Frozen Shoulder

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Nomenclature

- Adhesive Capsulitis
- Stiff shoulder
- 오십견
- 동결견
- 유착성 관절낭염

Clinical Feature

- 2~5% of the general population
- women > men
- 40~60 years에서 호발
- Usually, idiopathic condition
- 연관질환
  - Diabetes mellitus
  - Thyroid disease
  - Inflammatory arthritis
  - Prolonged immobilization
  - Trauma
  - Cerebrovascular accident
  - Myocardial infarction
  - Autoimmune disease
  - Fibroblastic proliferation

Clinical Feature -pathophysiology

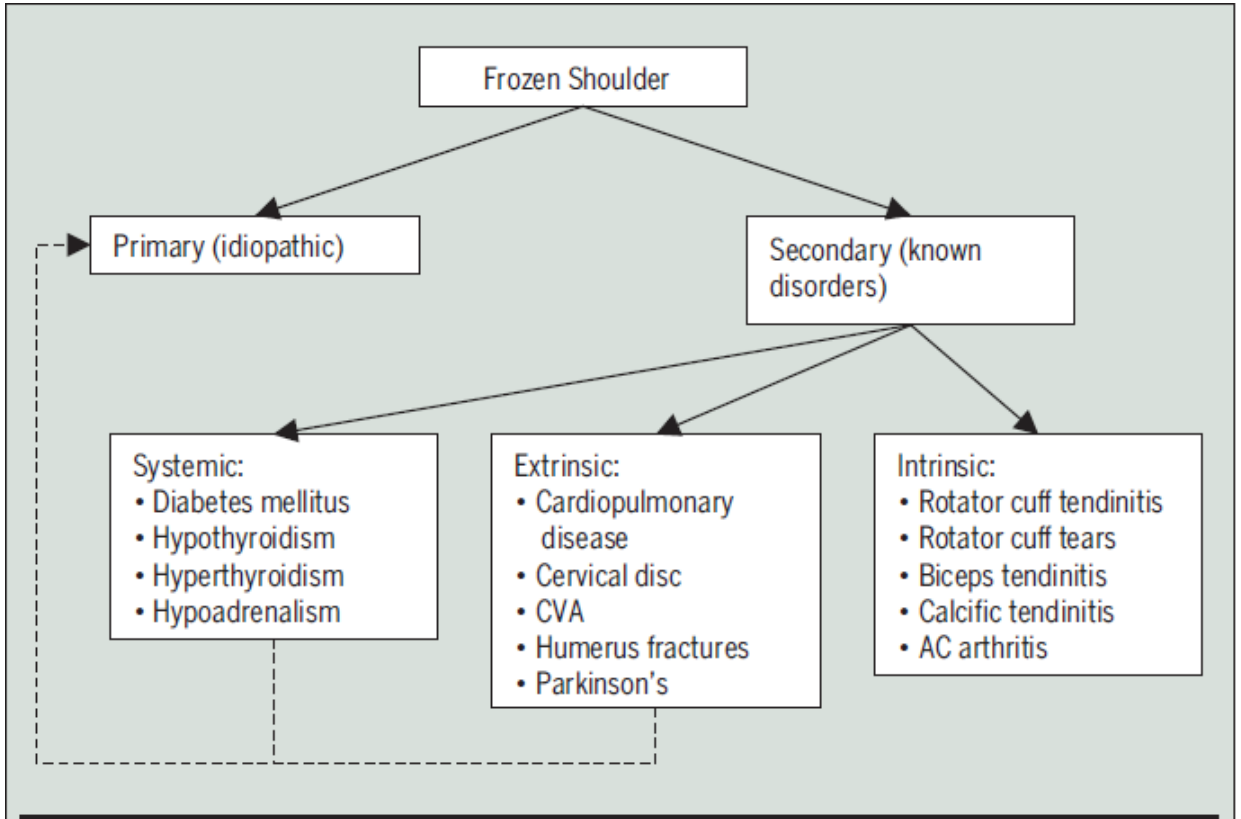


FIGURE 1. Classification system. Reprinted with permission from Coumo F. Diagnosis, classification, and management of the stiff shoulder. In Iannotti JP, Williams GR, eds. *Disorders of the Shoulder: Diagnosis and Management.* Philadelphia, PA: Lippincott, Williams & Wilkins; 1999.

