



## Effect of Stretching Exercise to Increase Joint Range of Motion and Functional Ability in Post-Burn Shoulder Contracture Patients: A Case Report

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### ORIGINAL ARTICLE

#### ABSTRACT

**Introduction:** Burns are tissue damage or loss caused by contact with high temperatures, such as heat, radiation, electricity, and chemicals. Causes damage to the epidermis and underlying soft tissue, bone, and muscle, placing burn victims at risk for contractures and joint deformities. Upper extremity function is critical to the performance of activities of daily living. Interventions such as surgery, pharmacological therapy, and nutritional support are important in aiding recovery and improving clinical outcomes after severe burns. The aimed to determine the effect of stretching exercises on increasing range of motion and functional ability in post-burn shoulder contracture. This study used the case study method which was conducted on post-shoulder contracture burn patients at Central General Hospital Dr. I.G.N.G Ngoerah Bali in February 2023. Pain measurements were taken using the Numeric Rating Scale (NRS). Measurement of muscle strength using Manual Muscle Testing (MMT). Goniometer to measure the Range of Joint Motion (ROM). Shoulder Pain and Disability Index (SPADI) to measure functional ability. SPADI is a quality of life questionnaire consisting of 13 items to evaluate 5 items for pain and 8 items for impairment. After 3 times of physiotherapy, the results showed a decrease in silent pain at T0 = 2 to T3 = 1. Tenderness at T0 = 4 to T3 = 2. Movement pain T0 = 5 to T3 = 3. Increased muscle strength T0 value 2, that is not full ROM to T3 value 3, namely full ROM and can fight gravity. Increased range of motion in active and passive flexion, extension, abduction, adduction, horizontal, abduction and horizontal adduction, internal and external rotation. The increase in the functional ability of SPADI T0 = 53% then decreased to T3 = 35%. There is a significant decrease in the measurement of functional ability using SPADI, which means the patient's functional ability is increasing. The conclusion is stretching exercises are effective for increasing the range of motion and functional ability of patients with post-burn shoulder contractures. Therefore, stretching exercises should be used to provide proper burn care to patients in hospitals and burn centers.

**Keywords:** Burn, Shoulder Contracture, Stretching

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#### ABSTRAK

**Pendahuluan:** Luka bakar adalah kerusakan atau kehilangan jaringan yang disebabkan oleh kontak dengan suhu yang sangat tinggi seperti panas, radiasi, listrik, bahan kimia. menyebabkan kerusakan pada epidermis dan jaringan lunak, tulang, dan otot di bawahnya, membuat korban luka bakar berisiko mengalami kontraktur dan kecacatan sendi. Fungsi ekstremitas atas sangat penting untuk kinerja aktivitas hidup sehari-hari. Intervensi seperti pembedahan, terapi farmakologis, dan dukungan nutrisi memainkan peran penting dalam membantu pemulihan dan meningkatkan hasil klinis setelah luka bakar parah. Tujuan penelitian ini adalah untuk mengetahui pengaruh stretching exercise terhadap peningkatan lingkup gerak sendi dan kemampuan fungsional pada kontraktur bahu pasca luka bakar. Penelitian ini menggunakan metode studi kasus yang dilakukan pada pasien luka bakar pasca kontraktur bahu di Rumah Sakit Umum Pusat Dr. I.G.N.G Ngoerah Bali pada bulan Februari 2023. Pengukuran yang dilakukan adalah pengukuran nyeri dengan menggunakan Numeric Rating Scale (NRS). Pengukuran kekuatan otot menggunakan Manual Muscle Testing (MMT). Goniometer untuk mengukur Range of Joint Motion (ROM). Indeks Nyeri dan Disabilitas Bahu (SPADI) untuk mengukur kemampuan fungsional. SPADI adalah kuesioner kualitas hidup yang terdiri dari 13 item untuk mengevaluasi 5 item untuk nyeri dan 8 item untuk penurunan nilai. Hasil setelah 3 kali fisioterapi terjadi penurunan nyeri diam pada T0 = 2 menjadi T3 = 1. Nyeri tekan pada T0 = 4 menjadi T3 = 2. Nyeri gerak T0 = 5 menjadi T3 = 3. Peningkatan kekuatan otot T0 nilai 2, yang tidak full ROM ke T3 nilainya 3 yaitu full ROM dan bisa melawan gravitasi. Peningkatan rentang gerak dalam fleksi aktif dan pasif, ekstensi, abduksi, adduksi, horizontal, abduksi dan adduksi horizontal, rotasi internal dan eksternal. Peningkatan kemampuan fungsional SPADI T0 = 53% kemudian menurun menjadi T3 = 35%. Terdapat penurunan yang signifikan pada pengukuran kemampuan fungsional menggunakan SPADI yang berarti kemampuan fungsional pasien semakin meningkat. Disimpulkan bahwa latihan peregangan efektif untuk meningkatkan jangkauan gerak dan

