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Regaining Glenohumeral Motion lost to Adhesive Capsulitis ... do Mobilizations Help?

David Peterson
Pacific University

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Regaining Glenohumeral Motion lost to Adhesive Capsulitis ... do Mobilizations Help?

Disciplines
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David J Peterson
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Title: Regaining Glenohumeral Motion lost to Adhesive Capsulitis… do Mobilizations Help?

Clinical Scenario: A large percentage of my current caseload is comprised of patients recovering from adhesive capsulitis; the majority of these patients are over 40 years of age, there is no overwhelming disparity between the number of women versus men, and in each case the principle impairment is decreased glenohumeral (GH) range of motion (ROM). Physical therapy intervention to date has consisted of passive stretching into flexion, internal rotation, and external rotation, and active stretching into abduction, given as a home exercise program (HEP).

Brief Introduction: Considering the time and difficulty associated with regaining full range of motion following a loss due to adhesive capsulitis, I think it is important to explore any interventions that may accelerate recovery. Although the etiology of adhesive capsulitis is not fully understood, there is widespread agreement that the capsule itself becomes contracted (Uitvlugt 1993), and, for this reason, glenohumeral mobilizations may be especially effective. This line of clinical reasoning assumes that gains in accessory motion will translate to gains in physiological motion.

Clinical Question: Do patients diagnosed with adhesive capsulitis regain full passive glenohumeral range of motion more quickly with a combination of accessory glide mobilizations, exercise, and stretching, than from exercise and stretching alone?

Clinical Question PICO:

Population: Men and women over the age of 40 diagnosed with adhesive capsulitis.
Intervention: Glenohumeral joint mobilization in addition to a stretching program.
Comparison: Stretching program.
Outcome Measures: Isolated passive glenohumeral range of motion.

Overall Clinical Bottom Line: Based on the results of outcomes by Johnson AJ et al. and Vermeulen HM et al., posterior mobilizations resulted in a significant increase in GH external rotation (ER) when compared to anterior mobilizations (Johnson 2007), and high-grade mobilizations resulted in a significant increase in passive abduction when compared to low-grade mobilizations (Vermeulen 2006). It is interesting to note that Johnson et al. focused on ER, the reason being that ER is often the most restricted physiological motion in adhesive capsulitis (Mao 1997); this corresponds with limitations I have seen in clinic, and the influence of restricted ER can be seen on abduction through the anterior translation of the humerus in the glenoid fossa during abduction beyond 90 degrees. Both studies had an acceptable level of evidence, with PEDro scores of 6/10 (Johnson 2007) and 8/10

(Vermeulen 2006), and both were randomized clinical trials. Neither study incorporated a control group that did not receive mobilizations, however, and this makes it impossible to claim that mobilizations and stretching together are more beneficial than stretching alone. There is a clear need for such a study, and these two articles offer excellent support for an experimental intervention of high-grade, posterior mobilizations combined with stretching, versus stretching alone.

Search Terms: adhesive capsulitis, mobilization

Appraised By:

David J Peterson, SPT
School of Physical Therapy
College of Health Professions
Pacific University of Oregon
Hillsboro, OR 97123
djp@pacificu.edu

Rationale for Articles Chosen

I began with a search of Medline - OVID, using the Multi-field Search, and the terms "adhesive capsulitis" and "mobilization"; nineteen results were returned. I repeated the search through PEDro with the same search terms; seven redundant results were returned. Of the nineteen found through Medline - OVID, several were systematic reviews, one was a proposed model of treatment, and others investigated shoulder mechanics in this population. I was hoping for articles isolating joint mobilization as the single variable; one fit this criteria, and two others compared different mobilizations against one another.

These three articles were chosen based on their similarity to my PICO:

1. Johnson AJ et al. The effect of anterior versus posterior glide joint mobilization on external rotation range of motion in patients with shoulder adhesive capsulitis. *J Orthop Sports Phys Ther*. 2007;37(3):88-99.

    P: Patients referred to physical therapy with a diagnosis of primary (non-traumatic) adhesive capsulitis. The study included both sexes, with ages ranging from 37-66 years (mean age of 52.7 years). This study population is similar to my PICO when considering the mean age of participants.

