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Corticosteroid Injections Accelerate Pain Relief and Recovery of Function Compared with Oral NSAIDS in Patients with Adhesive Capsulitis

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Abstract

Background: Adhesive capsulitis of the shoulder is a pathological process in which excessive adhesions and fibrous tissue are formed across the glenohumeral joint, resulting in gradually restricted shoulder movements, dysfunction, and pain.

Aim: To analyze the efficacy of corticosteroid injection applied in cases with 1^{ry} adhesive capsulitis and to compare the clinical results achieved with those achieved in cases given oral NSAIDs.

Materials and methods: This meta-analysis was conducted on 4 investigations according to the guidelines by the Cochrane Collaboration reporting followed the PRISMA statement (Preferred Reporting Items for Systematic Reviews and Meta-analyses).

Results: Two studies reported (follow up internal rotation) and all can be used. A significant heterogeneity was observed. Therefore, a random-effect model has been utilized for analysis (I^2 = 100%, P<0.001). The combined mean difference and 95% CIs was 1.68 (1.47 to 1.89). The combined result demonstrates highly statistically significant difference between groups regarding (follow up internal rotation) (Z = 15.65, P <0.001). Two studies reported (follow up external rotation) and all can be used. A non-significant heterogeneity was observed. Therefore, a random-effect model was utilized for analysis (I^2 = 0%, P=0.89). The combined mean difference and 95 % CIs was 1.30 (0.79 to 1.82). The combined result demonstrates highly statistically significant distinction among groups regarding (monitoring external rotation) (Z = 4.99, P <0.001).

Conclusion: Corticosteroid injection performed results in better outcome compared with oral NSAIDs in cases with adhesive capsulitis. More high-quality well-designed trials are required.

Key words: Corticosteroid Injections, Pain Relief, Adhesive Capsulitis

Introduction

Adhesive capsulitis of the shoulder is a pathological process that results in the progressive restriction of shoulder movements, pain, and dysfunction by the formation of

excessive adhesions and fibrous tissue across the glenohumeral joint. The condition is prevalent, affecting between two and five percent of the population, with a median age of onset of forty to sixty years of age, and is primarily affecting females **(1).**

Several terms have been utilized to define this illness, such as frozen shoulder, humeroglenoid acromioclavicular syndrome, contracture of the shoulder, and scapulohumeral periarthritis **(2).**

Adhesive capsulitis may be described as either 1ry (i.e., idiopathic), in which the cause is unknown, or 2ry, which is frequently associated with diabetes mellitus, rotator cuff tears, or trauma **(3).**

A physical evaluation with passive and active restricted range of motion in all directions, as well as a history of pain and decreased range of motion, are used to diagnose the condition. The only amount of radiopaque solution that may be injected into the joint is less than fifteen millimeters, and arthrography is used to make a definitive diagnosis. In the majority of cases, symptoms will resolve spontaneously within one to three years; however, a certain degree of joint movement restriction will persist **(4).**

Various therapeutic interventions have been utilized to treat adhesive capsulitis, such as physiotherapy modalities, pharmacological
therapies, acupuncture, joint distension, suprascapular nerve blocks, manipulation under anesthesia, and capsular release in the later stages **(5).**

One of the most frequently performed techniques among rheumatologists, orthopedic surgeons, and 1ry care physicians is the administration of intra-articular corticosteroid injections to manage adhesive capsulitis. The natural history of the illness can be shortened by the reduction of synovitis as a result of early management with intra-articular corticosteroid injections **(6).**

Numerous authors have recommended that intra-articular injections be administered under image control. Although some evidence suggests that the utilization of imaging improves accuracy, it is uncertain whether injections under image control improve patient-relevant results and such apparatus could not be accessible in all clinical settings **(7).**

Non-steroidal anti-inflammatory drugs (NSAIDs) are commonly utilized in conservative treatment, playing a pivotal role in frozen shoulder (FS) management. Classic NSAIDs are known to control the development of inflammation by blocking the synthesis of human prostaglandins by effectively inhibiting cyclooxygenase **(8)**.

Hence, the main goal of this meta-analysis has been to analyze the effectiveness of corticosteroid injection applied in cases with 1ry adhesive capsulitis and to compare the clinical results achieved with those achieved in cases given oral non-steroidal anti-inflammatory drugs.

