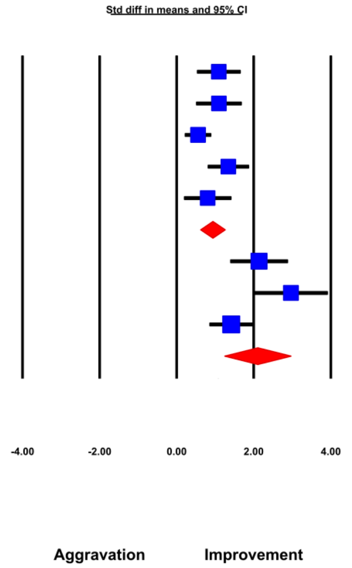


**Figure 4. Forest plot of Constant score using a random-effects model (Cochran's Q:6.255, *P-value*:0.012).**

### *Constant score*

Five studies in BC reported a Constant score, while only two reported it in the LD group. All studies reported significant improvements. Although the improvement in the LD group was larger than in the BC group, the difference was not statistically significant [95% confidence interval: BC=0.624-1.258, LD=1.250-2.964, Figure 4].

Six studies in the BC group and seven studies in the LD group reported the ASES outcome. All preoperative to postoperative improvements were significant. The LD group showed a greater improvement than the BC group, although the difference was not statistically significant [95% confidence interval: BC=0.507-1.442, LD=1.395-3.179, Figure 5].

| Group by Position | Study name | Std diff in means | Standard error | Variance | Lower limit | Upper limit | Z-Value | p-Value | Relative weight |
|---|---|---|---|---|---|---|---|---|---|
| BC | Sandra Boesmueller, 2017 | 1.292 | 0.316 | 0.100 | 0.672 | 1.912 | 4.085 | 0.000 | 14.44 |
| BC | Stephen F. Brockmeier, 2009 | 1.941 | 0.192 | 0.037 | 1.565 | 2.317 | 10.117 | 0.000 | 17.21 |
| BC | Nicole A. Friel, 2010 | 0.614 | 0.157 | 0.025 | 0.305 | 0.922 | 3.900 | 0.000 | 17.86 |
| BC | John E. Samani, 2001 | 0.931 | 0.239 | 0.057 | 0.462 | 1.400 | 3.888 | 0.000 | 16.20 |
| BC | Hyuk Jae Yang, 2014 | 0.555 | 0.168 | 0.028 | 0.226 | 0.883 | 3.306 | 0.001 | 17.67 |
| BC | Jin-Young Park, 2013 | 0.573 | 0.220 | 0.049 | 0.141 | 1.005 | 2.602 | 0.009 | 16.62 |
| BC | Overall | 0.974 | 0.239 | 0.057 | 0.507 | 1.442 | 4.085 | 0.000 | |
| LD | Alessandro Castagna, 2014 | 1.387 | 0.290 | 0.084 | 0.819 | 1.955 | 4.784 | 0.000 | 11.18 |
| LD | Patrick J. Denard, 2012 | 2.383 | 0.205 | 0.042 | 1.982 | 2.785 | 11.645 | 0.000 | 11.44 |
| LD | John N. Trantalis, 2015 | 2.014 | 0.270 | 0.073 | 1.486 | 2.542 | 7.471 | 0.000 | 11.25 |
| LD | Ji-Hoon Ok, 2012 (new) | 2.668 | 0.442 | 0.195 | 1.802 | 3.535 | 6.036 | 0.000 | 10.55 |
| LD | Ji-Hoon Ok, 2012 (old) | 1.953 | 0.341 | 0.116 | 1.284 | 2.621 | 5.727 | 0.000 | 10.99 |
| LD | Matthew T. Provencher, 2013 | 4.865 | 0.207 | 0.043 | 4.459 | 5.272 | 23.456 | 0.000 | 11.43 |
| LD | Jose María Silberberg, 2011 (1) | 1.808 | 0.325 | 0.105 | 1.172 | 2.445 | 5.570 | 0.000 | 11.05 |
| LD | Jose María Silberberg, 2011 (2) | 2.453 | 0.376 | 0.141 | 1.716 | 3.190 | 6.521 | 0.000 | 10.84 |
| LD | Patrick J. Denard, 2014 | 1.020 | 0.263 | 0.069 | 0.505 | 1.535 | 3.880 | 0.000 | 11.27 |
| LD | Overall | 2.287 | 0.455 | 0.207 | 1.395 | 3.179 | 5.027 | 0.000 | |