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kemampuan fungsional pasien kontraktur bahu pasca luka bakar. Oleh karena itu, disarankan untuk menggunakan latihan peregangan dalam memberikan perawatan luka bakar yang tepat kepada pasien di rumah sakit dan pusat luka bakar.

**Kata Kunci:** Luka Bakar, Kontraktur Bahu, Peregangan.

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## INTRODUCTION

Burns are tissue damage or loss caused by contact with very high temperatures such as heat (fire, hot liquids/fats, hot steam), radiation, electricity, and chemicals (Alzaabi et al., 2022). According to the World Health Organization, traumatic burns are the fourth leading cause of accidental injury, with an estimated 11 million cases resulting in approximately 180,000 deaths each year. (Oosterwijk et al. 2017) . In 2017 the American Burn Association (ABA) reported that fire burns are the most common cause of burns (41%) in the United States, followed by scald burns (31%). Most burns occur in children (1-16 years) and people of working age (20-65 years). A much higher incidence of burns is 1388/100000 per year in Southeast Asia and Pakistan (Palackic et al. 2021).

First-degree burns (superficial thickness, affecting only the epidermis) are usually harmless, very painful, heal without scarring, and don't require surgery. Burns that extend into the underlying layer of skin (dermis) are classified as partial thickness or second-degree burns and often form painful blisters. These burns range from superficial partial thickness, which is homogeneous, moist, hyperemic, and pale, to deep partial thickness, which is less pronounced, drier, and may have a reticular pattern to erythema and no pallor (Akter, Hassan, and Hossain 2022). Third-degree (full-thickness) and fourth-degree burns require surgery and, paradoxically, usually present painlessly (Jeschke et al., 2020).

Burns cause damage to the epidermis and underlying soft tissue, bone, and muscle, putting burn victims at risk for contractures and joint deformities (Adi, Saputra, and Yanti 2021). Contractures are structural changes in tissues such as muscles, tendons, ligaments, joint capsules, and skin, resulting in complete loss of joint range of motion (ROM) (Tehreem et al. 2022). Injury-related parameters such as burn depth, extent, etiology, and location may have a role in the formation of post-burn contractures. The majority of patients with burns have an upper extremity injury. Upper extremity function is critical to the performance of activities of daily living, work, and sports (Najafi et al. 2019). Interventions such as surgery, pharmacological therapy, and nutritional support play an important role in aiding recovery and improving clinical outcomes after severe burns (Patsaki et al., 2020).

Stretching exercise is a safe and effective strategy for recovery and increasing joint mobility. Stretching exercises have a key role in the release of post-burn contractures (Dogra et al. 2016) . Manual stretching techniques have the effect of maintaining range of motion function and can reduce the thickness and flexibility of burn contractures (Tehreem et al., 2022). The aim is to explain the effectiveness of stretching exercises on post-burn shoulder contracture, effectively helping to increase ROM and helping reduce functional disability in the shoulder joint.