Material and methods

This meta-analysis has been conducted on 4 studies regarding the guidelines by the Cochrane Collaboration reporting followed the Preferred Reporting Items for Systematic Reviews and Meta-analyses statement.

Search strategy

The following keywords were used to search electronic databases (PubMed, Web of Science, and the Cochrane library): Pain Relief, Corticosteroid Injections, Adhesive Capsulitis, and Oral NSAIDS. The titles and abstracts of the search outcomes were independently screened by 2 reviewers. The inclusion criteria have been assessed against the resulting investigations following the deletion of duplicate articles. The full texts of all investigations that were potentially relevant have been acquired for evaluation against the reported inclusion criteria. The outcomes have been synthesized only after the investigations that met the criteria were further evaluated. The

reference list of the articles that have been involved has been evaluated to determine whether any investigations met the inclusion criteria.

Eligibility criteria:

We involved investigations in which the target population consisted of cases aged eighteen or older, cases with stage two adhesive capsulitis, and the availability of radiographs and MRI or (if MRI has been contraindicated) ultrasonography of the affected shoulder to rule out 2ry etiologies of adhesive capsulitis. The restriction of passive motion in two or more planes of movement was above thirty degrees. We excluded investigations in which the target population consisted of cases with 2ry adhesive capsulitis, involving inflammatory or infectious arthritis, an earlier fracture, a rotator cuff lesion, an earlier corticosteroid injection or operation in the affected shoulder, bilateral adhesive capsulitis, and moderate to severe glenohumeral osteoarthritis. Additionally, observations, case reports, or reviews, as well as Phase I or observational investigations, have been excluded. Both ROM and pain scores information has been unavailable.

Risk of bias assessment

The Cochrane Risk of Bias assessment tool 1 (ROB 1), which has been developed particularly for interventional research, has been utilized to evaluate the quality of the trial. Attrition bias, detection bias, reporting bias, performance bias, Selection bias and prospective sources of bias are all included in this evaluation instrument. The level of bias in each trial was analyzed, and the researchers classified it as "high," "low," or "unclear" for each parameter under consideration.

Statistical analysis:

Review Manager version 5.4.1 has been utilized to conduct all data analyses. (Copenhagen: The Nordic Cochrane Centre, The Cochrane Collaboration, 2014). The odds ratio for binary results has been determined using a ninety-five percent confidence interval (CI). For continuous results, we determined the mean distinction with a ninety-five percent confidence interval. A fixed-effect model with the Mantel-Haenszel method has been utilized to compute the overall impact, which has been estimated with a ninety-five percent confidence interval, in the absence of heterogeneity among investigations. Alternatively, the random-effects model utilizing the method of DerSiomonian and Laird has been selected. The I^2 test and Q statistic have been utilized to assess the heterogeneity among investigations, which denotes the degree of variability in the effect estimates. A P-value of less than 0.05 has been regarded as significant.

Results

A total of four studies have been selected for the current analysis, including a total of 178patients. The publication year ranged from 2001 to 2015. 2 studies were conducted in USA, 1 study was conducted in each of the following: Germany and Argentina. Demographic data of involved investigations are showed in

Table 1.

Author, year	**year**	**country**	**Study period**		**Study design**	**Sample Size**		
			from	**to**		**Corticosteroid injections**	**oral NSAIDs**	**Total**
S Arslan, and Reyhan Çeliker, **(9)**	2001	Germany				10	10	20
Kyong Su Min, MD, **(10)**	2013	USA			double-blinded randomized controlled clinical trial.	15	17	32
Maximiliano Ranalletta, **(11)**	2015	Argentina	2012	2013	Randomized controlled trial	35	34	69
A. Dehghan, **(12)**	2013	USA	2009	2010	randomized clinical trial	29	28	57

Table 2. Patient's characteristics

The mean participants' age in studied groups was 51.82 ranging from 21 to 79 years, and gender was reported in 4 studies with 90 males and 88 females as shown in table 2.

