

Short-term effect of ultrasound therapy on stiffness elbow joint

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Abstract

Elbow stiffness is hard to treat and commonly resulted from trauma or degenerative arthritis. This study aimed to demonstrate the effectiveness of using ultrasound therapy in management of stiff elbow joint resulted from several etiological factors. A total number of 42 patients (35 male and 7 female) allocated randomly from the Department of Physiotherapy at Al-yarmouk Teaching Hospital during 2013. Each patient examined physically by physiotherapist taking in consideration the measurement of the joint movement angle using goniometer in flexion and the extension, and the pain score using visual analogue scale (VAS). Ultrasound therapy initiated thrice weekly for two weeks. At the time of entry, the means degree of flexion and extension movements were 148.45 and 113.33°. Ultrasound therapy significantly reduced the pain from of 1.238 ± 0.932 to 0.38 ± 0.538 score. Significant improvement observed in patients aged more than 20 years and the improvement in flexion elbow significantly correlated with the frequency of ultrasound. In Conclusions ultrasound therapy is safe, effective and provided pain relieve as well as wide range of movement in post-traumatic elbow stiffness.

Key words

Elbow stiffness,
ultrasound therapy,
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تأثير المعالجة القصيرة الأمد بالأمواج فوق الصوتية لتيبس مفصل المرفق

فرع شلال نده

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الخلاصة

من الصعب معالجة تيبس مفصل المرفق والذي يتجم من عواقب شدة خارجية او التهاب المفاصل التنكسي. هدفت الدراسة الى اظهار فعالية استعمال المعالجة بالأمواج الصوتية في معالجة تيبس مفصل المرفق الناتج من عدة عوامل مسببة. تم تعيين 42 مريضاً بصورة عشوائية (35 ذكر و 7 أنثى) من قسم العلاج الطبيعي التابع الى مستشفى اليرموك التعليمي خلال 2013. تم فحص كل مريض سريريا من قبل المعالج الطبي أخذاً بنظر الاعتبار زوايا حركات المفصل بواسطة goniometer عند وضع الأحناء والأمتداد , واحتساب نتيجة الألم بأستعمال مدرج الألم المائل البصري. تم تكرار المعالجة ثلاث مرات اسبوعياً لمدة اسبوعان. عند بدء الدراسة كانت معدلات درجة الأحناء والأمتداد للحركات 148,45 و 113,33 درجة. قللت المعالجة بدلالة نوعية متميزة مقدار الألم من $1,238 \pm 0,932$ الى $0,38 \pm 0,538$ كما لوحظ ان التحسن يكون بدلالة نوعية متميزة عند المرضى الذين تتجاوز أعمارهم 20 سنة وان التحسن في حركة الأحناء تترابط مع تكرار الأمواج فوق الصوتية بدلالة نوعية متميزة. نستنتج ان المعالجة بالأمواج فوق الصوتية آمنة وفعالة وتزيل الألم كما وانها تتيح مدى واسع من الحركة للمفصل المتيبس.

Introduction

Elbow joint has high degree of articular congruity and this conformity of the joint predisposes to limitation in

range of movement after articular injury. Therefore, stiffness of elbow joint is hard to treat. It can result from developmental abnormalities, burn

contractures, ossification followed neural axis trauma or degenerative arthritis [1]. Some authors attributed the causes of stiff elbow extrinsic and intrinsic contractures depending on the involvement of joint surfaces. The late sequel of trauma to elbow joint is commonly lead to stiffness of elbow [2], but may resulted from perturbations of bone, soft tissue, or a combination of both that may or may not follow a traumatic event [1]. The classification of primary elbow stiffness based to the structure impeding elbow motion i.e. Kay's classification or on the etiology and its anatomic location i.e. Morrey's classification [5, 6]. People with stiff elbow experienced pain that usually occurred at the end range of flexion or extension movement such as carrying a heavy object with the arm hanging or while attempting to dress, groom, or eat [8]. Management of stiff elbow needs to achieve a pain-free, functional, and stable elbow by approaching the patient either non-surgically or by operative modalities. Non-operative treatment modalities such as electrical stimulation and physical therapy are the mainstays of treatment [4, 11]. Ultrasound is one of the most well-known and applied forms of therapy in physical technology [10]. The energy transmitted to the tissue in form of a sound wave by means of a "head" or transducer with typical frequency between 0.8 and 3 MHz. Not all tissue absorbs the ultrasound energy to the same degree, connective tissue (collagen) with a high degree of denseness such as ligaments, tendons, fascia, joint capsules and scar tissue absorbed the ultrasound energy. In one study carried on patients with subacromial impingement syndrome, ultrasound therapy reduced visual analogue scale of pain, shoulder pain and disability index and sleep

interference index after three months of treatment. This study aimed to demonstrate the effectiveness of using ultrasound therapy in management of stiff elbow joint resulted from several etiological factors.