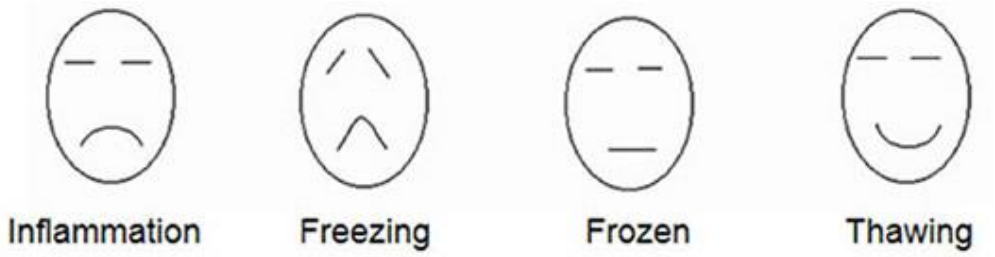
Kelley, M. J., et al. (2009). Frozen shoulder J Orthop Sports Phys Ther

Clinical Feature

- Stage 1
  - Pre-freezing stage
- Stage 2
  - Freezing stage
  - 냉동기
- Stage 3
  - Frozen stage
  - 동결기
- Stage 4
  - Thawing stage
  - 해동기

Table 38-2 Stages of Adhesive Capsulitis

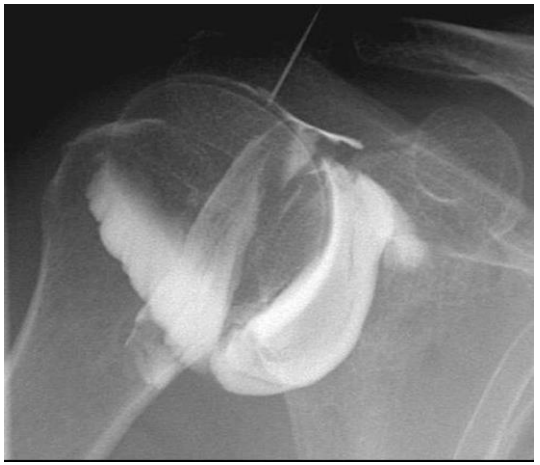
Stage	Symptom Duration	Signs and Symptoms
1	1-3 mo	Painful shoulder movement, minimal restriction in motion
2	3-9 mo	Painful shoulder movement, progressive loss of glenohumeral joint motion
3	9-15 mo	Reduced pain with shoulder movement, severely restricted glenohumeral joint motion
4	15-24 mo	Minimal pain, progressive normalization of glenohumeral joint motion



Clinical Feature

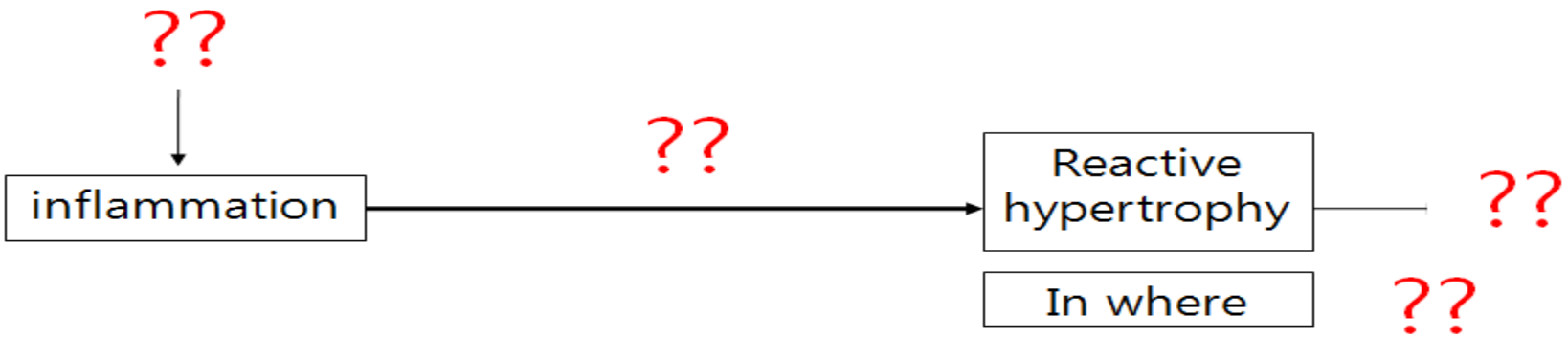
- Symptom
  - Pain and limited range of motion