Author, year	**Age (year)**						**sex**					
	Corticosteroid injections			**oral NSAIDs**			**Corticosteroid injections**			**oral NSAIDs**		
	mean	**SD**	**total**	**mean**	**SD**	**total**	**male**	**female**	**total**	**male**	**female**	**total**
S Arslan, and Reyhan Çeliker, (9)	55.6	12.2	10	56.4	7.1	10	3	7	10	7	3	10
Kyong Su Min, MD, (10)	39.1	10.5	15	39.6	9.4	17	12	3	15	13	4	17
Maximiliano Ranalletta, (11)	62.9	12.2	35	63.9	9.1	34	11	24	35	12	22	34
A. Dehghan, (12)	55.31	7.7	29	52.78	6.72	28	21	8	29	11	17	28

Shoulder dominance:

Two studies reported (Shoulder dominance) and all can be used. A non-significant heterogeneity has been identified. Therefore, a random-effect model has been utilized for analysis (I^2-value equals 0%, P-value equals 0.53). The combined mean difference and ninety-five percent confidence intervals was 0.70 (0.32 to 1.54). The combined result shows statistically insignificant distinction among groups regarding (Shoulder dominance) (Z-value equals 0.88, P-value equals 0.38).

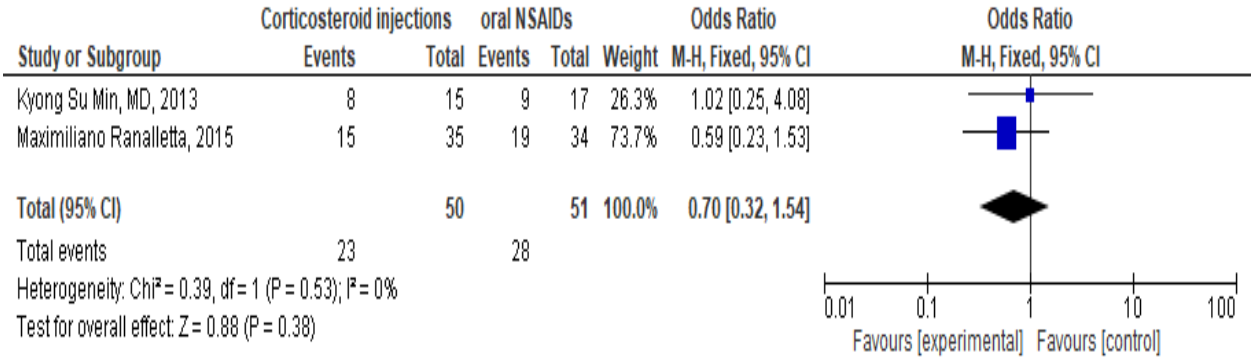

Figure 1. Forest plot of Shoulder dominance shows statistically insignificant distinction among corticosteroid injection and oral NASIDS groups.

Baseline abduction:

Three studies reported (baseline abduction) and all can be used. A non-significant heterogeneity has been identified. Therefore, a random-effect model has been utilized for analysis (I^2-value equals 13%, P-value equals 0.32). The combined mean difference and ninety-five percent confidence intervals was a0.71 (-1.19 to 0.23). The combined result demonstrates statistically significant difference between groups regarding (baseline abduction) (Z-value equals 2.92, P-value equals 0.003).

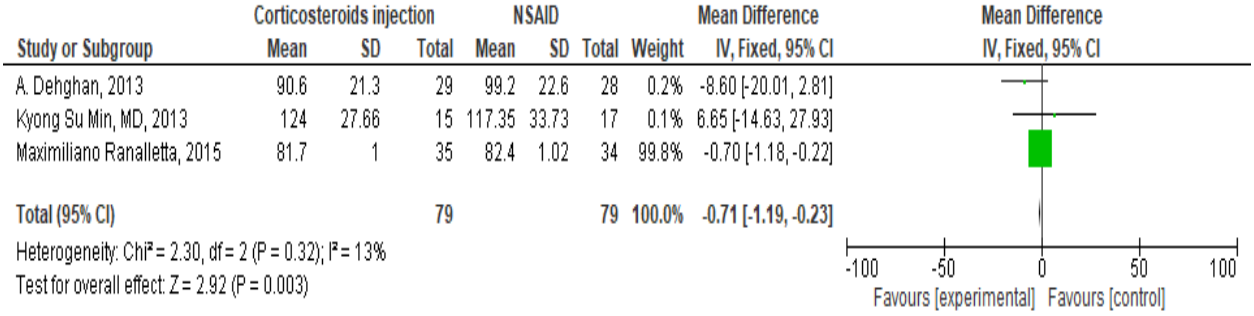

Figure 2. Forest plot of baseline abduction shows statistically significant distinction among corticosteroid injection and oral NASIDS groups.