    I: Posterior glide mobilizations, ultrasound, ergonomic exercise, no home program.

    C: Anterior glide mobilizations, ultrasound, ergonomic exercise, no home program.

    O: Isolated glenohumeral joint external rotation range of motion.

    PEDro score: 6/10 (via the Physiotherapy Evidence Database)

2. Nicholson G. The effects of passive joint mobilization on pain and hypomobility associated with adhesive capsulitis of the shoulder. *J Orthop Sports Phys Ther*. 1985;6(4):238-46.

    P: Patients referred to physical therapy for shoulder pain and limited glenohumeral ROM. The study included both sexes, with ages ranging from 20-77 years (mean age of 53 years). This study population is similar to my PICO when considering the mean age of participants.

    I: Mobilizations, and active exercises prescribed as home exercise program.

    C: Active exercises prescribed as home exercise program.

    O: Isolated glenohumeral joint range of motion (active IR, active ER, active abduction, passive abduction).

    PEDro score: 5/10 (via the Physiotherapy Evidence Database)

3. Vermeulen HM et al. Comparison of high-grade and low-grade mobilization techniques in the management of adhesive capsulitis of the shoulder: randomized controlled trial. *Phys Ther*. 2006;86(3):355-68.

P: Patients with unilateral adhesive capsulitis lasting 3 months or longer, and resulting in 50% or greater loss of passive glenohumeral joint mobility. The study included both sexes, with a mean age of 51.7 years. This study population is similar to my PICO.

I: High-grade joint mobilizations, no home exercise program assigned.

C: Low-grade joint mobilizations, no home exercise program assigned.

O: Isolated glenohumeral joint range of motion.

PEDro score: 8/10 (via the Physiotherapy Evidence Database)

Based on the above comparisons, I have chosen to write this critically appraised paper on the articles by Johnson AJ et al. and Vermeulen HM et al. At first glance, it appeared that the article by Nicholson offered the most appropriate study design based on my clinical PICO. This article was so poor in design and validity that I found it, at best, inconclusive; nowhere did Nicholson detail the active exercises prescribed, and the application of mobilizations was not standardized. Although the two articles I've chosen do not reflect my desired comparison group, the juxtaposition of anterior versus posterior mobilization, and high-grade versus low-grade mobilization, is intriguing. I believe that finding the most effective direction and intensity of mobilization will benefit future studies, wherein the best combination of mobilization direction and intensity can be combined as an intervention versus exercise and stretching alone.

Article (1): Johnson AJ et al. The effect of anterior versus posterior glide joint mobilization on external rotation range of motion in patients with shoulder adhesive capsulitis. *J Orthop Sports Phys Ther*. 2007;37(3):88-99.

Clinical Bottom Line: Patients with a diagnosis of primary adhesive capsulitis, who have suffered a loss of range of motion, are statistically more likely to regain external rotation with posterior, rather than with anterior, mobilizations. The direction of mobilization (anterior versus posterior) was the only variable between randomized groups, and both groups received their assigned intervention in addition to ultrasound and 3 minutes of exercise on an upper-body ergonomic bike. The group receiving anterior mobilizations had a mean change in ER ROM of 3.0° ± 10.8°; this is not a statistically significant amount of change (p = .40, 95% CI). The posterior mobilization group, on the other hand, regained a mean of 31.3° ± 7.4°; this change in ROM is very significant (p = <.001, 95% CI). Some threats to this study's validity did exist: internally, assessment of ROM was only partly blinded and no intention-to-treat analysis was performed; externally, the sample size (20 subjects) was small. These threats should be noted, but by no means invalidate what is otherwise very compelling evidence. Considering the great benefit and no foreseeable cost involved with changing the direction of mobilization, emphasis should be placed on posterior mobilization, rather than anterior, in situations when mobilization is indicated for this diagnosis.

Article PICO:

Population: Patients referred to physical therapy with a diagnosis of primary (non-traumatic) adhesive capsulitis. Study included both sexes, with ages ranging from 37-66 years (mean age of 52.7 years).

Intervention: Posterior glide mobilizations, ultrasound, ergonomic exercise, no home program.

Comparison: Anterior glide mobilizations, ultrasound, ergonomic exercise, no home program.

