MedCrave
Step into the World of Research
International Physical Medicine & Rehabilitation Journal

Research Article

Open Access

Observation on the curative effect of static progressive stretch (SPS) in the rehabilitation of post-traumatic elbow joint contractures

Abstract

Object: This study is aimed to explore the curative effect of static progressive stretch (SPS) in the rehabilitation of post-traumatic elbow joint contractures.

Method: Thirty post-traumatic elbow joint contractures inpatients and outpatients treated at the researchers' hospital from December 2017 to March 2020 were selected as subjects and divided into the treatment group (15 patients) and the control group (15 patients) by means of a random number table. The control group received conventional rehabilitation treatment, while the treatment group adopted SPS orthoses as an adjunct. After 8 weeks of treatment, the range of joint motion (ROM) and the pain VAS of the two groups were compared with each other.

Result: The elbow joint ROM of both groups before treatment were57.30±15.32° in the treatment group and 62±10.58° in the control group respectively. The elbow joint ROM of both groups after treatment were98.30±11.32° in the treatment group and 75±15.32° in the control group respectively. The post- and pre-treatment difference in elbow joint ROM was statistically significant ($P<0.05$). The ROM difference between the treatment group and the control group 8 weeks after treatment was statistically significant ($P<0.05$). After treatment, pain was relieved ($P<0.05$) in both groups with more obvious pain relief observed in the treatment group ($P<0.05$).

Conclusion: SPS orthoses applied as an adjunct to the conventional rehabilitation therapy can significantly improve the ROM in patients with post-traumatic elbow joint contractures and relieve the pain, with promising treatment compliance.

Keywords: static progressive stretch (SPS) orthoses, joint contractures, ROM, pain

Volume 5 Issue 4 - 2020

Xu Yanzhong,[1] Chang Jun,[2] Wu Zhonghua,[1] Qiao Feiei,[1] Qiu Xiaohong,[1] Wang Xin,[3] Yu Changlong[3]

[1]Rehabilitation Department, YiwuFuyuan Private Hospital, Zhejiang Province, China
[2]Department of Medical Informatics, General Hospital of PLA Xinjiang Command, China
[3]Orthopedic Department, Far East Horizon Medical Group, China

Correspondence: Wang Xin, Orthopedic Department, Far East Horizon Medical Group, No.9 Yaojiang Road, Shanghai City, China, Tel +86013522263103, Fax +8602138913000, Email wangx16@126.com
Yu Changlong, Orthopedic Department, Far East Horizon Medical Group, No.9 Yaojiang Road, Shanghai City, China, Tel +86013501831743, Fax +8602138913000, Email ycl123@vip.sina.com

Received: June 20, 2020 | **Published:** July 02, 2020

Abbreviations: SPS, static progressive stretch; ROM, range of motion; VAS, visual analogue scale

Introduction

Traumas, surgeries, or external fixation, especially inappropriate external fixation and long-term trans articular external fixation (a plaster cast or an external fixator), can lead to articular capsule contractures, fibrosis of ligaments around the joints and acinetatrophia of peripheral muscles.[1] As a result of pain or lack of timely guidance in rehabilitation, patients' joint movements are reduced, causing confined joint movement, joint stiffness, and even ankylosis.[2] Because braces are not applied in the current rehabilitation treatment, the efficacy obtained during the conventional treatment on daily basis cannot be maintained, and the improvement of the joint ROM is less than optimal. The conventional manual traction is often too painful to be endured with poor compliance and low curative rate. SPS orthoses are, therefore, applied to the treatment of elbow joint contractures to resolve the existing limitations. Based on the principle of stress relaxation, researchers exert stretch force repeatedly, to maintain and achieve the continuous strain of fibrous tissues, relieve patients' pain, and achieve the treatment goals. The application of SPS orthoses is elaborated hereafter.

Materials and methods

Selection criteria

Thirty post-traumatic elbow joint contractures inpatients and outpatients treated at the researchers' hospital from December 2017 to March 2020 were selected as subjects and divided into the treatment group (15 patients) and the control group (15 patients) by means of a random number table.

Inclusion criteria

a. Patients with history of local trauma/surgeries for the elbow joint

b. Patients with elbow joint ROM limitation over 50%

c. Courses of disease over 2-3 months.

Thirty patients -- 19 males and 11 females aged between 18 and 60 -- were included in the subject groups;

Exclusion criteria

a. Patients with joint contractures caused by post-burn scars

b. Patients with other dysfunctions

c. Patients with severe visceral diseases, malignancy, hematological disorders

d. Patients who cannot fully cooperate with the treatment.