Follow up abduction:

Three studies reported (**follow up abduction**) and all can be used. A non-significant heterogeneity has been identified. Therefore, a random-effect model has been utilized for analysis (I^2-value equals 55%, P-value equals 0.11). The combined mean difference and ninety-five percent confidence intervals was 8.28 (7.81 to 8.76). The combined result demonstrates highly statistically

significant difference between groups regarding (**follow up abduction**) (Z-value equals 34.08, P-value equals less than 0.001).

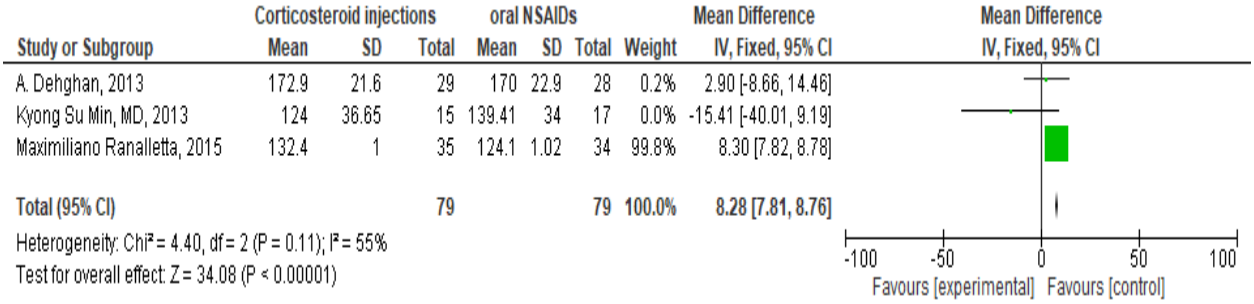

Figure 3. Forest plot of follow up abduction shows statistically significant distinction among corticosteroid injection and oral NASIDS groups.

Baseline flexion:

Three studies reported (**baseline flexion**) and all can be used. A non-significant heterogeneity has been identified. Therefore, a random-effect model has been utilized for analysis (I^2-value equals 0%, P-value equals 0.64). The combined mean difference and ninety-five percent confidence intervals was 0.39 (0.02 to 0.77). The combined result demonstrates statistically significant difference between groups regarding (**baseline flexion**) (Z-value equals 2.04, P-value equals 0.04).

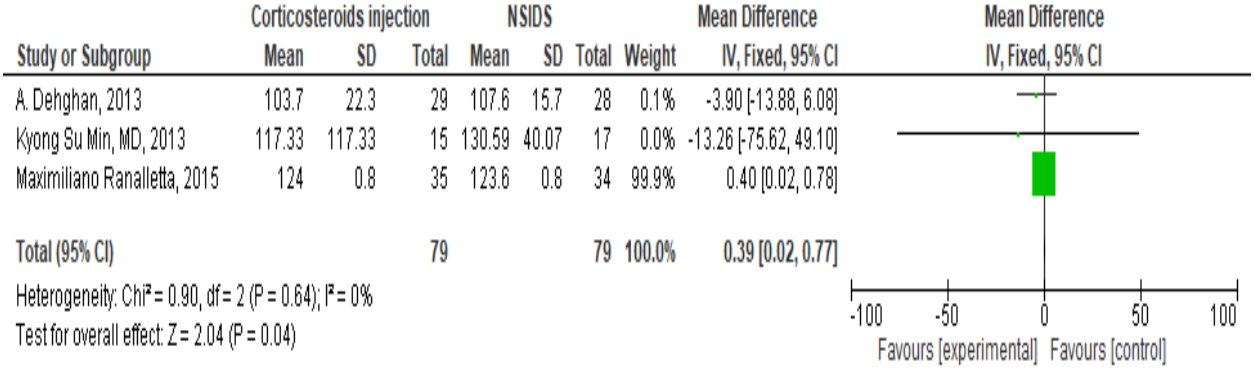

Figure 4. Forest plot of baseline flexion shows statistically significant distinction among corticosteroid injection and oral NASIDS groups.

