SUPRAPECTORAL VS SUBPECTORAL BICEPS TENODESIS

A SYSTEMATIC REVIEW & META-ANALYSIS OF COMPARATIVE STUDIES

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DISCLOSURES

- None to declare by all the authors

INTRODUCTION

- Non-operative treatment is the primary modality for pathologies involving long head of biceps tendon.
- Tenotomy is done for resistant cases in elderly patients[1,2].
- Tenodesis also shows encouraging results with lower complication rates as per literature[3].
- Biceps tenodesis technique can be performed open or arthroscopic and can be done via subpectoral or suprapectoral [4,5].
- The purpose of this meta-analysis is to critically analyse subpectoral versus suptapectoral method of bicesps tenodesis.

MATERIAL AND METHODS:

- This systematic review followed the preferred Reporting Items for Systemic Review and Meta-Analysis (PRISMA) guidelines.
- Primary electronic search was conducted on MEDLINE, Scopus , and Cochrane Library data bases for published literature from year of inception to August 2024.
- Primary outcomes of interest were American shoulder and elbow society (ASES) score, constant score, UCLA score, VAS, and complications.
- Secondary outcomes of interest was shoulder range of motion.

INCLUSION CRITERIA:

- Any prospective or retrospective English studies that evaluated the outcomes of sub pectoral versus suprapectoral were included.
- This involved randomized or non-randomized trials, case control or cohort studies.

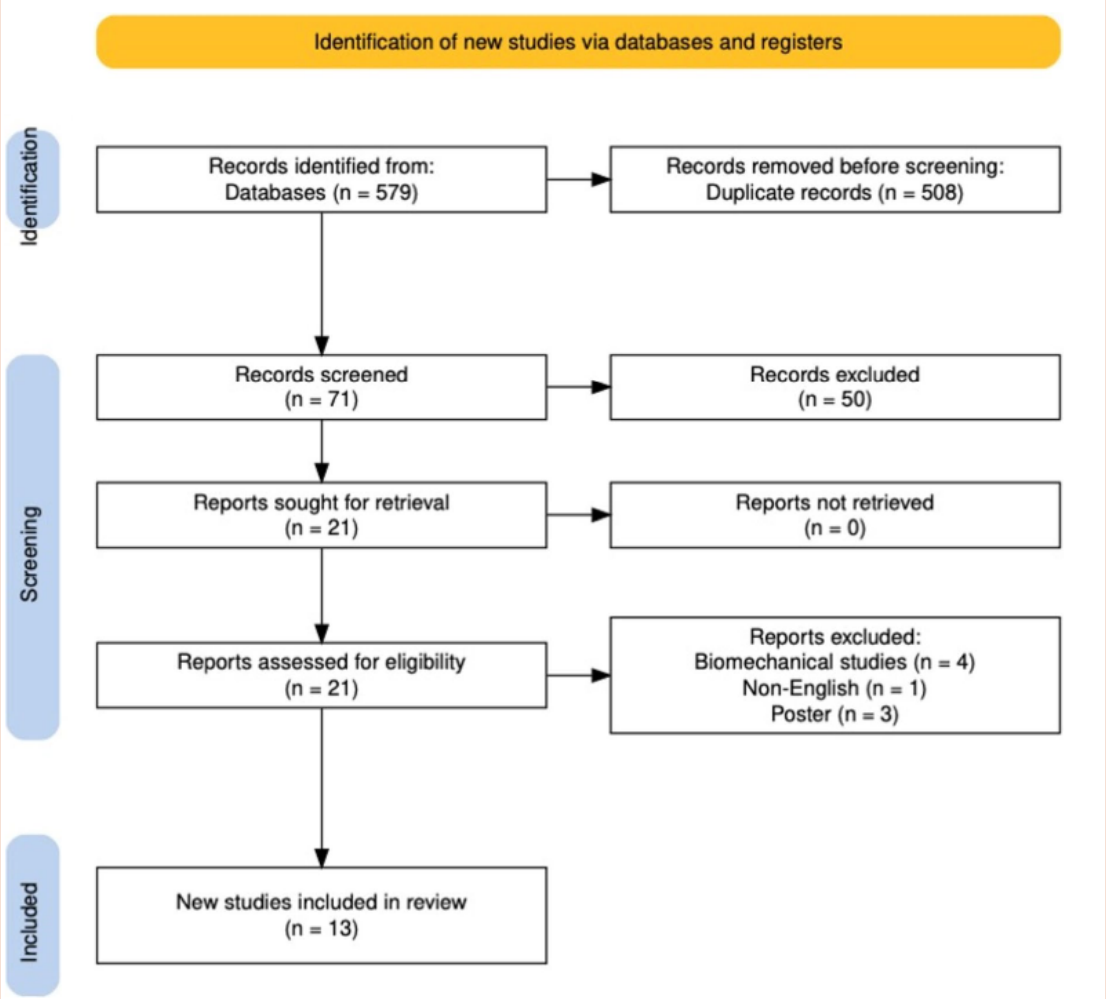
EXCLUSION CRITERIA:

