

SCAPULOTHORACIC ORTHOTIC INTERVENTION IN SCAPULAR WINGING

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Clinical Question: What functional level of rehabilitation can be restored in patients with scapular winging using a scapulothoracic orthosis comparable to their baseline?

Background: Scapular winging can be caused by a number of etiologies which affect the serratus anterior muscle including long thoracic nerve paralysis, radiculopathy, myelopathic and neuralgic amyotrophy.^{1,2,3} The treatment of scapular winging often involves treating the inflammatory and pain symptoms along with physical rehabilitation and bracing. Surgical intervention is used in cases of persistent and painful scapular winging.^{4,5} Orthotists and Physiatrists have been using bracing effectively in the treatment of scapular winging since 1937⁵ but clear evidence of what level of functional range of motion can be restored has resulted in mixed outcomes.

Search Strategy: Papers were selected based on repeatable outcome measures and consistent direct bracing technique against the scapula as a form of orthotic intervention. A baseline stat for ROM/MMT must have been taken by the paper's authors to compare their pre-intervention and post-orthotic interventions.

Databases Searched: The following data bases were searched JPO Online Library, PubMed, Ovid

Search Terms: "Scapulothoracic brace, Scapulothoracic orthosis, Scapular winging brace, Scapular winging orthosis"

Exclusion Criteria: Non-standardized outcome reporting, non-specific orthosis design, any study without a baseline measurement comparing orthosis use.

Inclusion Criteria: Date range 1990-2021, English Language or English Translated, Reported functional AROM as an outcome measure, Brace Design (direct contact scapulothoracic orthosis)

Synthesis of Results: Based on the current and past work relating to scapulothoracic bracing of scapular winging, we can determine that orthotic treatment can increase active range of motion and increase muscle strength while in-orthosis. Improvement varies within and out-of-orthosis over time. Acute or chronic status of scapular winging has to do with long term outcomes following orthotic and rehabilitative intervention. The results from current literature imply that an increase of 71-187% may occur from baseline AROM while using the orthosis after at least 4 weeks of using the device.¹⁻⁵ An increase of 1 grade of MMT may be seen in-orthosis as well, with the maximum functional rehabilitation being complete restoration of muscle strength in certain acute cases.^{1,3,4,5}

Clinical Message: The clinical implications of orthotic intervention relating to restoration of active range of motion are a mixed result. Working with a rehabilitation team to brace acute scapular winging etiologies early in diagnosis can result in a better prognosis. Chronic symptoms, while able to be improved by a brace, still show clinical indications for needing surgical intervention. The optimal bracing strategy across studies is not clearly defined, though it is indicated that limitation of painful scapular winging should be primarily the goal of any orthosis. Across studies which reported dominant extremity which suffered from scapular winging, the dominant limb is affected most. Delay of bracing less than six months did not affect pain levels of patients as compared to those who received orthotic treatment after six months; additionally delay of orthotic intervention did not impact ROM significantly in chronic symptoms. Often the strongest or most controlling device has been preferred from patient reported subjective responses. Orthotic intervention can be seen as an evidence-based method of treatment when approaching scapular winging in both acute and chronic cases, and benefit from rehabilitation while using orthosis.

References:

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2. Georgarakis AM, Xiloyannis M, Dettmers C, Joeleges M, Wolf P, Riener R. Reaching higher: External scapula assistance can improve upper limb function in humans with irreversible scapula alata. *Journal of Neuroengineering and Rehabilitation*. Sep 3 2021;18(1):131.
3. Marin R. Scapula winger's brace: a case series on the management of long thoracic nerve palsy. *Arch Phys Med Rehabil*. Oct 1998;79(10):1226-1230.
4. McGovern D, Rahman S, Lavezzo M, Dozier L. Case Report: Scapulothoracic Orthosis for Winging Scapula. *JPO: Journal of Prosthetics and Orthotics*. 2008;20(1):14-18.
5. Vastamäki M, Pikkarainen V, Vastamäki H, Ristolainen L. Scapular Bracing is Effective in Some Patients but Symptoms Persist in Many Despite Bracing. *Clinical orthopaedics and related research*. Aug 2015;473(8):2650-2657.