Material and methods

This study conducted in the Department of Physiology, Medical Physics, College of Medicine at Al-Mustansriya University, in Baghdad, Iraq during 2013. The study approved by the local scientific committee obtained in the institute. A verbal consent form obtained from each patient prior to the admission into the study. The eligible patients of this study were both genders of whatever age. The criteria of inclusion were elbow joint stiffness following trauma, un-used and bone fractures at site of elbow joint. The patients allocated randomly from the Department of Physiotherapy at Al-Yarmouk Teaching Hospital. The patients referred for physiotherapy because of joint stiffness and limitation of movement. Each patient was examined physically by physiotherapist taking in consideration the measurement of the joint movement angle using goniometer in flexion and the extension, and the pain score using visual analogue scale (VAS). These measurements were taken before and after application of ultrasound waves. The frequency of ultrasound waves ranged between 1 and 3 Hz at 1-3 watt/cm³ for 6 minutes thrice weekly and for two weeks i.e. six rounds.

Statistical analysis

The results are expressed as number (%) and whenever possible as mean \pm SD. The data analyzed using two-tailed "t" test and simple correlation test taking the $p \leq 0.05$ as the lowest limit of significance.

Results

Table 1 shows the characteristics of the study. Most of the cases were male gender (84.1%), and thirteen of them were currently smokers. The duration of elbow joint stiffness ranged between 0.33 and 6 months. The most common cause of joint stiffness was bone fractures of bones related to elbow joint. At the time of referral to the unit of rehabilitation, the means degree of flexion and extension movements were 148.45 and 113.33. Fig. 1 shows the effect of different forms of physiotherapeutic tools on the pain which was significantly reduced from the severity score of 1.238 ± 0.932 to

0.38 ± 0.538 respectively. Further analysis of the data taking the age factor in consideration, the results showed that there were no significant differences between patients < 20 years and those > 20 years in characteristics of patients whereas significant differences of the effect of physiotherapy on the elbow joint stiffness in patients > 20 years old (Table 2). The beneficial effect of physiotherapy on the elbow joint movement; flexion and extension was related to the frequency of ultrasound particularly the flexion movement ($r=0.234$, $df=40$, $p > 0.05$) (Fig.2).

Table 1: Characteristics of the study.

| | |
|-----------------------------|--------------|
| Gender (M:F) | 35:7 |
| Age (year) | 25.2±14.0 |
| Current smoking | 13(31%) |
| Alcohol drink | 0 |
| Chief complaint (stiffness) | |
| Duration (month) | 1.309±1.031 |
| Causes | |
| Trauma | 3(7.14) |
| Un-used | 2(4.76) |
| Fracture | 36(85.71) |
| Flexion angle (degree) | 148.45±24.43 |
| Extension angle (degree) | 113.33±17.55 |

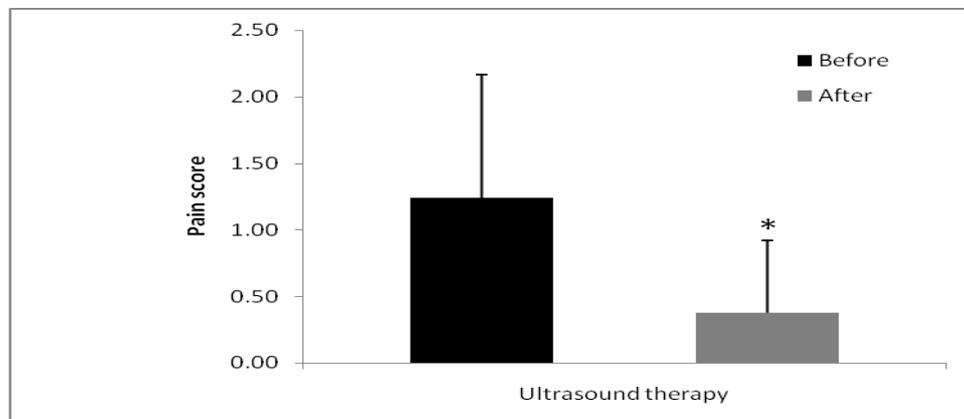


Fig. 1: Ultrasound treatment on the pain score resulted from stiffness of elbow joint..
* $p < 0.001$.