- Case reports, conference abstracts, e-posters, book chapters, review articles, tips and trics, animal studies, and articles not in English were excluded.

STATISTICAL ANALYSIS:

- The statistical analysis used Review Manager Software version 5.4 (the Cochrane Collaboration, 2020).
- Mean difference was used for continuous variables to describe the measure of treatment effects and odd's ratio war dichotomous variables.
- Statistical heterogeneity was evaluated by the I square test.
- A fixed effect model was used if the value of I2 was <50% and random effect model was used for values >50%.

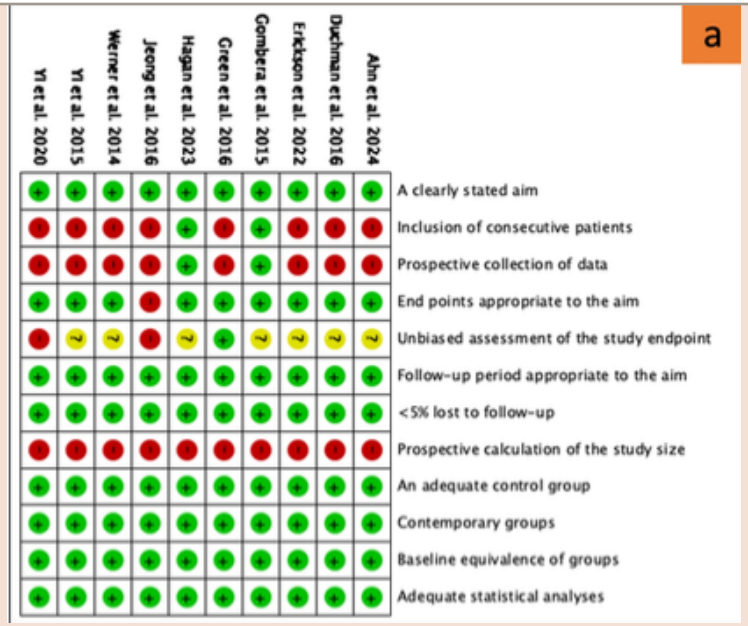
PRIMSA flowchart of literature retrieval and selection