## METHODS

The research method used is a case report (case study) conducted on patients on behalf of An. I, 11 years old male with grade II AB – III burns 38% (grade II A 23.5%, grade II B 10%, Grade III 4.5%) Region Facial – Coll, Trunk Anterior + Posterior, Extremity Superior et inferior dextran and sinistra etc. Skin graft at Central General Hospital Dr. I.G.N.G Ngoerah Bali in February 2023. The patient complained of pain and stiffness in the right shoulder, muscle weakness, and limited joint range of motion, resulting in decreased functional ability. The intervention program given was a stretching exercise.

Measurements taken were pain measurements using the Numeric Rating Scale (NRS), consisting of numbers between 0-10 (interpretation 0: no pain, 1-3: mild pain, 4-6: moderate pain, 7-10: severe pain) (Atisook et al. 2021) . The NRS scale is used because the research that has been done has obtained a level of validity and reliability of  $\alpha = 0.75$  (Pratitdya et al., 2020). Measurement of muscle strength using Manual Muscle Testing (MMT) with a value range of 0-5, value 0 is no contraction, value 1 is contraction but no movement, value 2 is able to move but cannot fight gravity, value 3 is able to move with the scope of joint motion (ROM) is full against

gravity but cannot yet fight resistance, value 4 is able to move with full LGS against minimum resistance gravity, and value 5 is able to move with full (ROM) against maximum resistance gravity (Bittmann et al. 2020). Goniometer to measure Joint Range of Motion (ROM), and Shoulder Pain and Disability Index (SPADI) to measure functional ability. SPADI is a quality of life questionnaire consisting of 13 items to evaluate 5 items of pain and 8 items of disability associated with shoulder dysfunction related to the patient's ability to perform basic activities of daily living. Each item is scored with a score consisting of 0-10 where 0 is no pain and 10 is the worst pain (Brindisino et al. 2021).

## RESULTS

**Table 1.** Evaluation of pain level using Numeric Rating Scale (NRS).

Pain Type	T0	T1	T2	T3
Silent Pain	2	2	2	1
Tenderness	4	4	3	2
Motion Pain	5	5	4	3

Table 1 shows a decrease in pain from silent pain, tenderness, and movement pain after 3 treatments. The results of measurements of silent pain at T0 = 2 become T3 = 1. Tenderness at T0 = 4 becomes T3 = 2. Movement pain T0 = 5 becomes T3 = 3.

**Table 2.** Evaluation of muscle strength using Manual Muscle Testing (MMT)

Motion	T0 Dextra	T1 Dextra	T2 Dextra	T3 Dextra
Flexi	2	2	2	3
Extension	2	2	2	3
Abduction	2	2	2	3
Adduction	2	2	2	3
Horizontal Abduction	2	2	2	3
Horizontal Adduction	2	2	2	3
Internal Rotation	2	2	2	3
External Rotation	2	2	2	3

Table 2 shows an increase in muscle strength from T0 to T3 in the shoulder joint area with a T0 value of 2, which is not full ROM to a T3 value of 3, which is full ROM and can fight gravity.

**Table 3.** Evaluation of the range of motion of the joint using a goniometer.

Shoulder	ROM	T0	T1	T2	T3	Normal Value
Dextra Motion						
Flexi	Aktive	S 25° 0° 110°	S 25° 0° 110°	S 30° 0° 130°	S 35° 0° 150°	S 45°- 0°-180°
Ekstension	Passive	S 30° 0° 135°	S 30° 0° 135°	S 35° 0° 140°	S 40° 0° 160°	S 45°- 0°-180°
Abduction	Aktive	F 100°0°50°	F 100°0°50°	F 120°0°60°	F 140°0°65°	F 180°- 0°-75°
Adduction	Passive	F 120°0°60°	F 120°0°60	F 140°0°65°	F 160°0°70°	F 180°- 0°-75°
Horizontal Abduction	Aktive	T 70°0°25°	T 70°0°25°	T 75°0°30°	T 80°0°35°	T 90°- 0°-40°
Horizontal Adduction	Passive	T 75°0°35°	T 75°0°35°	T 80°0°35°	T 85°0°40°	T 90°- 0°-40°
Internal Rotation	Aktive	R 75° 0° 65°	R 75° 0° 65°	R 80° 0° 70°	R 85° 0° 75°	R 90°- 0°-80°
Eksternal Rotation	Passive	R 80° 0° 70°	R 80° 0° 70°	R 85° 0° 75°	R 90° 0° 80°	R 90°- 0°-80°