Outcome Measures: Isolated glenohumeral joint external rotation range of motion.

Blinding: Subjects were not blinded and the primary clinician was not blinded. Assessment was partially blinded: a PTA blinded to intervention and group placement took all of the measurements for 14 of the 20 subjects, while the primary clinician, who was not blinded, took all of the measurements for the remaining 6 subjects. The lack of blinding with regard to 6 of the 20 measurements is a threat to internal validity.

Controls: There was an attempt to isolate the direction of mobilization as the sole variable by giving both groups ultrasound, ergonomic exercise, and no home program, but there was no control group that received these interventions in the absence of glenohumeral mobilization.

Randomization: Subjects were randomly assigned to treatment groups through a random-numbers table. Randomization appears to have been successful based on the similarity of shoulder external rotation ROM between groups at baseline.

Study: This was a randomized, controlled trial for which twenty subjects were chosen based on the following inclusion criteria: diagnosis of primary (non-traumatic) adhesive capsulitis or frozen shoulder, referral from 1 of 4 orthopedic surgeons, age between 25 and 80 years, and an external range limitation based on capsular, not muscular tightness. Subjects were excluded if they had a previous surgical manipulation of the shoulder, neurological disorder affecting the shoulder, or abnormal radiograph findings. Ten subjects were assigned to each the anterior and posterior mobilization groups (two subjects left the posterior mobilization group, and none left the anterior mobilization group).

Subjects received ultrasound, the assigned directional mobilization, and ergonomic exercise during each of 6 treatment sessions. Ultrasound (US) was used to change the viscoelastic properties of the capsule prior to mobilization, and for this reason US was administered to the anterior capsule in the anterior mobilization group, and the posterior capsule in the posterior mobilization group; US was administered for 10 minutes and the parameters were tailored for each subject. Joint mobilization followed immediately, was accompanied by slight lateral distraction of the humeral head, and consisted of Kaltenborn Grade III mobilizations held for at least 1 minute at end range with no oscillations. These Grade III mobilizations were repeated for 15 minutes, then followed by 3 minutes of forward-direction exercise on an upper body ergometer in each subject's pain-free range. Each subject's ER ROM was measured in supine at the end of each treatment session.

Outcome Measures: An initial external rotation measurement was taken during each subject's first treatment session, wherein each subject was ranged passively to his or her greatest degree of available abduction as the measurement was taken; each subject's subsequent ER measurements were taken at this same degree of abduction to ensure consistent measurement of ER against individual baselines. External rotation was measured both before and after each treatment session. A blinded PTA assessed all measurements for 14 subjects, and the primary clinician assessed the remaining 6 ER measurements. All measurements were taken using a standard 30-cm goniometer with the subjects in supine, and reliability, competency, and intra-rater reliability were presumed after successful, repeated measurements within 3° on 15 consecutive shoulders. The 3°-5° imprecision of goniometry is generally recognized and accepted, and the tool is ubiquitous in physical therapy.

Study Losses: Eighteen of 20 subjects completed this study, and although the 90% completion rate appears high, both losses occurred in the posterior mobilization group and the loss of 20% of the participants (2 out of 10) is substantial. Of these 2 subjects, one opted for surgical manipulation and the other suffered a fall which injured the affected shoulder. The data pertaining to these two subjects was omitted from both the initial demographic and the final intervention analyses, and no intention-to-treat analysis was performed. All other subjects were accounted for and considered within the groups to which they were randomly assigned.

Summary of Internal Validity: This study has good internal validity based on the authors' use of randomization, the control and isolation of the single variable of mobilization direction, the attempt at blinding, the validation of their outcome measure, and the similarity of groups at baseline. The study may have achieved very good validity has the authors been able to maintain blinding throughout, and had they performed an intention-to-treat analysis. A lack of blinding, ordinarily, should be considered a strong threat to internal validity, but I consider the threat to be moderate in this case because the attempt was made and blinding was maintained with the majority of subjects. The lack of an intention-to-treat analysis, which might be considered a low threat if the loss is a small percentage of the subjects, is a moderate threat, here, due to the large loss (20%) from a single group.