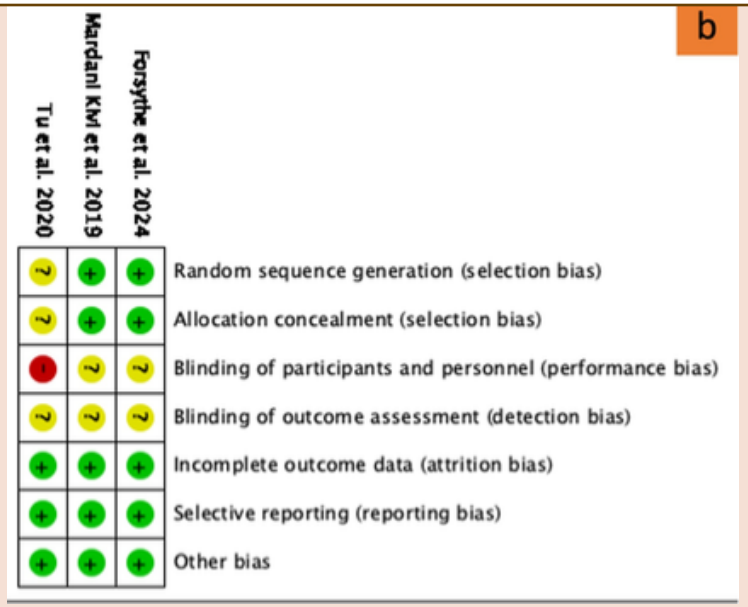
Literature search strategy

Database	Period -from period of inception to 4th August 2024 with keywords	Results
PubMed	((Suprapectoral) AND (Subpectoral)) AND (Biceps Tenodesis) "Suprapectoral"[All Fields] AND ("subpectoral"[All Fields] OR "subpectorally"[All Fields]) AND (("bicep"[All Fields] OR "biceps"[All Fields]) AND ("tenodesed"[All Fields] OR "tenodesing"[All Fields] OR "tenodesis"[MeSH Terms] OR "tenodesis"[All Fields] OR "tenodeses"[All Fields]))	54
Embase	suprapectoral AND subpectoral AND biceps AND tenodesis	86
Scopus	(ALL (suprapectoral) AND ALL (subpectoral) AND ALL (biceps AND tenodesis))	427
Cochrane Library	Suprapectoral in Title Abstract Keyword AND Subpectoral in Title Abstract Keyword AND Biceps Tenodesis in Title Abstract Keyword—(Word variations have been searched)	12
Total		579

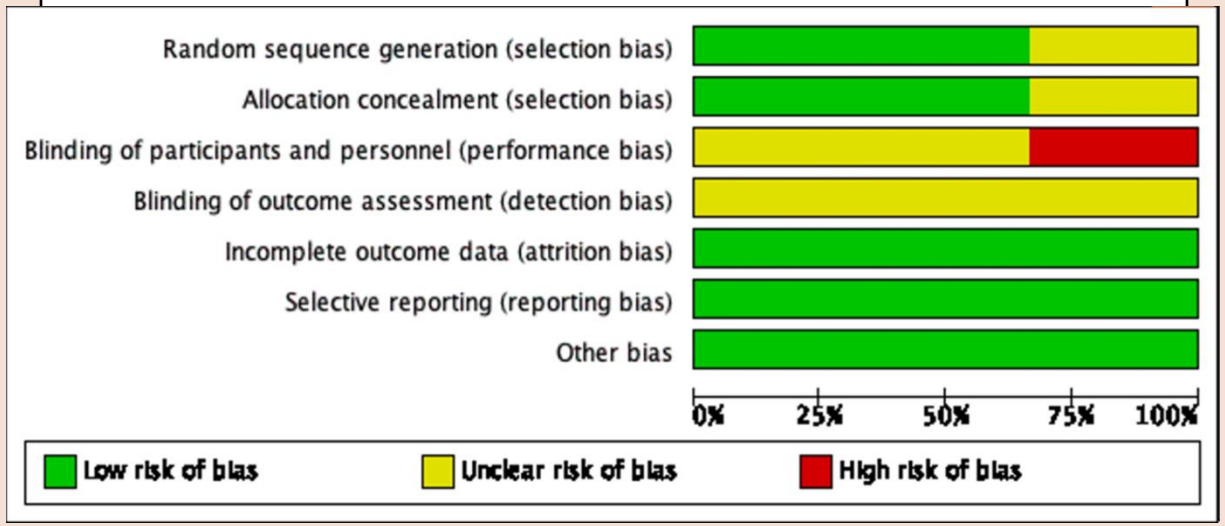
MINORS tool assessment used for non-randomized studies



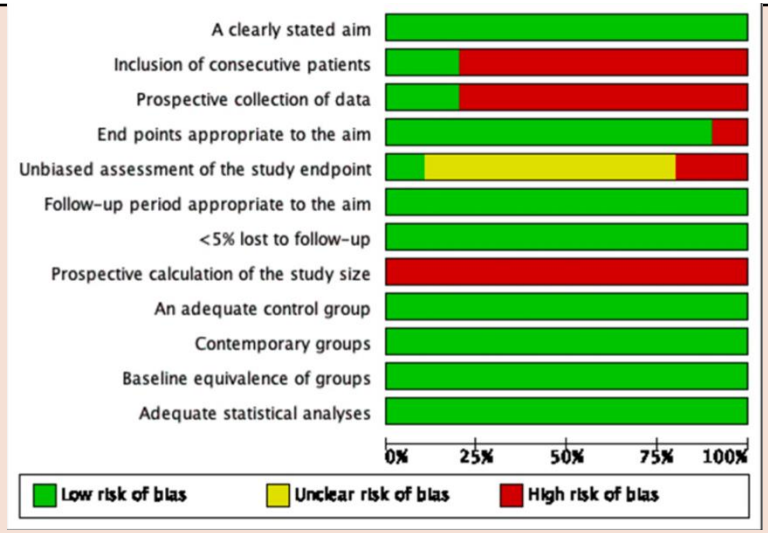
Cochrane Collaborations risk of bias tool for randomized controlled trials