- Diagnosis
  - Radiographic evaluation; normal
  - Arthrography: significant reduction in the capsular volume



Clinical Feature

- Cyriax
  - Long-standing capsular inflammation leads to fibrosis and thickening of the fibrous capsule.
  - These adhesions are mainly formed at the axilla and the anterior portion of the capsule
  - Greater loss of anterior capsular elasticity: seen clinically **more as restriction of lateral (ER)** than of medial rotation (IR) (the capsular pattern)



Treatment

- Mixed and initial non-surgical intervention
  - Intraarticular corticosteroid injection during stages 1 and 2
  - Medication
  - Closed monitored home exercise program(range of motion and shoulder girdle strengthening)
  - Manipulation of the shoulder under anesthesia
  - Hydrodilatation of the glenohumeral joint

- Surgical intervention
  - Arthroscopic capsular release
  - Open surgical release

Treatment

Table 1
Stages of frozen shoulder

Stage 1 The preadhesive stage	Stage 2 The acute adhesive or "freezing" stage	Stage 3 The fibrotic or "frozen" stage	Stage 4 The "thawing" phase
Hyper vascular synovitis with normal underlying capsule.	Decrease in hyper vascular synovitis with early adhesion formation leading to capsular contraction and thickening.	Less synovitis but more mature adhesion in the capsule and axillary fold.	Severe capsular restriction without apparent synovitis.
Patients present with mild or no end-range limitation and pain.	Patients have a high level of discomfort, limited passive and active motion, and increased pain near end-range of motion.	Patients note significant motion limitation with minimal pain.	Patients in this phase present with painless restriction of motion, which typically improves by remodeling.
Treatment Goal – decrease pain by interrupting the cycle of inflammation and pain	Treatment Goal – restore the normal glenohumeral biomechanics in addition to decreasing inflammation and pain.	Treatment goal – aggressively treat significant loss of motion and restore normal range of motion and functionality of the shoulder joint.	Treatment goal – maintain the normal range of motion and shoulder function while maintaining the normal glenohumeral biomechanics and avoiding pain and inflammation.
May last between 0–3 months.	May last between 3–9 months.	May last between 9–15 months.	May last between 15–24 months

Treatment

Stage 1 The preadhesive stage
Hyper vascular synovitis with normal underlying capsule.
Patients present with mild or no end-range limitation and pain.
Treatment Goal – decrease pain by interrupting the cycle of inflammation and pain
May last between 0–3 months.

Stage 1

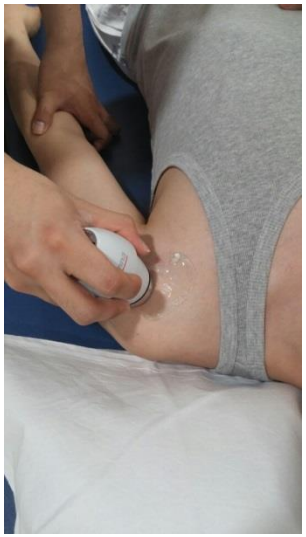
- Pain control
- Inflammation control
  - NSAID
  - Steroid Injection
  - Modality
    - Laser
    - Deep heat
    - Combined modality