This would be a stronger study had the authors treated a control group with ultrasound and upper body ergometric exercise in the absence of mobilizations, but it cannot be considered a threat to internal validity since this study is comparing the efficacy of anterior versus posterior mobilizations, and not the efficacy of mobilizations themselves as an intervention.

Evidence: The outcome measure considered for this clinical question is external rotation range of motion, specifically increases in this measure from individual baselines over a series of six treatments (mean duration of treatment 18.5 days).

Table 1: Between-group Comparison of Initial ER ROM, and its Significance

	Anterior Mobilization	Posterior Mobilization	Significance of Difference *p*-value at 95% CI
Initial External Rotation (mean ± SD degrees)	11.1 ± 15.5	1.3 ± 16.8	0.21

There was no statistically significant difference between groups at baseline with regard to external rotation range of motion, as evidenced by a *p*-value of .21 (Table 1).

Table 2: Between-group Comparison of Change in ER ROM, and its Significance

	Initial ER ROM (mean ± SD degrees)	Change in ER ROM (mean ± SD degrees)	*p*-value at 95% CI	range at 95% CI (degrees)
Anterior Mobilization	11.1 ± 15.5	3.0 ± 10.8	0.40	-4.8 to 10.8
Posterior Mobilization	1.3 ± 16.8	31.3 ± 7.4	<.001	25.1 to 37.5

The anterior and posterior mobilization groups differed notably with regard to change in ER ROM over the course of treatment. There was no statistically significant change in ER ROM in the anterior mobilization group (p = .40), and the range of -4.8° to 10.8° indicates that anterior mobilizations may result in either an increase *or* decrease in ER ROM (Table 2). The posterior mobilization group, on the other hand, did improve very significantly over the course of treatment (p = <.001), and the CI range of 25.1° to 37.5°, though not very precise, still represents a good gain in motion even on the smaller end (Table 2). Furthermore, I was able to determine, given the means and standard deviations provided by the authors, that the effect size between groups is large (2.99), which indicates that posterior mobilizations might meaningfully benefit patients more than anterior mobilizations.

Applicability of Study Results:

Similarity to my Patients: This study is very applicable to patients on my caseload who have been diagnosed with primary adhesive capsulitis, with regard to age, sex, and the primary impairment of loss of glenohumeral range of motion. Furthermore, given the similarity in manifestation between primary and secondary adhesive capsulitis, it is reasonable to conclude that I can apply the results of this study to patients with adhesive capsulitis secondary to surgery or other trauma.

Benefits vs. Costs: There were clear and significant improvements in external range of motion in the posterior mobilization group. Given that the largest improvement in the anterior mobilization group (18°) was less than the smallest improvement in the posterior mobilization group (22°), there is a clear benefit to posterior versus anterior mobilization in the treatment of adhesive capsulitis. There is less cost involved, in terms of function, in the posterior mobilization group as well: no subjects in the posterior mobilization group suffered a loss of range of motion, while two subjects in the anterior mobilization group lost ER range of motion (losses of 13° and 16°). All other costs, including financial and time considerations, are identical between interventions.

Feasibility of Treatment: The application of posterior mobilization is eminently feasible to any therapist currently treating this population with anterior mobilization. The technique and amplitude are virtually identical, and the only impediment would be a patient's inability to lie supine. The study itself was clear enough to be reproduced, though this may be considered a high number of treatments by some insurance companies.

<u>Summary of External Validity</u>: The subjects in this study are very similar to other patients I have encountered who have been referred to physical therapy with a diagnosis of adhesive capsulitis, and there are only mild concerns regarding internal validity that would compromise the ability to generalize the results of this study to the larger adhesive capsulitis population. The small sample size does compromise external validity, and the authors acknowledge this in their discussion.

Article (2): Vermeulen HM et al. Comparison of high-grade and low-grade mobilization techniques in the management of adhesive capsulitis of the shoulder: randomized controlled trial. *Phys Ther*. 2006;86(3):355-68.