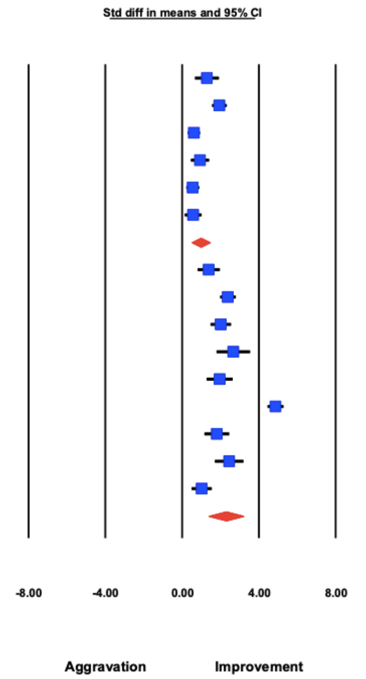


**Figure 5. Forest plot of ASES using a random-effects model (Cochran's Q:6.531, *P-value*:0.011).**

| Group by Position | Study name | Std diff in means | Variance | Lower limit | Upper limit | p-Value | Relative weight |
|---|---|---|---|---|---|---|---|
| BC | Stephen F. Brockmeier, 2009 | 0.518 | 0.014 | 0.282 | 0.754 | 0.000 | 51.74 |
| BC | Meng Zhu, 2018 | 0.643 | 0.045 | 0.226 | 1.060 | 0.003 | 16.55 |
| BC | Nicole A. Friel, 2010 | 0.517 | 0.024 | 0.216 | 0.819 | 0.001 | 31.71 |
| BC | Overall | 0.538 | 0.007 | 0.369 | 0.708 | 0.000 | |
| LD | Alessandro Castagna, 2014 | -0.082 | 0.043 | -0.488 | 0.325 | 0.694 | 9.51 |
| LD | Patrick J. Denard, 2012 | -0.059 | 0.011 | -0.264 | 0.146 | 0.571 | 10.25 |
| LD | John N. Trantalis, 2015 | 0.572 | 0.028 | 0.245 | 0.900 | 0.001 | 9.84 |
| LD | Ulunay Kanatli, 2010 | 3.285 | 0.256 | 2.293 | 4.276 | 0.000 | 6.44 |
| LD | Ji-Hoon Ok, 2012 (new) | 0.761 | 0.055 | 0.300 | 1.221 | 0.001 | 9.26 |
| LD | Ji-Hoon Ok, 2012 (old) | 0.968 | 0.059 | 0.493 | 1.443 | 0.000 | 9.19 |
| LD | Patrick J. Denard, 2014 | -0.000 | 0.045 | -0.418 | 0.418 | 0.999 | 9.46 |
| LD | Jose María Silberberg, 2011 (1) | 1.025 | 0.102 | 0.400 | 1.650 | 0.001 | 8.40 |
| LD | Jose María Silberberg, 2011 (2) | 0.789 | 0.077 | 0.244 | 1.333 | 0.005 | 8.83 |
| LD | Brian R. Neri, 2009 (<40) | -0.264 | 0.041 | -0.662 | 0.135 | 0.195 | 9.55 |
| LD | Brian R. Neri, 2009 (=40) | -0.844 | 0.054 | -1.301 | -0.388 | 0.000 | 9.28 |
| LD | Overall | 0.465 | 0.042 | 0.062 | 0.869 | 0.024 | |

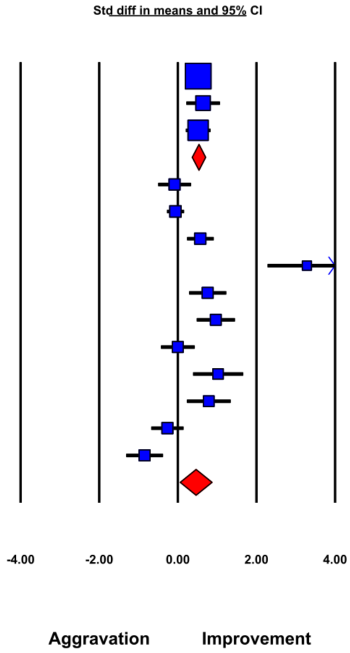


**Figure 6. Forest plot of forward flexion using a random-effects model (Cochran's Q:0.107, *P-value*:0.744).**

### *Forward Flexion*

Three studies in BC groups and eight studies in the LD group reported forward flexion. All studies in the BC showed significant improvements. Four studies of the eight studies in the LD group showed a reduction in forward flexion, of which two showed a significant reduction after surgery. Forward flexion measurements showed significant improvement in the BC group, but the improvement was not significant in the LD group [95% confidence interval: BC=0.369-0.708, LD=0.062-0.869, Figure 6].

### *External Rotation*

In the BC group, two studies reported external rotation before and after surgery. The pooled effect of the two studies showed significant improvement in external rotation, while each individual paper could not show a significant change. In the LD group, seven studies reported external rotation before and after surgery. The pooled effect did not show a significant change from pre to postoperative external rotation, whereas one study even showed a significant reduction in external rotation [95% confidence interval: BC=0.019-0.371, LD=0.166-1.170, Figure 7].