Treatment

Physical Modality

- 통증 조절을 위해서 사용
- 동시에 적용
- Laser
- Combined with exercise

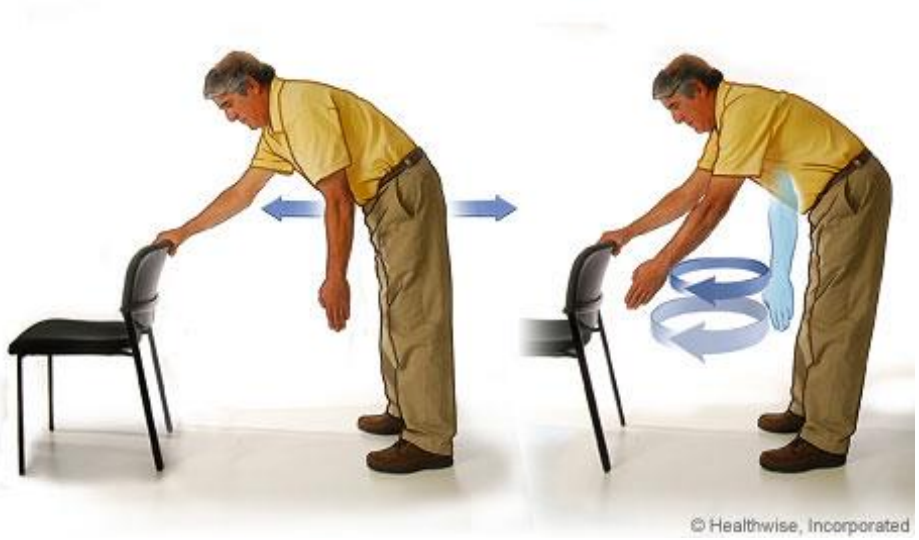


Treatment

Self Exercise (ROM)

Pendulum Exercise



Treatment

Self Exercise (ROM)

Treatment

Stage 2
The acute adhesive or "freezing" stage

Decrease in hyper vascular synovitis with early adhesion formation leading to capsular contraction and thickening.

Patients have a high level of discomfort, limited passive and active motion, and increased pain near end-range of motion.

Treatment Goal – restore the normal glenohumeral biomechanics in addition to decreasing inflammation and pain.

May last between 3–9 months.

Stage 2

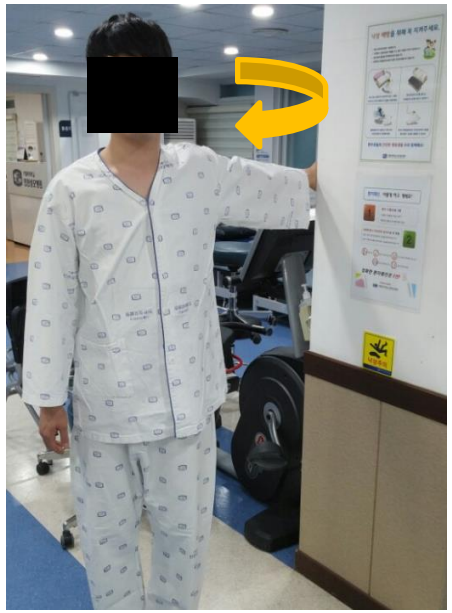
- Improved ROM and function
  - Therapeutic exercise
  - Joint mobilization

Treatment

Self Exercise (ROM)

- 통증이 없는 범위로
- 5초/15초 유지
- 10-20 회 반복

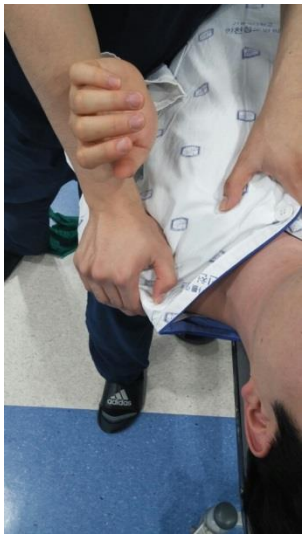


Treatment

Joint Mobilization

- Low grade
- Moderate grade (low ~ high)
- High grade (sustained hold)