Clinical Bottom Line: Patients with adhesive capsulitis resulting in a 50% or greater loss of motion, and lasting longer than 3 months, are likely to experience a statistically significant reclamation of GH abduction following high-grade mobilization to the shoulder; no such statistically significant gain was noted with low-grade mobilizations. No statistically significant gains in passive flexion or passive ER were noted in either group. High- and low-grade mobilizations were done inferiorly, posterolaterally, anteromedially, and laterally and the amplitude of treatment was the only variable; other interventions included 5 minutes of passive physiological ranging before mobilization, and 3 minutes of passive PNF ranging afterward. Regarding abduction, there was a mean improvement of 47.9° (38.8° to 57.0°) in the High-grade Joint Mobilizations (HGMT) group, and 34.8° (27.3° to 42.2°) in the Low-grade Joint Mobilizations (LGMT) group; no standard deviations were provided. Further analysis, including a direct comparison of HGMT versus LGMT at 3 months, was not possible due to the reporting methods employed in this study. The overall statistical validity of this article is suspect, but beyond this there were no significant threats to either internal or external validity. Based on the minimal benefit reported in this study, coupled with the expense of time and effort that could be allocated to an intervention with greater efficacy, the use of mobilizations to treat adhesive capsulitis cannot be encouraged.

Article PICO:

Population: Pts with unilateral adhesive capsulitis lasting 3 months or longer, and resulting in 50% or greater loss of passive glenohumeral joint mobility. Study included both sexes, with a mean age of 51.7 years.

Intervention: High-grade joint mobilizations (HGMT), no home exercise program assigned.

Comparison: Low-grade joint mobilizations (LGMT), no home exercise program assigned.

Outcome Measures: Isolated passive glenohumeral joint range of motion (flexion, abduction, and external rotation).

Blinding: Subjects and therapists were not blinded; assessors were blinded with regard to both treatment and the administering therapist.

Controls: An attempt was made to isolate the amplitude of mobilization as the sole variable in this study. Both treatment groups received 5 minutes of passive ranging, then the assigned mobilization technique (HGMT or LGMT), and finally 3 minutes of passive proprioceptive neuromuscular facilitation (PNF) within a pain-free zone; patients also were instructed in prone pendular exercises to encourage relaxation of the shoulder musculature, and no home exercise program was given to either group. There was no control group that received these interventions in the absence of glenohumeral mobilization.

Randomization: A random-number generator was used to assign subjects to one of the two treatment groups. Subjects were stratified for both the presence of diabetes mellitus and for joint capacity (≤15 or >15 cm^3); the former due to the increased incidence of adhesive capsulitis in this population, and the latter because the influence of joint capacity on recovery is unknown. Randomization was successful, based on there being no significant difference between groups at baseline with regard to the considered outcome measures (passive flexion, passive abduction, and passive external rotation).

Study: This was a randomized, controlled study for which 100 subjects were chosen based on the following criteria: unilateral adhesive capsulitis lasting ≥3 months, with ≥50% loss of passive glenohumeral joint mobility in one or more of the assessed physiological movements. Subjects were excluded if mobilization to the shoulder was contraindicated, if they had previously received manipulation under anesthesia or corticosteroid injections within the previous 4 weeks, if they had cervical, elbow, wrist, or hand pain, or if they had a neurological deficit affecting shoulder function. Forty-nine subjects were assigned to the HGMT group, and 51 subjects were assigned to the LGMT group (two subjects were lost in each group, and a third subject withdrew from the HGMT group after 3 weeks but was included in the analysis).

Subjects received 5 minutes of passive physiological ranging through flexion, abduction, and external rotation at the beginning of each treatment session. Then, treatment progressed to a standardized sequence of inferior glides, posterolateral glides, anteromedial glides, and distraction; the mobilizations were performed at greater degrees of elevation and abduction if glenohumeral (GH) ROM increased during treatment. The only variability in treatment was the amplitude of mobilizations applied: subjects in the HGMT group received Maitland grades III and IV mobilizations at end-range, whereas subjects in the LGMT group received Maitland grade I and gentle grade II mobilizations in a pain-free range. Each treatment session ended with 3 minutes of passive PNF ranging in a pain-free zone, and 2 minutes of prone pendulum exercises to relax the shoulder.

Outcome Measures: A blinded physical therapist took ROM measurements at the beginning of each treatment, with a conventional goniometer, in accordance with standard guidelines established by the American Academy of Orthopaedic Surgeons; test-retest reliability was cited at .94-.98. Measurements were taken of abduction, flexion, and external rotation at 0° of abduction, and each measurement was rounded off to the nearest 5 degrees. There is a recognized margin of error of 3°-5° in goniometric measurement, but the use of this tool is widespread and the margin of error is generally accepted.