Risk of bias graph : RCT's



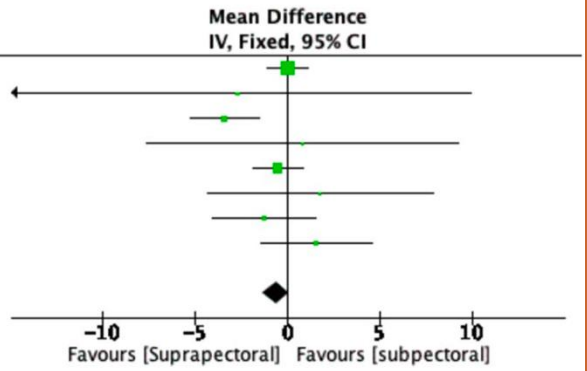
RISK OF BIAS GRAPH : RCT'S



RESULTS : META-ANALYSIS

Study or Subgroup	Suprapectoral Mean	SD	Total	Subpectoral Mean	SD	Total	Weight	Mean Difference IV, Fixed, 95% CI
Ahn et al. 2024	98.5	2.2	33	98.5	2.7	39	41.4%	0.00 [-1.13, 1.13]
Duchman et al. 2016	79.6	22.3	20	82.3	20.4	25	0.3%	-2.70 [-15.33, 9.93]
Gombera et al. 2015	88.96	3.4	23	92.36	3.2	23	14.6%	-3.40 [-5.31, -1.49]
Green et al. 2016	91.4	13.9	15	90.6	11.4	23	0.7%	0.80 [-7.64, 9.24]
Tu et al. 2020	88.51	3.42	55	89.05	4.02	62	29.2%	-0.54 [-1.89, 0.81]
Werner et al. 2014	90.16	13.6	27	88.4	10	35	1.4%	1.76 [-4.35, 7.87]
Yi et al. 2015	84.71	5.45	34	85.97	6.19	32	6.7%	-1.26 [-4.08, 1.56]
Yi et al. 2020	87.69	5.27	36	86.13	7.58	35	5.7%	1.56 [-1.48, 4.60]
Total (95% CI)			243			274	100.0%	-0.63 [-1.35, 0.10]

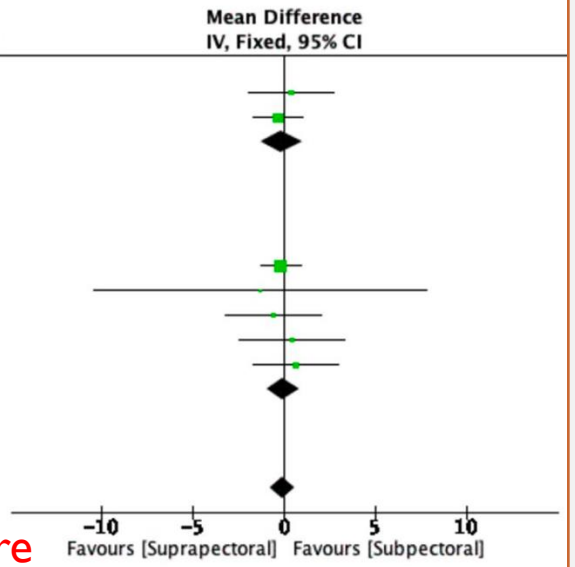
Heterogeneity: Chi² = 12.28, df = 7 (P = 0.09); I² = 43%
Test for overall effect: Z = 1.68 (P = 0.09)



ASES

NO statistically significant difference between the two groups (P = 0.09).