Treatment

Stage 3 The fibrotic or "frozen" stage
Less synovitis but more mature adhesion in the capsule and axillary fold.
Patients note significant motion limitation with minimal pain.
Treatment goal – aggressively treat significant loss of motion and restore normal range of motion and functionality of the shoulder joint.
May last between 9–15 months.

Stage 3

- Aggressive treatment
- Restore ROM and function
  - Arthrographic distension
  - Manipulation
  - Therapeutic exercise
  - Joint mobilization

Treatment

Manipulation

- Under anesthesia
  - General or a local brachial plexus block
  - Completely relaxes the shoulder muscles
- Not responded to conservative treatment
- Potential complications
  - Fractures
  - Shoulder dislocations
  - Post-manipulation pain
  - Hemarthrosis
  - Rotator cuff tear, labral tears
  - Traction injuries of the brachial plexus or a peripheral nerve

Treatment

Stage 4
The "thawing" phase

Severe capsular restriction without apparent synovitis.

Patients in this phase present with painless restriction of motion, which typically improves by remodeling.

Treatment goal – maintain the normal range of motion and shoulder function while maintaining the normal glenohumeral biomechanics and avoiding pain and inflammation.

May last between 15–24 months

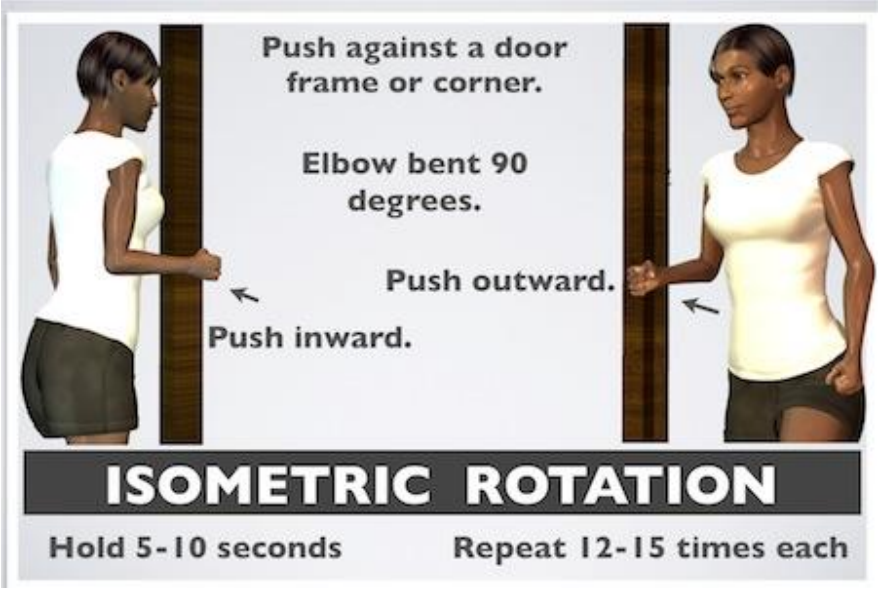
Stage 4

- Maintain ROM and function
- Avoiding pain and inflammation
  - Patient education

Treatment

Self Exercise (Strengthening Exercise)

- 등척성운동
- 벽을 이용해서
- 건측 상지를 이용해서



Treatment

Self Exercise (Strengthening Exercise)

IA Injection

- **Corticosteroid**
  - Anti-inflammatory effect on the synovium during stages 1 and 2
  - Discriminate between stages 1 and 2
    - Regain full ROM in stage 1
    - Whereas ROM of stage 2 will be unchanged or partially improved
  - Not indicated in stages 3 or 4 d/t lack of inflammatory process

Sheridan MA and Hannafin JA. Orthop Clin North Am. 2006;37:531-9

IA Steroid Injection vs PTx.