Study Losses: Ninety-five of 100 subjects completed this study, and 96 of 100 were included in the analysis; the one-subject differential was due to this subject withdrawing after 4 treatments, but returning for follow-up assessment. The 95% completion rate, and 96% analysis rate, are high, and it does not appear that the losses were related to the intervention applied. It appears that all subjects have been accounted for given these withdrawals and the final data, and an intention-to-treat analysis was performed using all available data, with the subjects were analyzed in their original groups.

Summary of Internal Validity: This study had very good internal validity, given the randomization of subjects, blinding of the assessor, valid outcome measure, similarity of subjects at baseline, and intention-to-treat analysis. Ideally, this study would have a control group that received passive ranging, sham treatment instead of mobilization, passive PNF, and prone pendulum exercises, but this cannot be considered a threat to internal validity since this study compared HGMT and LGMT, and not the efficacy of mobilizations themselves.

Evidence: The outcome measures considered for this clinical question are passive flexion, passive abduction, and passive external rotation at 0° of abduction; specifically, change in these measures over 12 weeks. The mean number of treatments within 12 weeks was 18.6 (SD = 4.9) in the HGMT group, and 21.5 (SD = 2.5) in the LGMT group. The authors took follow-up measurements at 6 and 12 months, but those measures are not being considered because treatment had ceased, and because adhesive capsulitis seems to resolve naturally over time.

Table 3: Between-group Comparison of Passive GH ROM at Baseline, and its Significance

	Flexion (°) median (interquartile range)	Abduction (°) median (interquartile range)	ER (°) median (interquartile range)
HGMT Group	105.0 (95.0 to 115.0)	85.0 (70.0 to 95.0)	20.0 (10.0 to 30.0)
LGMT Group	95.0 (90.0 to 112.5)	85.0 (80.0 to 95.0)	20.0 (12.5 to 35.0)
Statistically Significant Difference at $p = .05$ (yes / no)	no	no	no

There was no statistically significant difference ($p = .05$) between groups at baseline with regard to passive flexion, passive abduction, or passive external rotation at 0° of abduction (Table 3). The authors did not discuss their reasons for providing median ROM measurements instead of means; it is possible that the raw data were skewed.

Table 4: HGMT Within-group Comparison of Passive GH ROM over 3 Months, and its Significance

	Flexion (degrees) mean (95% CI range)	Abduction (degrees) mean (95% CI range)	ER at 0° ABD (degrees) mean (95% CI range)
at 3 Months	27.8 (22.8 to 32.8)	47.9 (38.8 to 57.0)	13.1 (9.7 to 16.5)
Statistically Significant Diff. from Baseline at *p* = .05 (yes / no)	no	yes	no

A statistically significant improvement was seen at 3 months in passive abduction, but no significant improvement was noted in passive flexion or passive ER at 0° of abduction (Table 4). There is a fairly wide 95% CI range associated with the abduction mean, which alludes to greater uncertainty as to the actual effect size.

Table 5: LGMT Within-group Comparison of Passive GH ROM over 3 Months, and its Significance

	Flexion (degrees) mean (95% CI range)	Abduction (degrees) mean (95% CI range)	ER at 0° ABD (degrees) mean (95% CI range)
at 3 Months	23.8 (19.4 to 28.2)	34.8 (27.3 to 42.2)	11.7 (8.0 to 15.4)
Statistically Significant Diff. from Baseline at *p* = .05 (yes / no)	no	no	no

No statistically significant improvement was seen at 3 months in any of the three measures in the LGMT group (Table 5). No *p*-values were reported at this point, so it is unknown how close the changes were to significance.

Whereas baseline measurements were reported as medians and interquartile ranges, the 3-month measurements were reported as means and 95% CI ranges. This lack of empirical consistency, coupled with the lack of raw data, makes independent verification of the results impossible. It is unfortunate that the authors expressed their results via different statistical vehicles; comparing medians and means is not acceptable, as they are not equal expressions of a central tendency. It should be noted that there is a fair amount of overlap in the 95% CI ranges of all measures between the HGMT and LGMT groups, and this is particularly striking with regard to abduction given that the authors note statistical significance in the HGMT group, but not the LGMT group. It begs several questions: how significant were gains in abduction in the HGMT, how close to significance were gains in the LGMT group, and is there a significant amount of difference between the groups?