### *Abduction*

Two studies in each group reported abduction. The two studies in the BC group showed significant improvements, and the pooled effect was significant. The two studies in the LD group showed a significant reduction in abduction, but the calculated pooled effect was not significant. [95% confidence interval: BC=0.330-0.820, LD= (-2.770)-0.313, Figure 8].

## Discussion

This study aimed to compare type II SLAP repair outcomes when performed in the BC versus LD position. We pooled the outcomes in three domains: pain score, functional scores (Constant, ASES, UCLA), and ROM. Our results showed greater improvement in pain and functional scores in the LD position, while ROM was similar for both groups with the exception of abduction which favored the BC position.

We found a more remarkable improvement in pain in the LD compared to the BC position, which explains a higher functional score in the LD position. It has been reported that visualization of the glenohumeral joint is reduced in the BC position for instability and SLAP repair compared to the LD position.[35] It is possible that a more anatomic repair can be achieved with better visualization, possibly resulting in a better outcome. All three functional scores of ASES, Constant, and UCLA comprise the pain rating in the total score, showing a direct correlation between pain and functional scores.

Although the difference was statistically significant for VAS pain, the minimal clinically important difference (MCID) is 1.4 points after shoulder arthroplasty and 2.4 points after rotator cuff repair.[36, 37] This value is more than the VAS difference between LD and BC in our study (1.13 points) although the MCID for pain after SLAP repair is not currently available in the most recent systematic review.[38] Functional outcomes have shown substantial

| Group by Position | Study name | Std diff in means | Variance | Lower limit | Upper limit | p-Value | Relative weight |
|---|---|---|---|---|---|---|---|
| BC | Stephen F. Brockmeier, 2009 | 0.138 | 0.013 | -0.085 | 0.360 | 0.226 | 62.76 |
| BC | Nicole A. Friel, 2010 | 0.292 | 0.022 | 0.003 | 0.581 | 0.047 | 37.24 |
| BC | Overall | 0.195 | 0.008 | 0.019 | 0.371 | 0.030 | |
| LD | Alessandro Castagna, 2014 | -0.509 | 0.048 | -0.940 | -0.078 | 0.021 | 10.50 |
| LD | John N. Trantalis, 2015 | 0.175 | 0.024 | -0.131 | 0.481 | 0.263 | 10.92 |
| LD | Ulunay Kanatli, 2010 | 3.905 | 0.345 | 2.754 | 5.056 | 0.000 | 7.12 |
| LD | Ji-Hoon Ok, 2012 (new) | 1.322 | 0.080 | 0.767 | 1.877 | 0.000 | 9.99 |
| LD | Ji-Hoon Ok, 2012 (old) | 1.383 | 0.078 | 0.835 | 1.931 | 0.000 | 10.02 |
| LD | Patrick J. Denard, 2014 | -0.003 | 0.045 | -0.421 | 0.415 | 0.990 | 10.55 |
| LD | Jose María Silberberg, 2011 (1) | 1.069 | 0.105 | 0.435 | 1.703 | 0.001 | 9.63 |
| LD | Jose María Silberberg, 2011 (2) | 0.789 | 0.077 | 0.244 | 1.333 | 0.005 | 10.04 |
| LD | Brian R. Neri, 2009 (<40) | -0.293 | 0.042 | -0.694 | 0.107 | 0.151 | 10.61 |
| LD | Brian R. Neri, 2009 (=40) | 0.032 | 0.040 | -0.360 | 0.424 | 0.872 | 10.64 |
| LD | Overall | 0.668 | 0.066 | 0.166 | 1.170 | 0.009 | |

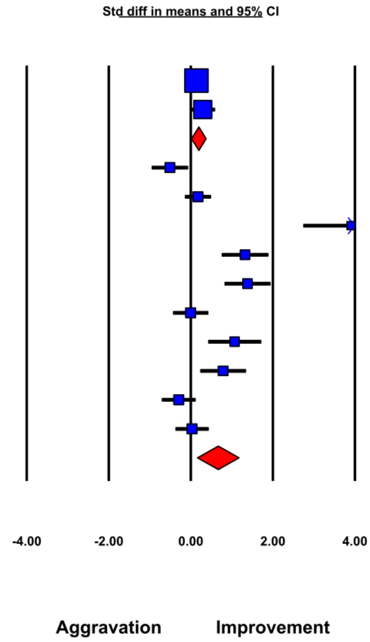


**Figure 7. Forest plot of external rotation using a random-effects model (Cochran's Q:3.041, *P-value*:0.081).**

improvement with time following a SLAP repair.[39] Intuitively, the more considerable improvement in pain and function in the LD group might be due to the longer mean follow-up (44 months) than the BC (35 months). We speculate that there may be no substantial difference between the LD and BS positions if the follow-ups were equalized.

