



EFFECTIVE APPROACH OF MODIFIED SHOULDER ORTHOSIS IN POSTERIOR SHOULDER SUBLUXATION- A CASE STUDY

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Abstract— Background: Shoulder subluxation is treated with various types of customized and prefabricated orthosis and splints available in market. Among these, Wilmer carrying orthosis is well established. Problem arises in wilmer carrying orthosis with position of forearm, as position of forearm piece is quite effective in standing position but it may change during sitting position and this leads significant change in functionality of orthosis.

Aim: The aim of this case study is to identify the need and provide additional support system which maintained the desired position and support of forearm piece in wilmer carrying orthosis.

Method: A detailed assessment was performed to identify posterior shoulder subluxation. Customized wilmer carrying orthosis was fabricated followed by measurement, casting, moulding and trimming procedure. After checkout wilmer carrying orthosis was delivered and patient was called for one month follow up. During follow up, patient reported few complaints regarding position of forearm during sitting position. A modified wilmer carrying orthosis was fabricated which includes custom molded shoulder saddle, forearm piece and placement of turn buckle. Comparative result of Pre and Post test were conducted to analyse the effectiveness of both design.

Result: Pre and post test of performance of both designs of wilmer orthosis was used for result. Modified wilmer carrying orthosis resolved the problem associated with sitting position. This design also provided variable change in angulation of forearm piece in comparison of standard wilmer orthosis for effective lever arm function in posterior shoulder subluxation case.

Discussion & Conclusion: Custom molded modified wilmer carrying orthosis with turn buckle provided re-establishment of position of forearm piece and maintain desired position of shoulder. Wilmer orthosis used only in case of posterior shoulder subluxation and support the shoulder with biomechanically realign surrounding shoulder muscles. Provision of change in angulation also leads scope of graduation change in posterior shoulder subluxation during recovery stage.

Keywords: Posterior shoulder subluxation, Wilmer carrying orthosis, Shoulder orthosis, Lever arm, Mechanical stress.

I. INTRODUCTION

Glenohumeral subluxation is defined as a partial or incomplete dislocation that usually stems from changes in the mechanical integrity of the joint. In a subluxation, the humeral head slips out of the glenoid cavity as a result of weakness in the rotator cuff or a blow to the shoulder area. A subluxation can occur in one of three types, Anterior subluxation (Forward), Posterior subluxation (Backward) and Inferior subluxation (Downward). The Glenohumeral joint is the main articulation of the shoulder joint. It is the multiaxial ball-and-socket synovial joint formed by the articular surfaces. This mobility provides the upper extremity with tremendous range of motion such

as adduction, abduction, flexion, extension, internal rotation, external rotation, and 360° circumduction in the sagittal plane. This wide range of motion also makes the shoulder joint unstable. This instability is compensated for by rotator cuff muscles, tendons, ligaments, and the glenoidlabrum. Anterior shoulder instability is an injury to the glenohumeral joint (GHJ) where the humerus is displaced from its normal position to the centre of the glenoid fossa and the joint surfaces no longer touch each other. In Posterior shoulder Subluxation, structures that stabilize the shoulder, cause of dysfunction include the posterior band of the inferior gleno-humeral ligament, glenoid, coracohumeral ligament, posterior capsule, the rotator cuff muscles and the biceps tendon. A number of variety of shoulder braces are available in market in prefabricated and customized form to address these shoulder subluxation such as shoulder sling, hemisling, shoulder cap, wilmer carrying orthosis etc. Among all these splints, Wilmer orthosis is used only in case of posterior shoulder subluxation and support the shoulder with biomechanically realign the related shoulder muscles. With the use of wilmer carrying orthosis, a problem is associated with position of forearm. As position of forearm piece is quite effective in standing position but it may change during sitting position and this leads significant change in functionality of orthosis. The objective of this study is to address this issue and provide additional support system which maintain the desired position and support of forearm piece in wilmer carrying orthosis.

II. CASE REPORT

Patient was reported to NILD Kolkata. Consent form was taken from patient. A detailed assessment and examination was performed over patient. After detailed examination patient, posterior shoulder Subluxation was identified and wilmer carrying orthosis was prescribed by clinical team. Customized wilmer carrying orthosis was fabricated followed by measurement, casting, moulding and trimming procedure. After checkout wilmer carrying orthosis was delivered and patient was called for one month follow up. During follow up, patient reported few complaints regarding position of forearm during sitting position. A modified wilmer carrying orthosis was fabricated to address this issue. This modified wilmer carrying orthosis consist of Forearm trough, Turn buckle, Shoulder saddle, Chest strap, Axillary strap, Velcro and other adjustment accessories. Fabrication procedure is divided into 2 major areas; a) fabrication of shoulder saddle (e.g. figure1), b) attachment and placement of turn buckle mechanism over form arm tough (e.g. figure2). Fabrication includes measurement, casting, modification, molding, cutting and finishing process. To identify the difference in between these two brace comparative result of Pre and Post test were conducted to analyze the effectiveness of both designs.



Figure 1: Shoulder saddle



Figure 3: Forearm trough with adjustment attachment

III. RESULT

Comparison in between Wilmer carrying orthosis (figure 3) and modified wilmer carrying orthosis (figure 4) was based on patients feedback and effectiveness of design. Modified wilmer carrying orthosis shows some alteration in basic design concept. Gradual correction and axial support are not available in wilmer carrying orthosis while it provided good support and gradual reloading over shoulder area in modified wilmer carrying brace. This modified brace also assist in speedy recovery of shoulder area. Advantage of modified wilmer orthosis shows effective neutralisation and maintenance of muscle in shoulder Subluxation, reduced chance on oedema formation in hand, fingers and forearm, reduced pain and discomfort in arm and shoulder, no neck loading, high wearing comfort partly because of open and lightweight construction, ventilation in forearm trough, gradual positional alteration possible.



Figure 3: Fornt, side and back view of wilmer carrying orthosis in initial fittment over patient.



Figure 5: Fornt, side and back view of modified wilmer carrying orthosis in final fittment over patient. Elevation and postural maintenance over shoulder area is clearly visible.

IV. DISCUSSION

Modified wilmaer carrying orthosis provide good amount of support over shoulder area. Biomechanics of Modified wilmer carrying orthosis is mainly based on lever system and pressure distribution. Modified Wilmer carrying orthosis based upon third class lever where fulcrum is located at attachment point of forarm torch and turn buckle. As per the old concept, wilmer carrying orthosis is working in lever function. A 3rd class lever works there. Problem occurs when patient sit over table or chair. At this time forarm piece is touched with another surface, which leads changes in lever function as resistance arm get additional support. At this time lever fulcrum not perform 3rd class lever and position alteration reported with shoulder area. In the Modified Wilmer Carrying Orthosis with Turnbuckle the load is not transfer to the sitting surface due to the placement of turnbuckle and original function of wilmer orthosis will remain maintained. Modified wilmer carrying orthosis provides more contact area in forearm trough and shoulder saddle which provide more pressure distribution as $P=F/A$. Load of forearm is distributed over large surface area of forearm trough.

V. CONCLUSION

Modified wilmer carrying orthosis with turnbuckle in a case for posterior shoulder subluxation may resolve the problem associated with sitting position. This design also may provide variable change in angulation of forearm piece for effective lever arm function in posterior shoulder subluxation case. Custom molded Modified wilmer carrying orthosis with turn buckle may provide re-stabilishment of position of forarm piece and maintain desired position of shoulder. Provision of change in angulation also leads scope of gradual change in posterior shoulder subluxation.

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