The comparison of the selection criteria of the two groups did not yield statistical significance (P<0.05), hence allowing the comparison in the experiment to be valid.

Method

The control group was given conventional treatment

a. Health education:patients were trained on the principles and methods of the basic muscle strength training, self-stretching, joint movement, swelling reduction, pain alleviation, and other functional exercises;

b. Wax and ultrasound therapies: the therapies were applied to relieve the joint tension, improve the regional blood circulation, and enhance the elasticity of the tissues and skin around the joint;

c. Static manual stretch: the therapist passively moved the patients' joint for 30-120 seconds until patients felt moderately sore and bloating;

d. Sports therapies: the therapies aimed to increase the joint ROM, and also enhance the muscle strength, endurance, and functional movement.

One or multiple methods above could be applied based on patients' conditions. The rehabilitation training was performed once a day (around 45 minutes) for 8 weeks.

The treatment group adopted SPS orthoses as an adjunct to conventional treatment. The SPS was featured with low loads, static positions, and dynamic loads. During treatment, therapists stretched the joint in one motional direction under the chosen stretch intensity. Therapists could adjust the knob to generate gentle, painless stretching force (Scales of stretch range from level 0 (no stretch feeling) to level 10 (painful stretch), and level 2-3 was used in the treatment). The therapists increased the joint angle every 5 minutes. The 30-minute session was performed 3 times a day for 8 weeks. After the treatment in one direction finished, the patients rested for 1 minute before moving on to the next direction under the same procedures.

Observation index and evaluation standard

Patients' ROM was assessed before treatment and 8 weeks after treatment.

Patients' pain VAS was assessed before and after treatment.[3] Pain VAS scores range from 0-10 points with 0 corresponding to no pain, 1-3 to mild pain, 4-6 to moderate pain, and 7-10 to severe pain.

Statistical method

The statistical software SPSS13.0 was employed to analyze the data. The measurement data was expressed by the mean±standard deviation (x±s), and the t-test was used to determine if there was a statistically significant difference between the two groups. The measurement data was expressed by rate, and the $\chi 2$ was employed to determine if there was a statistically significant difference between the two groups, with P<0.05 as the threshold value.

Results

The ROM of the treatment group increased after 8 weeks of treatment and indicated statistical significance compared with the ROM before treatment (P<0.05), and compared with the ROM of the control group 8 weeks after treatment (P<0.05) (Table 1). Post-treatment pain relief was observed in both groups(mean P<0.05) with relief in treatment group more apparent. (P<0.05). After treatment, the painful sense in 93.3% of patients from treatment group was controlled within the range of mild pain, higher than 60.0% in control group (Table 2).

ROM comparison of the two groups (Table 1).

Table 1 ROM Values (X±s)

Group	n	Before treatment	8 weeks after treatment
The Control Group	15	62±10.58	75±15.32a
The Treatment Group	15	57.30±15.32	98.30±11.32a b

Notes: When compared with the ROM before treatment, a P<0.05; when compared with the control group, abP<0.05

Pain VAS comparison of the two groups (Table 2).

Table 2 VAS Comparison of the two groups before and after treatment (%)

Group	n	Time	No Pain	Mild Pain	Moderate Pain	Severe Pain
The Treatment Group	15	Before Treatment	3 (20.0)	6(40.0)	5 (33.3)	1(6.7)
	15	After Treatment	8 (53.3)	6(40.0)	1 (6.7)	0
The Control Group	15	Before Treatment	1 (13.3)	7(46.7)	5 (40.0)	2(13.3)
	15	After Treatment	3 (20.0)	6(40.0)	4 (26.7)	2(13.3)

Notes: After treatment, when each group was compared with its pre-treatment VAS, P<0.05; when the two groups were compared with each other after treatment, P<0.05

Citation: Yanzhong X, Jun C, Zhonghua W, et al. Observation on the curative effect of static progressive stretch (SPS) in the rehabilitation of post-traumatic elbow joint contractures. *Int Phys Med Rehab J.* 2020;5(4):132–134. DOI: 10.15406/ipmrj.2020.05.00245