Follow up flexion

Three studies reported (**follow up flexion**) and all can be used. A significant heterogeneity has been identified. Therefore, a random-effect model has been utilized for analysis (I^2-value equals 83%, P-value equals 0.003). The combined mean difference and ninety-five confidence intervals was 6.18 (5.81 to 6.56). The combined result demonstrates highly statistically significant difference between groups regarding (**follow up flexion**) (Z-value equals 32.12, P-value equals 0.001).

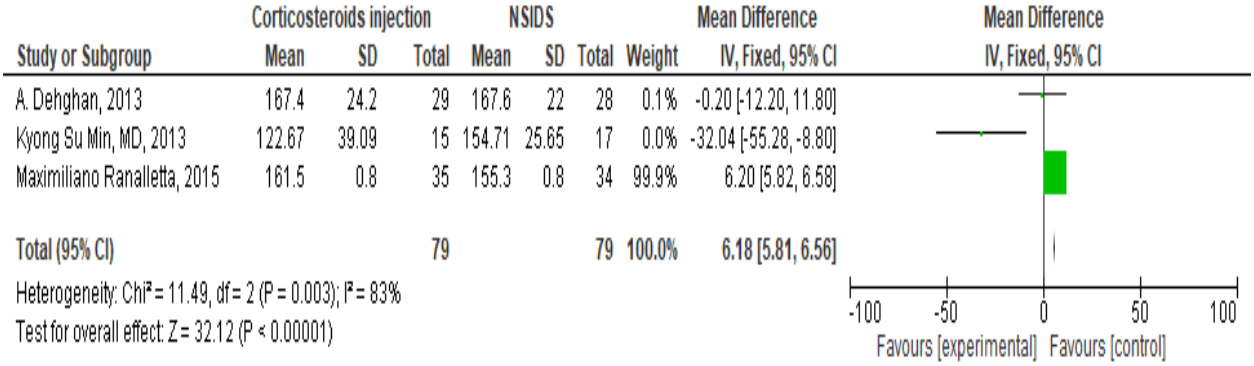

Figure 5. Forest plot of follow up flexion demonstrates statistically significant difference between corticosteroid injection and oral NASIDS groups.

Follow up internal rotation

Two studies reported (**follow up internal rotation**) and all can be used. A significant heterogeneity has been identified. Therefore, a random-effect model has been utilized for analysis (I^2-value equals 100%, P-value equals 0.001). The combined mean difference and ninety-five percent confidence intervals was 1.68 (1.47 to 1.89). The combined result demonstrates highly statistically significant difference between groups regarding (**follow up internal rotation**) (Z-value equals 15.65, P-value equals 0.001).

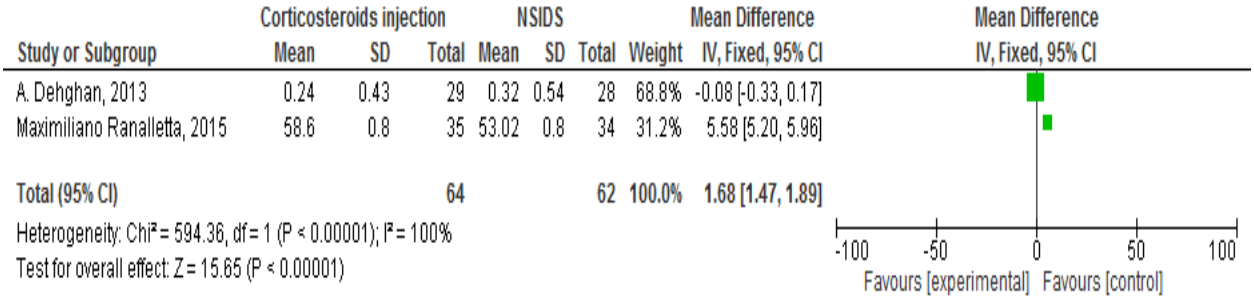

Figure 6. Forest plot of follow up internal rotation demonstrates statistically significant difference between corticosteroid injection and oral NASIDS groups.

Follow up external rotation

Two studies reported (**follow up external rotation**) and all can be used. A non-significant heterogeneity has been identified. Therefore, a random-effect model has been utilized for analysis (I^2-value equals 0%, P-value equals 0.89). The combined mean difference and ninety-five percent confidence intervals was 1.30 (0.79 to 1.82). The combined result demonstrates highly statistically significant difference between groups regarding (**follow up external rotation**) (Z-value equals 4.99, P-value less than 0.001).