Study or Subgroup	Suprapectoral Mean	SD	Total	Subpectoral Mean	SD	Total	Weight	Mean Difference IV, Fixed, 95% CI
2.1.1 RCT								
Mardani Kivi et al. 2019	93.1	3.9	30	92.7	5.2	30	9.4%	0.40 [-1.93, 2.73]
Tu et al. 2020	90.38	3.14	55	90.71	4.29	62	27.7%	-0.33 [-1.68, 1.02]
Subtotal (95% CI)			85			92	37.1%	-0.15 [-1.31, 1.02]
Heterogeneity: Chi² = 0.28, df = 1 (P = 0.59); I² = 0%								
Test for overall effect: Z = 0.24 (P = 0.81)								
2.1.2 Non-RCT								
Ahn et al. 2024	98.23	2.3	33	98.4	2.6	39	39.6%	-0.17 [-1.30, 0.96]
Duchman et al. 2016	86.7	11.1	20	88	19.7	25	0.6%	-1.30 [-10.43, 7.83]
Jeong et al. 2016	85.9	6.1	33	86.5	5.3	39	7.1%	-0.60 [-3.26, 2.06]
Yi et al. 2015	86.38	5.74	34	85.97	6.19	32	6.1%	0.41 [-2.47, 3.29]
Yi et al. 2020	89.14	5.37	36	88.49	4.55	35	9.5%	0.65 [-1.66, 2.96]
Subtotal (95% CI)			156			170	62.9%	-0.05 [-0.95, 0.85]
Heterogeneity: Chi² = 0.73, df = 4 (P = 0.95); I² = 0%								
Test for overall effect: Z = 0.11 (P = 0.91)								
Total (95% CI)			241			262	100.0%	-0.09 [-0.80, 0.63]
Heterogeneity: Chi² = 1.03, df = 6 (P = 0.98); I² = 0%								
Test for overall effect: Z = 0.24 (P = 0.81)								
Test for subgroup differences: Chi² = 0.02, df = 1 (P = 0.90), I² = 0%								

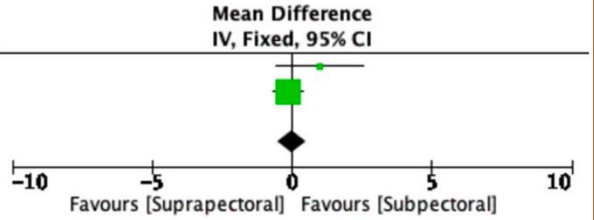


Constant Score

NO statistically significant difference among studies in the RCTs [P=0.81], nor among those in the non-RCTs [P=0.91]

Study or Subgroup	Suprapectoral Mean	SD	Total	Subpectoral Mean	SD	Total	Weight	Mean Difference IV, Fixed, 95% CI
Jeong et al. 2016	31.5	3.1	33	30.5	3.6	39	10.8%	1.00 [-0.55, 2.55]
Yi et al. 2020	33.41	1.24	36	33.54	1.07	35	89.2%	-0.13 [-0.67, 0.41]
Total (95% CI)			69			74	100.0%	-0.01 [-0.52, 0.50]

Heterogeneity: Chi² = 1.83, df = 1 (P = 0.18); I² = 45%
Test for overall effect: Z = 0.03 (P = 0.98)



UCLA

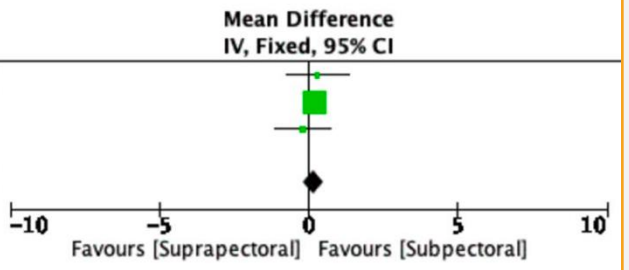
Comparable outcome for the two groups with MD of 0.01 [P=0.98]

RESULTS : META-ANALYSIS

Study or Subgroup	Suprapectoral Mean	SD	Total	Subpectoral Mean	SD	Total	Weight	Mean Difference IV, Fixed, 95% CI
Duchman et al. 2016	11.1	1.4	20	10.8	2.2	25	9.9%	0.30 [−0.76, 1.36]
Mardani Kivi et al. 2019	11.5	0.7	30	11.3	0.8	30	76.9%	0.20 [−0.18, 0.58]
Werner et al. 2014	10.46	2.1	27	10.66	1.4	35	13.2%	−0.20 [−1.12, 0.72]
Total (95% CI)			77			90	100.0%	0.16 [−0.18, 0.49]

Heterogeneity: Chi² = 0.70, df = 2 (P = 0.70); I² = 0%
Test for overall effect: Z = 0.92 (P = 0.36)

SST

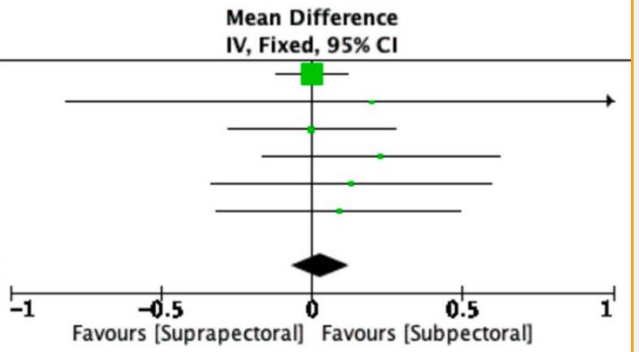


Comparable outcome score for the two groups [P= 0.36]