Discussion

Joint contractures refer to reduced active or passive joint movement caused by various reasons. It is a highly prevalent disease in clinical settings[4,5] and one of the dysfunctions commonly seen in the Department of Rehabilitation Medicine. The incidence rate of post-traumatic joint contracture is 50%,[6] and The biomechanical properties of soft tissues around the joint were exploredas the most widely used therapy clinically.[7] Fibrous tissues present viscoelastic properties when stretched by anexternal force. Creep refers to the phenomenon that tissues around the joint generate time-dependent extension when stretched by stress. As a result, the collagen fibers in the connective tissues grow along the same direction of the stress.[8] If the stress remains, tissues can further extend slowly. Stress relaxation means that if the length of fibrous tissues is maintained after extension without retracting,[9] the internal tension will decrease gradually. The strain properties of tissues are related to the rate of the imposed load. The rapid or sudden loading of stress will mainly cause elastic deformation of the tissues, while the slow loading will cause more plastic deformation of the tissues. The optimal therapy should induce as much plastic deformation of the tissues as possible, and the curative effect of long-term low load therapies will be much better than that of short-term high load ones. According to the above principles, researchers in the United States and China have done a lot of relevant clinical research.[10,11]

SPS orthoses were applied to the rehabilitation treatment of the post-traumatic elbow joint contractures in this study. The stress relaxation extended the fibrous tissues, and the SPS orthoses kept the tissues from retracting. The internal tension reduced gradually, and the slow loading of the stress gave rise to the plastic deformation of the tissues, hence maintaining the improved joint ROM. The results show that the ROM value of the treatment group increased significantly after 8 weeks of treatment (meaning that the ROM improved greatly), and the comparison between the treatment group and the control group yielded statistical significance ($p<0.05$). The gentle, painless stretching force was adopted during the treatment. The stretch feeling was controlled within level 2-3 low load, with each training session lasting 30 minutes. The results from the basic SPS study demonstrated that the joint capsules' inflammatory reactions were alleviated after 30 minutes of SPS, the pain was relieved to the lowest level with the joint functions recovered to the best state.[11]

Conclusion

Furthermore, the joint ROM can be adjusted during the SPS orthoses treatment, ensuring an extremely high degree of safety. The gentle, painless stretching force can effectively prevent the secondary injures to muscles, joint capsules, ligaments, tendons, and soft tissues caused by violent stretching.[12] The pain is alleviated after the treatment. The patient compliance of the SPS orthoses therapy is high, due to controlled pain during the treatment, thus attaining the goals of clinical rehabilitations.

Funding

None.

Acknowledgments

None.

Conflicts of interest

The authors declare no conflicts of interest.

References

1. Zhang C. Musculoskeletal rehabilitation. 1 ed. Beijing: *People's Health Press*, 2008:301–303.
2. Cheng H. Rehabilitation prevention and treatment of knee contracture. Modern rehabilitation. 2000;4(1):16–17.
3. Saarinen AJ, Uimonen MM, Sandelin H, et al. Minimal important change for the visual analogue scale foot and ankle (VAS-FA). *Foot Ankle Surg*. 2020;S1268–7731(20)30070-9.
4. Zhou Y, Zhang QB, Zhong HZ, et al. Research progress on animal model of joint contracture. *Austin Surg Case Rep*. 2016;1(2):1006.
5. Hagiwara Y, Saijo Y, Chimoto E, et al. Increased elasticity of capsule after immobilization in a rat knee experimental model assessed by scanning acoustic microscopy. *Ups J Med Sci*. 2006;111(3):303–313.
6. Dunham CL, Castile RM, Chamberlain AM, et al. The role of periarticular soft tissues in persistent motion loss in a rat model of posttraumatic elbow contracture. *J Bone Joint Surg Am*. 2019;101(5):e17.
7. Ni GX. Application of viscoelastic theory in the rehabilitation treatment of joint contracture. *Chinese Journal of Rehabilitation Medicine*. 1999;14(3):140–141.
8. McNair PJ, Dombroski EW, Hewson DJ, et al. Stretching at the anklejoint: viscoelastic responses to holds and continuous passivemotion. *Med Sci Sports Exerc*. 2001;33(3):354–358.
9. Li TJ, Cai B, Li X. Treatment of knee joint contractures with static progressive stretch (SPS). *Journal of Medical Biomechanics*. 2012;27(3):351–354.
10. Sodhi N, Yao B, Anis HK, et al. Patient satisfaction and outcomes of static progressive stretch bracing: a 10-year prospective analysis. *Ann Transl Med*. 2019;7(4):67.
11. Wang L, Li-Ning Z, Jia-le H, et al. The study of the curative effect and mechanism of different durations of static progressive stretch (SPS) treatment on traumatic knee joint contractures in rats. *Journal of Sichuan University (Medical Science Edition)*. 2020; 51(2):185−192.
12. Yang YL, Liao XB, Luo YH, et al. Clinical efficacy of static progressive stretch (SPS) in the treatment of post-operative proximal humeral fractures. Yunnan Medicine Journal. 2017;38(3):232–233.