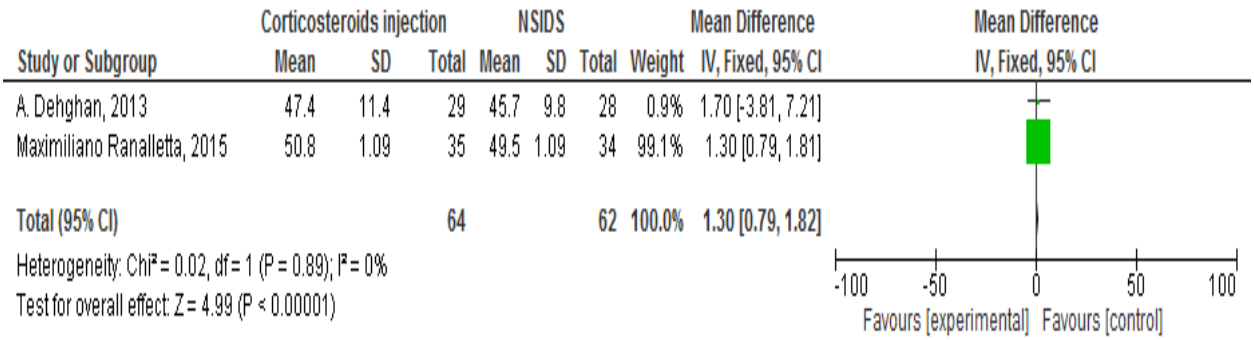

Figure 7. Forest plot of follow up external rotation demonstrates statistically significant difference between corticosteroid injection and oral NASIDS groups.

Pain follow-up (VAS)

Four studies reported (**Pain follow-up (VAS)** and all can be used. A non-significant heterogeneity has been identified. Therefore, a random-effect model has been utilized for analysis (I^2-value equals 42%, P-value equals 0.16). The combined mean difference and ninety-five percent confidence intervals was -0.01 (-0.05 to 0.04). The combined result demonstrates statistically insignificant distinction among groups regarding (**Pain follow-up (VAS)** (Z-value equals 0.25, P-value equals 0.80).

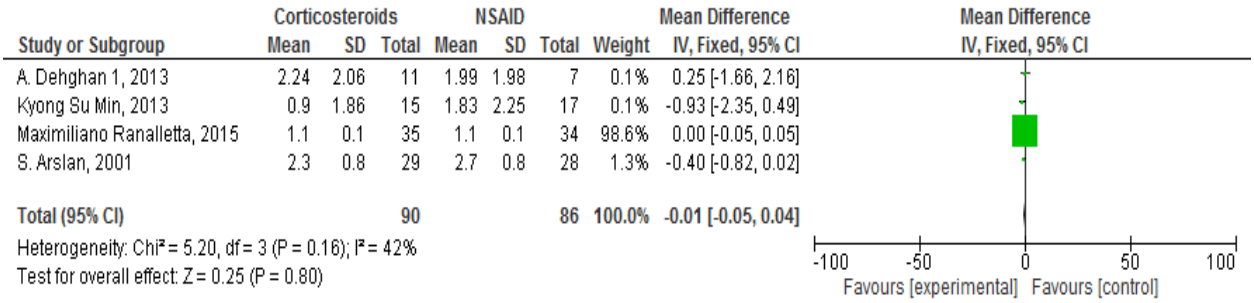

Figure 8. Forest plot of Pain follow-up (VAS) shows statistically insignificant distinction among Corticosteroids and NSAID groups

Discussion

A total of 4 studies **(9), (10), (11), (12)** were selected for the current analysis, including a total of 178patient. The publication year ranged from 2001 to 2015. 2 studies were conducted in USA, 1 study was conducted in each of the following: Germany and Argentina.