Study or Subgroup	Suprapectoral Mean	SD	Total	Subpectoral Mean	SD	Total	Weight	Mean Difference IV, Fixed, 95% CI
Ahn et al. 2024	0.1	0.2	33	0.1	0.3	39	70.5%	0.00 [−0.12, 0.12]
Green et al. 2016	0.9	1.8	15	0.7	1.1	23	0.9%	0.20 [−0.82, 1.22]
Mardani Kivi et al. 2019	0.4	0.6	30	0.4	0.5	30	12.2%	0.00 [−0.28, 0.28]
Tu et al. 2020	1.18	1.36	55	0.95	0.65	62	6.1%	0.23 [−0.16, 0.62]
Yi et al. 2015	2.38	0.98	34	2.25	0.95	32	4.4%	0.13 [−0.34, 0.60]
Yi et al. 2020	2.13	0.91	36	2.04	0.83	35	5.8%	0.09 [−0.31, 0.49]
Total (95% CI)			203			221	100.0%	0.03 [−0.07, 0.12]

Heterogeneity: Chi² = 1.65, df = 5 (P = 0.89); I² = 0%
Test for overall effect: Z = 0.54 (P = 0.59)

VAS

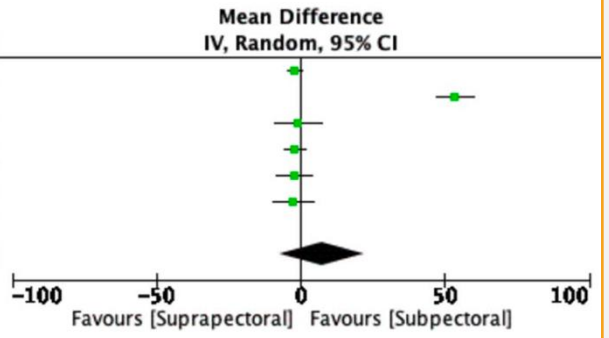


NO significant difference between the two groups [P=0.59]

Study or Subgroup	Suprapectoral Mean	SD	Total	Subpectoral Mean	SD	Total	Weight	Mean Difference IV, Random, 95% CI
Ahn et al. 2024	175.2	5.7	33	177.4	5	39	17.1%	−2.20 [−4.70, 0.30]
Duchman et al. 2016	171.3	11.7	20	117.8	9.3	25	16.6%	53.50 [47.21, 59.79]
Green et al. 2016	168.2	11	15	169.2	14.9	23	16.3%	−1.00 [−9.25, 7.25]
Werner et al. 2014	95.96	9.4	27	98.16	3.6	35	17.0%	−2.20 [−5.94, 1.54]
Yi et al. 2015	165.5	13.3	34	167.8	13.4	32	16.6%	−2.30 [−8.75, 4.15]
Yi et al. 2020	157.63	15.81	36	160.24	13.94	35	16.5%	−2.61 [−9.54, 4.32]
Total (95% CI)			165			189	100.0%	7.17 [−7.61, 21.95]

Heterogeneity: Tau² = 331.73; Chi² = 276.92, df = 5 (P < 0.00001); I² = 98%
Test for overall effect: Z = 0.95 (P = 0.34)

Forward Flexion

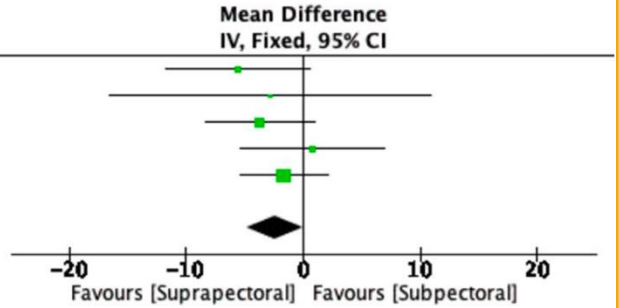


NO statistically significant difference between the two methods of tenodesis with [P=0.34]