Table 3 shows an increase in range of motion in both active and passive movements. Increased range of motion associated with decreased pain. This is because pain or discomfort can cause the patient difficulty moving the shoulder active or passive. In active flexion extension motion T0 = S 25° 0° 110° becomes T3 = S 35°-0°-150° while in passive motion T0 = S 30°-0°-135° becomes T3 = S 40°-0°- 160°. In the active motion of adduction abduction T0 = F 100°-0°- 50° becomes T3 = F 40°-0°-65° while in passive motion T0 = F 120°-0°-60° becomes T3 = F 160°-0°- 70°. In active horizontal abduction and horizontal adduction motion T0 = R 70°-0°-25° becomes T3

= R 80°-0°-35° while in passive motion T0 = T 75°-0°- 35° becomes T3 = T 85 °-0°-40°. In the active internal external rotation T0 = R 75°-0°-65° becomes T3 = R 85°-0°-75° while the passive motion T0 = R 80°-0°- 70° becomes T3 = R 90°- 0°-80°.

**Table 4.** Evaluate the functional ability of the shoulder using the Shoulder Pain and Disability Index (SPADI).

Category	Pain Scale			
	T0	T1	T2	T3
Pain	5	5	5	3
Sleeping on the side hurts	6	6	6	4
Grabbing something on a high shelf	6	6	6	4
Touching the back of the neck	7	7	7	5
Pushing with the arm on the sore side	7	7	7	5
<b>Disability Scale</b>				
Washing hair	5	5	5	3
Back rub	7	7	7	5
Wear a shirt buttoned in the front	3	3	3	1
Wearing pants	4	4	4	2
Place objects in higher places	6	6	6	4
Carrying things weighing 4.5 kg	7	7	7	5
Take something in back pocket	7	7	7	5
<b>SPADI Total Score</b>	<b>70</b>	<b>70</b>	<b>70</b>	<b>46</b>
<b>DI Score</b>	<b>53%</b>	<b>53%</b>	<b>53%</b>	<b>35%</b>

Table 4 shows the results of measuring functional ability using SPADI which decreased after being given 3 times of physiotherapy. The results of the SPADI score measurement T0 = 53% then decreased to T3 = 35%. There is a significant decrease in the measurement of functional ability using SPADI, which means that the patient's functional ability is increasing.

## DISCUSSION

The less significant reduction in pain was due to the stretching exercises which were only done 3 sessions. Based on previous studies carried out 3 times a week for 4 weeks so as to provide optimal results (Tehreem et al. 2022). The reduction in pain which was less significant was also seen from the patient's daily activities, namely as a student. Activities that are carried out monotonously and repeatedly using the arm, such as writing, playing, carrying a book. In addition to environmental activities that are less ergonomic, they also affect, such as study tables and shelves of goods that are too high.

The effect of stretching exercise on the body can increase blood flow to the muscles thereby increasing the supply of nutrients to the muscles, can cause a relaxed response in the central nervous system, in the shoulder muscles so as to reduce pain and change the physiology and mechanics of the muscles resulting in extensibility in soft tissue and increased range of motion ( Tehreem et al. 2022).

Stretching exercise is useful for determining the value of the ability of joints and muscles to carry out movements, checking bones and joints, muscles, preventing joint stiffness and increasing blood circulation(Rafique, et al., 2016). The benefits of various movements, one of which can increase blood circulation which carries nutrients to cells, especially muscle cells which are useful for carrying out activities, namely contraction and relaxation which can minimize contractures because physiological changes will occur in the body's systems such as lowering blood pressure, increasing muscle tone, improve joint mobilization and increase muscle mass (Perera, Perera, and Karunanayake 2017). Giving stretching exercises can increase muscle strength and also stabilize a group of muscle tissue and joints in the shoulder. Besides that, it can also maintain and train shoulder muscles such as the upper trapezius, levator scapula, supraspinatus, and serratus anterior.