The soft tissue involvement of the glenohumeral joint is the cause of adhesive capsulitis, a relatively frequent musculoskeletal complaint in outpatients. It is more prevalent among females over the age of fifty. The most prevalent clinical presentations are shoulder pain and restricted active and passive movement **(13).**

A variety of interventions have been recommended, including active and passive mobilization, acupuncture, oral and injected corticosteroids, NSAIDs, capsular distension, manipulation under anesthesia, and surgical capsular release. It is unexpected that there is no consensus on the most efficient therapy for a condition that is so prevalent **(14).**

The mean participants' age in studied groups was 51.82 ranging from 21to 79 years, and gender was reported in 4 studies with 90 males and 88 females.

Regarding shoulder dominance, our estimated results showed a non-significant heterogeneity has been identified. Therefore, a random-effect model has been utilized for analysis (I^2-value equals 0%, P-value equals 0.53). The combined mean difference and ninety-five percent confidence intervals was 0.70 (0.32 to 1.54). The combined result demonstrates statistically insignificant distinction among groups regarding shoulder dominance (Z-value equals 0.88, P-value equals 0.38).

Our findings in agreement with **Ranalletta et al., (11)** demonstrated that insignificant distinctions have been found among betamethasone and oral NSAIDs as regard shoulder dominance.

Also, our findings in line with **Min et al., (10)** found that insignificant distinctions in shoulder dominance have been found among both groups.

Regarding baseline abduction, three studies were reported and found that a non-significant heterogeneity has been identified. Therefore, a random-effect model has been utilized for analysis (I^2-value equals 13%, P-value equals 0.32). The combined mean difference and ninety-five percent confidence intervals was 0.71 (-1.19 to 0.23). The combined result demonstrates statistically significant distinction among groups regarding baseline abduction ($Z = 2.92$, $P = 0.003$).

In contrast to the current study **Ranalletta et al., (11)** demonstrated that a statistically insignificant distinction has been found among betamethasone and oral Non-steroidal anti-inflammatory drugs regarding baseline abduction. Three studies reported (follow up abduction) and all can be used. A non-significant heterogeneity has been identified. Therefore, a random-effect model has been utilized for analysis (I^2-value equals 55%, P-value equals 0.11). The combined mean difference and ninety-five percent confidence intervals was 8.28 (7.81 to 8.76). The combined result demonstrates highly statistically significant difference between groups regarding (follow up abduction) ($Z = 34.08$, $P =<0.001$).

Our results in concordance with **Ranalletta et al., (11)** demonstrated that the intervention group not only restored abduction significantly faster than the control group, but remained better than in the control group until the end of the investigation (at twelve weeks: P-value less than 0.001).

Also, our findings in line with **Min et al., (10)** discovered that active abduction in the steroid group reduced to 134 at the four-week monitoring, whereas active abduction in the non-steroidal anti-inflammatory drugs group elevated to 151, which was statistically significant (P-value equals 0.03).

In contrast to an investigation conducted by **Dehghan et al., (12)**, they stated that insignificant distinctions have been observed among both groups in terms of abduction after a six-month monitoring. ($P = 0.76$)

Additionally, a meta-analysis of six RCTs carried out by Zheng et al. (15) that compared the therapy impacts of Non-steroidal anti-inflammatory drugs and corticosteroids on shoulder pain determined that Non-steroidal anti-inflammatory drugs and corticosteroid therapy had similar impacts on active abduction within four to six weeks, in contrast to the current investigation.

Three studies reported (baseline flexion) and all can be used. A non-significant heterogeneity has been identified. Therefore, a random-effect model has been utilized for analysis (I^2-value equals 0%, P-value equals 0.64). The combined mean difference and ninety-five percent confidence intervals was 0.39 (0.02 to 0.77). The combined result demonstrates statistically significant distinction among groups regarding baseline flexion (Z-value equals 2.04, P-value equals 0.04).