Evidence Table

	Alsancak, 2001 ¹	Georgarakis, 2021 ²	Marin, 1998 ³	McGovern, 2008 ⁴	Vastamäki, 2015 ⁵
Population	20 year old male with bilateralfascio-scapulo-humeral dystrophy (FSHD) leading to bilateral scapular winging	8 patients with Scapular dyskinesis diagnoses: FSHD, necrotizing myositis (MYOS), or calpainopathy, (CALP)	14 patients from December 1994 to September 1997 presenting to military clinic with at least 3 months of diagnosed long thoracic nerve palsy	30 year old male with serratus anterior palsy presenting with unilateral right scapular winging	110 patients from 1980 to 1999 ranging from ages 15-52 years all with at least 3cm of winging present due to acute serratus palsy
Study Design	Case Study	Randomized Controlled Crossover Trial	Case Series	Case Study	Longitudinal Study/Retroactive Chart Analysis with minimum 10 year follow up
Intervention	Custom Scapulothoracic Orthoses STFO, JO, CO, MO.	3 layer orthosis with rigid thermoplastic custom molded to patient shape, non-elastic textile harness, and outer carbon plate reinforcement with cable boa pulley system	Custom “scapular winger’s brace” which uses a figure 8 design with scapular pad which added pressure with contralateral protraction	Custom carbon fiber scapulothoracic brace with derotational strap alignment	Custom Scapulothoracic Orthosis 2 strap design
Comparison	ROM/MMT with and without orthotic intervention compared to baseline with 4 different designs	Three objective scapular support conditions “none” “therapist” and “orthosis” intervention with a range of motion task and functional task Subjective comparison of orthosis design also performed	ROM/MMT with and without orthotic intervention compared to baseline as well as personal interview with follow-up	ROM/MMT with and without orthotic intervention compared to baseline	Follow up from initial intervention, baseline comparison and to contralateral limb Additional comparison to other studies in the past
Methodology	Pre/Post orthotic intervention ROM measured with Rippstein plurimeter. MMT measured according to Daniels and Worthingam criteria.	Pre/Post orthotic and therapist comparison measured by ROM via motion capture and a force model measured with orthosis force sensor Nordic Questionnaire, Borg Scale, and qualitative questionnaire about the orthosis design	Pre/Post orthotic intervention MMT and ROM measured by practitioners, BTE Work simulator calculated increase in force.	Pre/Post orthotic intervention ROM measured by practitioners and MMT measured with a dynamometer	Pre/Post orthotic intervention ROM, amount of scapular winging MMT using a Salter spring balance and Jamar dynamometer, and patient reported questionnaires.

	Alsancak, 2001 ¹	Georgarakis, 2021 ²	Marin, 1998 ³	McGovern, 2008 ⁴	Vastamäki, 2015 ⁵
Outcomes	Manual Muscle Testing and Active ROM	Brooke Scale Force model in and out of orthosis and with therapist ROM during tasks ScAla Score in ROM task Borg Scale and SPARC movement in functional task	Manual Muscle Testing and Active ROM with follow up	Manual Muscle Testing and Active ROM	Active ROM for both the affected and unaffected limb and Manual Muscle Testing with follow up Recovery, Pain, and Paresis
Key Findings	Out-of-brace limitations were minimized most with the scapulothoracic fixation orthosis (STFO), the 2 nd most effective design was the Johnson orthosis (JO)	Therapist intervention demonstrated the upper bounds of significant ROM improvement though brace assisted with flexion and abduction compared to baseline. Trunk compensation decrease with external scapular support. Stronger support resulted in higher subjective ratings for comfort and function	In-brace increases were seen to muscle strength consistently. Average increase of muscle force was 12% using BTE work simulator. Average MMT improvement was 1 grade	This rigid orthosis design reduced pain and increased ROM 81-86% and increased MMT force by 25-400% through glenohumeral motion	ROM comparison between baseline and follow up showed complete recovery of patients across papers of 64% objectively and retained 62% recovery at six months or greater at follow up. Subjectively 58% of patients recovered and 38% reported recovery past a six month follow up.
Study Limitations	Singular patient for the case study with 4 devices. No self-report scores from the patient regarding the orthoses.	Brace design was not conducive for independent donning and operation. Therapist intervention represented a better level of scapular support during tasks.	Brace use was inconsistent among the patients. Inclusion of both chronic and acute long thoracic nerve palsy could affect outcomes. The age range of cases was 19-38, 93% of cases involved dominant limb, and 85% of participants male	Singular patient with no comparable orthosis design or materials to compare rigid orthosis effectiveness	Authors admit to changing brace design over years from “cumbersome” to function in terms of compliance. 76% of patients male Range of follow up for recovery is not standardized among papers