Although the degree of significance between groups is unknown, the effect size between groups can be determined. The effect size for flexion is 1.67; this large effect size indicates that HGMT might benefit patients more than LGMT. With regard to the other ranges of motion: the effect size for abduction is 3.1, which is very substantial and corroborates the statistically significant effect that HGMT has over LGMT; an effect size of 0.75 for ER, on the other hand, is medium/large, and merely suggests that a benefit might exist. Although the authors noted a statistically significant improvement from baseline in only HGMT abduction, but there is a clear advantage to using HGMT over LGMT for the recovery of motion in all three planes.

Applicability of Study Results:

Benefits vs. Costs: Financial and time considerations were equal between high- and low-grade mobilizations, and no adverse effects were reported with either technique. There are, however, tangible costs involved with these treatments: time and expense that could be spent engaged in some intervention with greater efficacy.

Feasibility of Treatment: Given that the duration of treatment, the direction of technique, and the positioning of the subjects are virtually identical between these two interventions, the only foreseeable impediment to a therapist's application of HGMT, instead of LGMT, is the patient's tolerance of pain at end-range. Two treatments per week, for 12 weeks, would be considered excessive by some insurance companies, although it is possible that patients diagnosed with adhesive capsulitis would see a therapist twice a month for 12 months before regaining full passive glenohumeral ROM. This study was designed and written clearly enough to be reproduced.

Summary of External Validity: This subjects in this study are similar to other patients referred to physical therapy with a diagnosis of adhesive capsulitis. There are no threats to internal validity that would compromise the ability to generalize the results of this study to the larger adhesive capsulitis population, and a fairly large sample size avoids any threats to external validity.

Synthesis/Discussion:

The methodological quality of both studies was good. The Johnson et al. study was randomized and controlled, with a PEDro score of 6/10 reflecting point losses due to a lack of subject, clinician, and assessor blinding, and the lack of an intention-to-treat analysis. The study population is representative of the typical clinical population with adhesive capsulitis, although the sample size was small (n = 20). Johnson et al. reported no significant difference in external rotation between groups at baseline (p = 0.21), and found that posterior mobilizations resulted in greater recovery of GH external rotation versus anterior mobilizations in a control group. The posterior mobilization group gained a mean of 31.3° ± 7.4° over six treatments (mean 18.5 days); this improvement is highly statistically significant ($p < 0.001$). The anterior mobilization group, conversely, expressed insignificant gains of 3.0° ± 10.8° (p = 0.40) over the same number of treatments, and a 95% CI of -4.8° to 10.8° suggests that some subjects lost ER ROM secondary to anterior mobilizations. Furthermore, the large effect size of 2.99 supports posterior mobilizations as a more beneficial treatment than anterior mobilizations for this population.

Vermeulen et al. authored a larger study of the adhesive capsulitis population (n = 100) and considered a wider scope of GH ROM outcome measures, which included flexion, abduction, and external rotation. This study was randomized and controlled, garnered a PEDro score of 8/10, reflecting a lack of subject and clinician blinding, and there were no significant differences between the HGMT and LGMT groups at baseline. Greater gains were reported in all three outcome measures in the HGMT group, but only gains in passive abduction reached a level of statistical significance (p = 0.05). The effect sizes between groups mirrored these results: the effect size was very substantial for abduction (3.1), large for flexion (1.67), and moderate/large for external rotation (0.75), indicating a clear advantage to using HGMT over LGMT for the recovery of GH range of motion.

Neither study appropriately addressed my original clinical question, which asked if mobilizations with stretching is better than stretching alone with regard to regaining GH ROM in patients diagnosed with adhesive capsulitis. These studies together, though, clarify which direction and amplitude of mobilization would be most beneficial; this understanding is crucial for establishing a strong intervention based on significant improvements (high-grade posterior mobilizations), which can be compared to stretching alone in a future study.

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