A decrease in the range of motion in the shoulder joint is a complication of a burn injury, while

the stretching done to the muscle fibers first affects the sarcomere, which is the basic unit of contraction of the muscle fibers. When the sarcomere contracts, the area of overlap between the thick and thin myofilaments increases (Ashraf et al., 2022). When stretching occurs, this overlapping area decreases, causing the muscle fibers to elongate. Consistent and continuous stretching carried out in this study is proven to be able to change physiologically and mechanically in the muscles, resulting in extensibility in soft tissues and an increase in the range of motion of the joints (Zhang, Li-Tsang, and Au 2017).

Based on the measurement of functional ability using SPADI, there is an increase in daily functional activities. It is known that there is a significant decrease from T0 to T3. SPADI measurements are carried out to evaluate activities related to daily life such as dressing, grooming hair, rubbing the back when bathing, and doing other work on the sore side. Contracture of the shoulder joint in burns is considered to affect daily activities (Tyagi et al. 2018). Based on the table above, there was a decrease in pain, so there was an increase in functional ability after being given 3 sessions.

## CONCLUSION

Based on a case study, they carried out 3 therapy sessions in November 2022 for a patient on behalf of An. I, 11 years old with a diagnosis of grade II AB – III burns 38% (grade II A 23.5%, grade II B 10%, Grade III 4.5%) Facial Region – Coll, Trunk Anterior + Posterior, Extremity Superior et inferior (D) et (S) etc. Skin grafts. Patients' complaints are pain, decreased muscle strength, limited range of motion, and decreased functional ability given interventions in the form of stretching exercises. After being given physiotherapy intervention in the form of stretching exercises for 3 sessions, it was found that there was a reduction in pain, an increase in muscle strength, and an increase in range of motion, so there was also an increase in functional ability. Therefore, stretching exercises should be used to provide proper burn care to patients in hospitals and burn centers.

## REFERENCE

- Adi, N. M. K. D. W. P., Saputra, I. K., & Eva, P. N. (2021). Gambaran kejadian luka bakar dan tingkat pengetahuan ibu tentang pertolongan pertama luka bakar pada anak usia toddler di desa padangsambian klod. *Community of Publishing In Nursing (COPING)*, 9(3), 297-304.
- Akter, P., Hassan, M. N., & Hossain, M. A. (2022). Physiotherapy Intervention for Soft tissue Contracture and Joint Stiffness followed by BURN: A Case Report. *International Journal of Clinical Science and Medical Research*, 2(5), 25-27.
- Alzaabi, F. S. M. M., Bairapareddy, K. C., Alaparathi, G. K., & Hegazy, F. (2022). Caregiver Perspectives on Physiotherapy Treatment for Paediatric Burns in the United Arab Emirates. *Patient preference and adherence*, 1477-1486.
- Ashraf, U., Maqbool, S., Fatima, T., Asghar, H. M. U., Anwar, M., & Baig, F. (2022). Comparison of the effect of Range of Motion exercises versus stretching techniques in prevention of burn contractures of upper limb; RCT-A Randomized clinical trial. *Pakistan Journal of Medical & Health Sciences*, 16(05), 54-54.
- Atisook, R., Euasobhon, P., Saengsanon, A., & Jensen, M. P. (2021). Validity and utility of four pain intensity measures for use in international research. *Journal of pain research*, 1129-1139.
- Bittmann, F. N., Dech, S., Aehle, M., & Schaefer, L. V. (2020). Manual muscle testing—force profiles and their reproducibility. *Diagnostics*, 10(12), 996.
- Brindisino, F., Indaco, T., Giovannico, G., Ristori, D., Maistrello, L., & Turolla, A. (2021). Shoulder Pain and Disability Index: Italian cross-cultural validation in patients with non-specific shoulder pain. *Shoulder & Elbow*, 13(4), 433-444.
- Dogra, B. B., Kataria, M., Kandari, A., Ahmed, S., Singh, A., & Virmani, R. (2016). Management of postburn contractures of upper extremities: A general surgeon's perspective. *Indian Journal of Burns*, 24(1), 29-35.
- Jeschke, M. G., van Baar, M. E., Choudhry, M. A., Chung, K. K., Gibran, N. S., & Logsetty, S. (2020). Burn injury. *Nature Reviews Disease Primers*, 6(1), 11.
- Najafi, S., Jahani, S., Ravanbakhsh, M., Cheraghian, B., & Babai, K. (2019). The Effect of Range of Motion Exercises on Activity Daily Living and Quality of Life in Patients with Burn. *J Biochem Tech*, 10(2), 115-20.