Study or Subgroup	Suprapectoral Mean	SD	Total	Subpectoral Mean	SD	Total	Weight	Mean Difference IV, Fixed, 95% CI
Duchman et al. 2016	171.8	11.4	20	177.4	9.3	25	15.2%	−5.60 [−11.78, 0.58]
Green et al. 2016	158.9	20	15	161.7	22.6	23	3.1%	−2.80 [−16.50, 10.90]
Werner et al. 2014	94.46	12.1	27	98.16	3.2	35	26.4%	−3.70 [−8.39, 0.99]
Yi et al. 2015	170.3	12.2	34	169.5	13.4	32	15.1%	0.80 [−5.39, 6.99]
Yi et al. 2020	168.53	7.98	36	170.17	8.32	35	40.3%	−1.64 [−5.43, 2.15]
Total (95% CI)			132			150	100.0%	−2.45 [−4.86, −0.04]

Heterogeneity: Chi² = 2.50, df = 4 (P = 0.64); I² = 0%
Test for overall effect: Z = 2.00 (P = 0.05)

Abduction



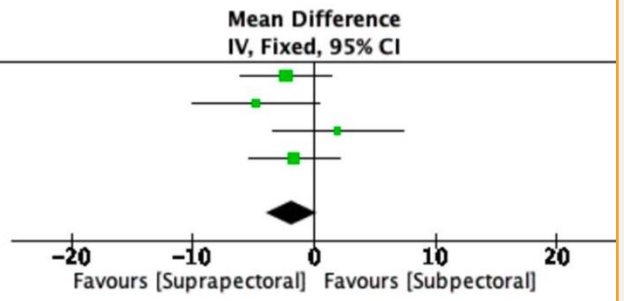
equivocal results between the two methods of tenotomy with [P=0.05]

RESULTS : META-ANALYSIS

Study or Subgroup	Suprapectoral Mean	SD	Total	Subpectoral Mean	SD	Total	Weight	Mean Difference IV, Fixed, 95% CI
Ahn et al. 2024	73.6	7.8	33	75.9	8.5	39	33.2%	−2.30 [−6.07, 1.47]
Werner et al. 2014	94.66	10.7	27	99.46	9.9	35	17.4%	−4.80 [−10.00, 0.40]
Yi et al. 2015	61.62	11	34	59.69	11.3	32	16.3%	1.93 [−3.46, 7.32]
Yi et al. 2020	58.32	11.41	36	59.96	1.85	35	33.1%	−1.64 [−5.42, 2.14]
Total (95% CI)			130			141	100.0%	−1.83 [−4.00, 0.34]

Heterogeneity: Chi² = 3.20, df = 3 (P = 0.36); I² = 6%
Test for overall effect: Z = 1.65 (P = 0.10)

External rotation

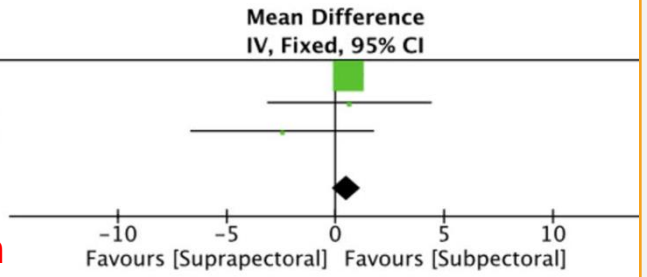


NO difference between the two methods of tenotomy [P=0.10]

Study or Subgroup	Suprapectoral Mean	SD	Total	Subpectoral Mean	SD	Total	Weight	Mean Difference IV, Fixed, 95% CI
Ahn et al. 2024	8.9	1.6	33	8.3	1.3	39	94.5%	0.60 [−0.08, 1.28]
Werner et al. 2014	95.2	7.8	27	94.56	7.2	35	3.1%	0.64 [−3.15, 4.43]
Yi et al. 2020	54.26	9.45	36	56.71	8.73	35	2.5%	−2.45 [−6.68, 1.78]
Total (95% CI)			96			109	100.0%	0.53 [−0.14, 1.19]

Heterogeneity: Chi² = 1.95, df = 2 (P = 0.38); I² = 0%
Test for overall effect: Z = 1.56 (P = 0.12)