Our results demonstrated a greater improvement in abduction following SLAP repair in the BC position, although all other ROMs were not significant. Few studies in both groups reported the ROM; hence, making these findings vulnerable to publication bias with bias in interpreting the results. Since the ROM is a domain comprising the UCLA and Constant scores, one would expect to see a direct correlation, which contrasts with the findings of this study. There are two studies in each

| Group by Position | Study name | Std diff in means | Standard error | Variance | Lower limit | Upper limit | Z-Value | p-Value | Relative weight |
|---|---|---|---|---|---|---|---|---|---|
| BC | Nicole A. Friel, 2010 | 0.564 | 0.155 | 0.024 | 0.259 | 0.868 | 3.628 | 0.000 | 64.66 |
| BC | Meng Zhu, 2018 | 0.596 | 0.210 | 0.044 | 0.184 | 1.008 | 2.837 | 0.005 | 35.34 |
| BC | Overall | 0.575 | 0.125 | 0.016 | 0.330 | 0.820 | 4.603 | 0.000 | |
| LD | Alessandro Castagna, 2014 | -0.430 | 0.216 | 0.047 | -0.854 | -0.006 | -1.987 | 0.047 | 49.26 |
| LD | Matthew T. Provencher, 2013 | -2.003 | 0.100 | 0.010 | -2.200 | -1.806 | -19.955 | 0.000 | 50.74 |
| LD | Overall | -1.228 | 0.786 | 0.619 | -2.770 | 0.313 | -1.562 | 0.118 | |

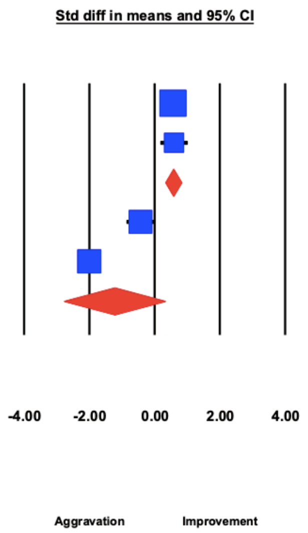


**Figure 8. Forest plot of abduction using a random-effects model (Cochran's Q:5.128, *P-value*:0.024).**

**Table 2. Reported change in motion following an arthroscopic SLAP repair**

| Study | Position | Direction | Preop (degrees) | Final (degrees) |
|---|---|---|---|---|
| Friel 2010 | BC | FF | 160 | 180 |
| Zhu 2018 | BC | FF | 129 | 139 |
| Castagna 2014 | LD | FF | 168 | 166 |
| Provencher 2013 | LD | FF | 164 | 159 |
| Friel 2010 | BC | Abd | 156 | 179 |
| Zhu 2018 | BC | Abd | 117 | 136 |
| Castagna 2014 | LD | Abd | 91 | 85 |
| Provencher 2013 | LD | Abd | 166 | 151 |

BC: beach chair; LD: lateral decubitus; FF: forward flexion; Abd: abduction

group reporting abduction. The study of Castagna et al. is the shortest follow-up with 12 months, while other studies have a minimum of 2-year follow-up. The other Provencher et al. study included a military patient cohort, which is a different cohort from the general population and with athletes. Some studies have demonstrated lower outcomes and delayed return to duty in this population.[40, 41] Although there was a slight decrease in LD and an increase in BC, the average numerical final abduction and forward flexion in all other studies are comparable, showing no clinically significant difference [Table 2].

The study of Provencher et al.is the only one with a significant decrease in motion despite improved pain and function, and SLAP repairs were performed in the LD position in a military cohort. The results of this study might explain the bias in motion improvement. Among the included studies for ROM, Kanatli et al. had an eminent effect on the results. The study was on patients over 45 years of age in the LD position, and none of the patients experienced any complications.[28]

The main limitation of this study is the lack of comparative studies and outcomes. Although most of the reported measurements were satisfactory for both positions, the technique (e.g., fixation type) and the materials were chosen based on the surgeon's preferred position.[6] Multiple factors may bias comparing the results of these case series, including the surgical technique, application of the regional block, use of the accessory portals, concomitant conditions, postoperative rehabilitation protocol, and patients' compliance. Moreover, although the mean follow-up of both groups is comparable, there is still a bias when comparing the results.

Based on the findings of this systematic review and meta-analysis, both the BC and LD positions provide patients better outcomes following operative repair of type II SLAPs. While LD represented a better improvement in functional outcome measures, the BC position demonstrated better abduction with no other significant differences between both positions. An individualized approach to position selection concerning the patient's complaint (pain vs. motion) as well as the surgeon's discretion is recommended.

***Funding:*** The authors received no funding for this work.

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