- Corticosteroid injection are more beneficial than PTx. in the short-term (around 6 to 7 weeks)

- However, this decreased over time (beyond 6 to 12 weeks), with only a small or no effect in favour of injection in the longer time

Blanchard V et al. Physiotherapy. 2010;96:95-107

IA Steroid Injection vs Distension

Treatment of "frozen shoulder" with distension and glucorticoid compared with glucorticoid alone. A randomised controlled trial

- Steroid alone (n=8) vs Distension combined with steroid (n=12)
- 1 injections per week for 6 weeks
- Outcome; VAS & ROM at 3, 6, 12 weeks

- VAS showed no difference between the treatments
- ROM in distension group showed significant improvement (ER, p=0.0007 / Flexion, p=0.03 / Extension, p=0.01)

- Distension with steroid can seem to help in management of "Frozen shoulder"

Gam AN et al. Scand J Rheumatol. 1998;27:425-30

IA Steroid Injection vs Distension

Hydrodilatation, corticosteroids and adhesive capsulitis: A randomized controlled trial

- INJ (n=39); 4 ml contrast + 2 ml triamcinolone (20 mg) + 4 ml bupivacaine
  DIL (n=37); INJ + 10 ml saline (total 20 ml) – capsule rupture
- 3 injections with 2 week intervals under fluoroscopic guidance – f/up 6 weeks after

Movement	Baseline Mean (SD)		Change Mean (SD) or Mean (95% CI)			Follow-up Mean (SD) or Mean (95% CI)		
	DIL	INJ	DIL	INJ	Group diff.	DIL	INJ	Group diff.
SPADI	59 (20)	63 (20)	*-39 (21)*	*-38 (22)*	*-1 (-11 to 9)*	20 (17)	26 (19)	-6 (-14 to 2)
Passive abduction	31 (11)	31 (11)	*14 (12)*	*14 (10)*	*-1 (-6 to 4)*	44 (12)	46 (13)	-2 (-8 to 4)
Passive forward flexion	46 (17)	48 (14)	*15 (18)*	*16 (13)*	*-1 (-8 to 6)*	61 (13)	65 (12)	-3 (-9 to 2)
Passive ext. rotation	16 (14)	19 (13)	*11 (14)*	*10 (11)*	*1 (-5 to 6)*	27 (17)	29 (16)	-2 (-10 to 5)
Passive int. rotation	32 (13)	34 (14)	*13 (10)*	*15 (12)*	*-2 (-7 to 3)*	45 (12)	48 (15)	-3 (-9 to 4)
Active abduction	55 (20)	57 (21)	*31 (30)*	*26 (33)*	*5 (-10 to 19)*	86 (34)	83 (37)	4 (-13 to 20)
Active forward flexion	89 (25)	87 (24)	*28 (31)*	*29 (28)*	*-1 (-15 to 12)*	117 (28)	116 (30)	1 (-12 to 15)
Active ext. rotation	22 (16)	23 (15)	*18 (16)*	*14 (12)*	*3 (-3 to 10)*	39 (20)	37 (17)	3 (-6 to 11)
Active int. rotation	45 (16)	46 (15)	*22 (16)*	*21 (15)*	*2 (-5 to 9)*	68 (17)	66 (18)	1 (-7 to 9)

- No significant differences between the two treatment groups

Tveitå EK et al. BMC Musculoskelet Disord. 2008;9:53

IA Steroid Injection vs MUA

Manipulation Under Anesthesia for Frozen Shoulder With and Without Steroid Injection

Duration of Symptoms	Pain Hampering Sleep (n = 24)	Pain Hampering Dressing (n = 24)
1 week after manipulation	17	10
1 month after manipulation	4	7
More than 1 but less than 3 months after manipulation	2	4
3 months or more after manipulation	1	3