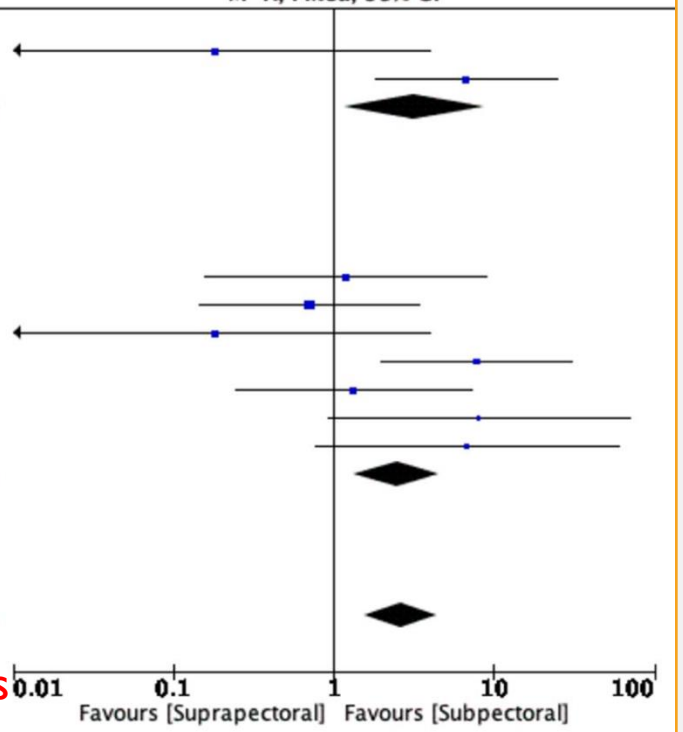
Internal rotation



Equivocal results between the two methods of tenotomy with [P=0.12]

Study or Subgroup	Suprapectoral Events	Total	Subpectoral Events	Total	Weight	Odds Ratio M-H, Fixed, 95% CI
10.1.1 RCT						
Forsythe et al. 2024	0	37	2	36	13.7%	0.18 [0.01, 3.97]
Tu et al. 2020	14	55	3	62	11.6%	6.72 [1.81, 24.87]
Subtotal (95% CI)		92		98	25.3%	3.17 [1.16, 8.65]
Total events	14		5			
Heterogeneity: Chi² = 4.56, df = 1 (P = 0.03); I² = 78%						
Test for overall effect: Z = 2.25 (P = 0.02)						
10.1.2 Non-RCT						
Ahn et al. 2024	2	33	2	39	9.5%	1.19 [0.16, 8.97]
Duchman et al. 2016	3	20	5	25	20.8%	0.71 [0.15, 3.40]
Gombera et al. 2015	0	23	2	23	13.4%	0.18 [0.01, 4.03]
Jeong et al. 2016	13	33	3	39	9.2%	7.80 [1.98, 30.67]
Werner et al. 2014	3	27	3	35	12.8%	1.33 [0.25, 7.19]
Yi et al. 2015	7	34	1	32	4.5%	8.04 [0.93, 69.54]
Yi et al. 2020	6	36	1	35	4.6%	6.80 [0.77, 59.75]
Subtotal (95% CI)		206		228	74.7%	2.47 [1.34, 4.55]
Total events	34		17			
Heterogeneity: Chi² = 10.87, df = 6 (P = 0.09); I² = 45%						
Test for overall effect: Z = 2.90 (P = 0.004)						
Total (95% CI)		298		326	100.0%	2.65 [1.57, 4.45]
Total events	48		22			
Heterogeneity: Chi² = 15.80, df = 8 (P = 0.05); I² = 49%						
Test for overall effect: Z = 3.66 (P = 0.0002)						
Test for subgroup differences: Chi² = 0.17, df = 1 (P = 0.68), I² = 0%						

Complications



Statistically significant fewer complications were noted in subpectoral tenodesis as compared to suprapectoral tenodesis [P= 0.0002]

DISCUSSION:

No statistically significant difference between the two techniques in terms of functional scores and ROM.

The studies reported improvement in all the scores in both groups, when comparison was done between preoperative and postoperative values.

Suprapectoral tenodesis patients had higher complication rates as compared to subpectoral tenodesis.

The common complications reported by the authors:

Anterior shoulder pain, cramping pain in anterior arm, popeye deformity due to excessive bulging of biceps belly on elbow flexion, postoperative stiffness, or implant failure.

CONCLUSION:

Both the techniques of biceps tenodesis have show comparable functional outcomes in most of trials.

Suprapectoral tenodesis was found to be associated with higher rate of complications on performing meta-analysis.

Hence, it is advisable to choose subpectoral tenodesis, as and when possible.

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