Table 2: Effect of ultrasound therapy on elbow stiffness in considerations the interaction of age and other characteristics.

| | < 20 years (n=17) | > 20 years (n=25) |
|--------------------------|----------------------|----------------------|
| Age (year) | 12.23±4.07 | 34.0±11.11 |
| Duration (month) | 1.117±0.332 | 1.44±1.304 |
| Causes of stiffness | | |
| Trauma | 0 | 3 |
| Un-used | 0 | 2 |
| Fracture | 17 | 19 |
| Flexion angle (degree) | 155.88±18.47 | 143.4±26.95 |
| Extension angle (degree) | 112.94±16.20 | 113.6±18.73 |
| Pain score | | |
| Before ultrasound | 1.352±1.057 | 1.16±0.85 |
| After ultrasound | 0.588±.618 | 0.24±0.435* |

The results presented as number, mean ± SD, * $p < 0.05$ in comparison with patients under 20 years old.

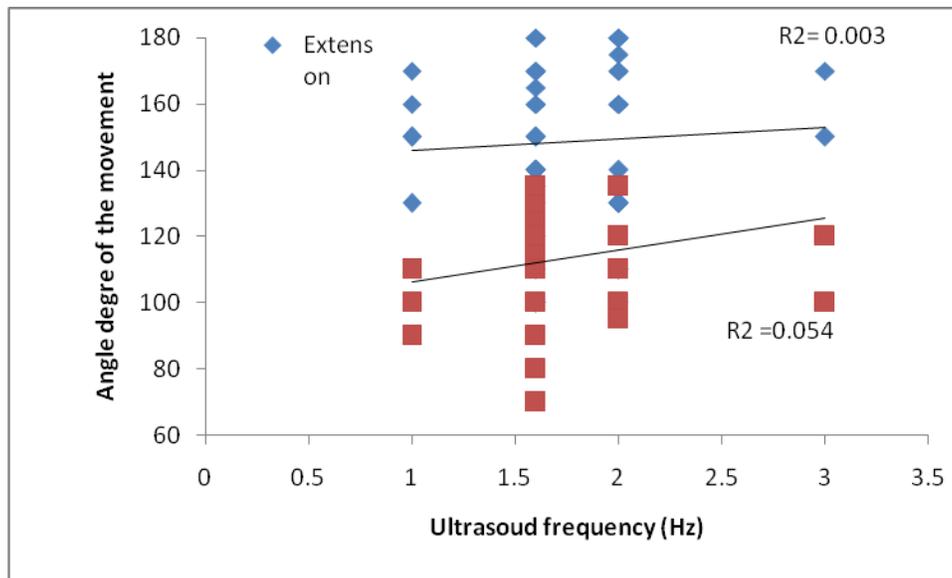


Fig. 2: Correlation between the ultrasound frequencies used to relieve elbow stiffness and the initial angle degree of flexion and extension.

Discussion

The results of this study demonstrate the effectiveness of ultrasound therapy as a part in management of stiff elbow joint. Ultrasound therapy improves the movement of elbow joint and reduced the pain score based on the age and the frequency of ultrasound application. Ultrasound physical

therapy applied in a large variety of skeleton-muscular disorders with different response rate of benefit [3]. In this study the effect of the ultrasound did not relate to its thermal effect because all the patients presented with stiffness followed fractures and there is no evidence of inflammation

[12]. The significant beneficial effect of ultrasound observed in patients aged more than 20 year that does not agree with previous study showed no significant correlation between age, gender and the beneficial effect of ultrasound therapy [7,13]. Significant improvement in flexion of elbow that correlated with the frequency of application highlights the use of such therapy in stiff elbow and avoids the surgical approach. Pederzini *et al* reported that arthroscopic procedures included: synovectomy, debridement of osteophytes, removal of loose bodies, anterior and posterior capsulectomy, radial head excision resulted in improvement in the range of movements by 33° post-traumatic and 20° in degenerative elbow stiffness[9]. Limitations in this study are short duration of ultrasound application i.e. two weeks in this study; variation in the presenting symptoms after trauma and the study not controlled.

Conclusions

It concludes that ultrasound therapy is safe, effective and provided pain relieve as well as wide range of movement in post-traumatic elbow stiffness.

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