	Manipulation With Steroid Injection (n = 13)			Manipulation Without Steroid Injection (n = 11)		
	Mean	SD	p	Mean	SD	p
Flexion (deg)						
Before manipulation	101	14		109	21	
1 day after manipulation	148	18		157	18	
4 months after manipulation	156	24	<.001	159	24	<.001
Abduction (deg)						
Before manipulation	83	15		85	14	
1 day after manipulation	145	17		144	18	
4 months after manipulation	147	18	<.001	150	15	<.001
Outer rotation (deg)						
Before manipulation	27	22		28	14	
1 day after manipulation	43	20		48	17	
4 months after manipulation	49	22	<.001	47	20	<.001
Inner rotation (rating 1–15)						
Before manipulation	2.5	2.0		1.6	0.9	
1 day after manipulation	3.5	1.6		4.7	3.6	
4 months after manipulation	5.9	3.8	<.001	8.4	4.1	<.001

- MUA with steroid injection did not enhance the effect of the manipulation

Kivimäki J et al. Arch Phys Med Rehabil. 2001;82:1188-90

Dosage of Steroid Injection

Intra-articular triamcinolone acetonide injection in patients with capsulitis of the shoulder: a comparative study of two dose regimens

- 10 mg (n=32) vs 40 mg (n=25)
- 3 injections performed (1st – 1 wk – 2nd – 2 wks – 3rd) under blind approach

	Improvement from baseline (SD)			
	10 mg	40 mg	Difference in favour of 40 mg	Significance of difference
Pain expressed in VAS scales	31.2 (49.3)	49.3 (21.3)	18.1	(p <0.01)[a]
Disturbance of sleep[b]	1.7 (0.7)	1.7 (0.8)	–0.003	NS
Functional impairment[b]	0.7 (0.8)	1.3 (0.9)	0.54	(p = 0.03)[a]
Movement restriction[b]	0.7 (0.8)	1.1 (0.7)	0.5	(p = 0.04)[a]

- Greater symptom relief is obtained with a dose of 40 mg triamcinolone IAI than 10 mg

de Jong BA et al. Clin Rehabil. 1998;12:211-5

IA Hyaluronic Acid Injection

Intraarticular injection of sodium hyaluronate plus steroid versus steroid in adhesive capsulitis of the shoulder

- HA (n=15); HA 20 mg + triamcinolone 20 mg + PTx.
  control (n=15); triamcinolone 20 mg + PTx.
- Monthly injections for 6 months / PTx. was performed 4-12 weeks

- Improvement of pain & ROM after 6 months, especially HA group
- IA HA combined with triamcinolone and PTx. may improve adhesive capsulitis

Rovetta G et al. Int J Tissue React. 1998;20:125-30

IA Hyaluronic Acid Injection

Addition of Intra-articular Hyaluronate Injection to Physical Therapy Program Produces No Extra Benefits in Patients With Adhesive Capsulitis of the Shoulder: A Randomized Controlled Trial

- HAPT (n=32); HA 20 mg, once for week for 3 weeks, PTx. for 3 months
  PT (n=31); PTx. alone

Scores on Questionnaires	Group	
SDQ score		
	PT	6
	HAPT	6
SPADI score		
Pain	PT	5
	HAPT	5
Disability	PT	4
	HAPT	4
Total	PT	4
	HAPT	5

NOTE. Values are mean ± SD or
*P values for within-group compa
†P values for between-group com
‡P values for time and group inte