- Oosterwijk, A. M., Mouton, L. J., Schouten, H., Disseldorp, L. M., van der Schans, C. P., & Nieuwenhuis, M. K. (2017). Prevalence of scar contractures after burn: a systematic review. *Burns*, 43(1), 41-49. <https://doi.org/10.1016/j.burns.2016.08.002>
- Palackic, A., Suman, O. E., Porter, C., Murton, A. J., Crandall, C. G., & Rivas, E. (2021). Rehabilitative exercise training for burn injury. *Sports Medicine*, 51(12), 2469-2482. <https://doi.org/10.1007/s40279-021-01528-4>
- Patsaki, I., Kyriakopoulos, A., Katartzi, M., Markaki, V., & Papadopoulos, E. (2020). Physiotherapy in a burn patient admitted in Intensive Care Unit. *Hospital Chronicles*, 15(1), 18-23. <https://doi.org/10.2015/hc.v15i1.877>
- Perera, A. D., Perera, C., & Karunanayake, A. (2017). Effectiveness of early stretching exercises for range of motion in the shoulder joint and quality of functional recovery in patients with burns-a randomized control trial. *International Journal of Physiotherapy*, 302-310. <https://doi.org/10.15621/ijphy/2017/v4i5/159426>
- Pratitdya, G., Rehatta, N. M., & Susila, D. (2020). Perbandingan Interpretasi Skala Nyeri Antara Nrs-Vas-Wbfs Oleh Pasien Pasca Operasi Elektif Orthopedi Di RSUD Dr. Soetomo." *Care: Jurnal Ilmiah Ilmu Kesehatan* 8(3):447. <https://doi.org/10.33366/jc.v8i3.1802>
- Rafique, S., Ijaz, M. J., Adeel, M., Malik, S., & Choudhary, S. (2016). Effectiveness of Active Range of Motion in Combination with Stretching in Treatment of Burn Patient: JRCRS. 2016; 4 (2): 50-53. *Journal Riphah College of Rehabilitation Sciences*, 4(2), 50-53.
- Tyagi, A., Rajan, M., Dvivedi, S., & Rawat, K. A. (2019). Clinical profile of patients with post burn contracture. *International Surgery Journal*, 6(1), 126-129. <https://doi.org/10.18203/2349-2902.isj20185459>.
- Tehreem, Z., Kazmi, Y., Khalid, M. U., Mansha, H., Hassan, M., & Majeed, R. (2022). Comparison of soft tissue mobilization versus static stretching in post-burn contractures at elbow and wrist, A pilot study. *Journal of University Medical & Dental College*, 13(3), 408-411. <https://doi.org/10.37723/jumdc.v13i3.680>.
- Zhang, Y. T., Li-Tsang, C. W., & Au, R. K. (2017). A systematic review on the effect of mechanical stretch on hypertrophic scars after burn injuries. *Hong Kong Journal of Occupational Therapy*, 29(1), 1-9. <https://doi.org/10.1016/j.hkjot.2016.11.001>.