In contrast to the current study **Ranalletta et al., (11)** reported that a statistically insignificant distinction has been observed among betamethasone and oral Non-steroidal anti-inflammatory drugs regarding baseline flexion.Three studies reported (follow up flexion) and all can be used. A significant heterogeneity has been identified. Therefore, a random-effect model has been utilized for analysis (I^2-value equals 83%, P-value equals 0.003). The combined mean difference and 95% CIs was 6.18 (5.81 to 6.56). The combined result demonstrates highly statistically significant difference between groups regarding (follow up flexion) ($Z = 32.12$, $P < 0.001$).
Our results in concordance with **Ranalletta et al., (11)** reported that the intervention group not only restored forward flexion significantly quicker than the non-steroidal anti-inflammatory drugs group, but also maintained a higher level of forward flexion until the conclusion of the investigation (at twelve weeks: P-value not more than 0.001).
Also, our findings in line with **Min et al., (10)** found that at the 4-week follow-up, statistically significant distinction among groups regarding flexion, (P-value equals 0.04).
In contrast to a research by **Dehghan et al., (12)** stated that after 6 months of follow-up an insignificant distinction has been observed among groups regarding flexion (P-value equals 0.51).
Two studies reported (follow up internal rotation) and all can be used. A significant heterogeneity has been identified. Therefore, a random-effect model has been utilized for analysis (I^2-value equals 100%, P-value less than 0.001). The combined mean difference and ninety-five percent confidence intervals was 1.68 (1.47 to 1.89). The combined result demonstrates highly statistically significant difference between groups regarding (follow up internal rotation) ($Z = 15.65$, $P < 0.001$).
Our findings in line with **Ranalletta et al., (11)** reported that the intervention group not only experienced a significantly quicker restoration of internal rotation, remained better than in non-steroidal anti-inflammatory drugs group until the end of the investigation (at twelve weeks: P-value not more than 0.001).
However, **Dehghan et al., (12)** reported that following six months of monitoring, they didn't find any significant distinction among both groups regarding internal rotation.
Two studies reported (follow up external rotation) and all can be used. A non-significant heterogeneity has been identified. Therefore, a random-effect model has been utilized for analysis (I^2-value equals 0%, P-value equals 0.89). The combined mean difference and ninety-five confidence intervals was 1.30 (0.79 to 1.82). The combined result demonstrates highly statistically significant difference between groups regarding (follow up external rotation) ($Z = 4.99$, $P < 0.001$).
Our findings in line with **Ranalletta et al., (11)** reported that the intervention group experienced a rapid initial improvement in external rotation (two weeks: P-value not more than 001), which then leveled off at week four (P-value equals .064). The distinction in external rotation among the groups had disappeared at the end of the investigation.
However, **Dehghan et al., (12)** reported that an insignificant distinction has been observed among groups regarding follow up external rotation ($P = 0.12$).
Four studies reported Pain follow-up (VAS) and all can be used. A non-significant heterogeneity has been identified. Therefore, a random-effect model has been utilized for analysis (I^2-value equals 42%, P-value equals 0.16). The combined mean difference and ninety-five confidence intervals was -0.01 (-0.05 to 0.04). The combined result demonstrates statistically insignificant distinction among groups regarding Pain monitoring (VAS) ($Z = 0.25$, $P = 0.80$).
Additionally, this research concurred with **Dehghan et al., (12)** reported that after 6 months of follow-up, an insignificant distinction has been observed among groups as regard pain score (P-value equals 0.91).

Also, our findings in line with **Ranalletta et al., (11)** reported that cases who received corticosteroid injections experienced more rapid pain alleviation than control cases within the initial eight weeks of therapy (P-value not more than 0.001). Nevertheless, an insignificant distinction has been observed in pain levels between the groups at the final monitoring.
Also, a meta-analysis conducted by **Zheng et al., (15)** demonstrated that non-steroidal anti-inflammatory drugs and corticosteroid didn't have a significant distinction on pain improvement (SMD, ε0.13, 95%CI, ε0.40-0.14), with slight evidence of heterogeneity (I 2 164 =16.4%, P=0.31). Additionally, **Shin et al., (16)** discovered that all cases, experienced statistically significant (P-value not more than 0.05) faster relief from pain for up to sixteen weeks when management with corticosteroids in comparison to oral non-steroidal anti-inflammatory drugs. Despite the fact that corticosteroids have been discovered to produce quicker outcomes, results for all 4 groups were not significantly distinct at twenty-four weeks (p-value equals .670).
Furthermore, **Min et al., (10)** found that the mean improvement in the VAS at four weeks was 1.83 for the non-steroidal anti-inflammatory drugs group and 0.90 for the steroid group, despite the fact that this wasn't statistically significant (P-value equals 0.23).

Conclusion

This meta-analysis demonstrated that corticosteroid injection performed results in better outcome compared with oral non-steroidal anti-inflammatory drugs in cases with adhesive capsulitis. More high-quality well-designed trials are required.

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