Subitem Scores on SF-36	Group	Evaluation Time: Pretreatment	Evaluation Time: 1.5mo of Teatment	Evaluation Time: 3mo of Treatment	Time Effects P*	Group Effects P†	Time and Group Interactions P‡
Physical functioning	PT	72.26±15.59	74.68±20.33	79.68±16.93	<.001	.83	.99
	HAPT	71.25±20.32	73.91±17.40	78.91±14.96	<.001		
Role-physical	PT	33.06±42.03	44.35±41.69	57.10±42.23	<.001	.74	.54
	HAPT	25.00±37.57	40.63±40.54	60.31±41.46	<.001		
Bodily pain	PT	50.42±16.23	61.42±18.27	67.42±16.78	<.001	.33	.33
	HAPT	47.63±18.93	54.16±19.42	65.28±21.11	<.001		
General health	PT	62.45±17.85	51.81±14.82	65.68±19.75	<.001	.56	.77
	HAPT	61.31±24.98	48.19±20.41	62.47±20.76	<.001		
Vitality	PT	63.23±18.69	62.10±15.53	65.81±12.85	<.05	.41	.78
	HAPT	58.91±18.17	59.69±15.91	63.44±15.58	<.05		
Social functioning	PT	74.19±20.40	81.05±18.22	84.10±15.12	<.05	.24	.38
	HAPT	71.88±22.45	74.22±23.75	76.56±22.68	<.05		
Role-emotional	PT	65.59±44.29	69.89±39.77	81.45±33.57	<.001	.28	.36
	HAPT	47.92±44.75	62.50±46.95	79.16±37.64	<.001		
Mental health	PT	67.48±17.82	70.32±16.32	71.97±17.05	<.05	.28	.76
	HAPT	63.75±19.22	64.63±17.66	67.81±17.49	<.05		

- IA HA injection did not produce added benefits who were already receiving PTx.

Hsieh LF et al. Arch Phys Med Rehabil. 2012;93:957-64

IA Steroid or HA Injection

[Primary Care]

Glenohumeral Joint Injections: A Review

Clinical Recommendation	SORT Evidence Rating
Intra-articular corticosteroid injections may be helpful for reducing symptoms in glenohumeral arthritis.[38,54]	C
Intra-articular corticosteroid injections are helpful for reducing symptoms in adhesive capsulitis.[4,8,18,24,48,57]	B
Intra-articular HA injections may be helpful for reducing symptoms in glenohumeral arthritis and adhesive capsulitis.[7,11,27,38,43,49,50,53]	C

Gross C et al. Sports Health. 2013;5:153-9

Distension c or s Steroid

Intra-articular distension and steroids in the management of capsulitis of the shoulder

- Distension only (n=14); bupivacaine 6 ml + 3 ml air (total 9 ml)
  Steroid only (n=15); 40 mg triamcinolone 1 ml (total 1 ml)
  Steroid & distension (n=18); bupivacaine + air + triamcinolone (total 10 ml)

Grade		No of patients	
0	Non		
1	Slig		
2	Afte		
3	Mod		
4	Mar		
5	Seve		
0	Non		
1	Mild (slight ache)	24	4
2	Moderate (no pain inhibition)	4	4
3	Severe (pain inhibition)	4	0

Movement	Improvement in work done over 16 weeks (J/week (95% confidence interval))				
	Distension only	Steroid only	Steroid and distension	*F* value	p Value
Abduction	0·4 (0·1 to 0·7)	0·8 (0·4 to 1·2)	0·9 (0·6 to 1·7)	1·92	>0·05
Flexion	0·7 (0·3 to 1·1)	1·0 (0·4 to 1·6)	0·9 (0·5 to 1·4)	0·56	>0·05

Movement
Abduction
Flexion
External rot

- Intra-articular steroid injections have a useful role in the outpatient management of early capsulitis

Jacobs LG et al. BMJ. 1991;302:1498-501

Distension Therapy

- **Amount of fluid?**
  - 2 ml (Carette 2003)
  - 10 ml (Jacobs 1991, Ibrahim 2006)
  - 20 ml (Corbeil 1992, Gam 1998, Khan 2005)
  - 25 ml (Park 2000) - 35 ml (Kim 2008)
  - 21-80 ml (Buchbinder 2004) (until capsule rupture)
  - Until full distension of subscapular bursa or rupture down the long head of biceps sheath (Lyn 2007)
- **Capsular state?**
  - Preserved or ruptured?

경청해 주셔서 감사합니다.