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The application of matrix rhythm therapy as a new clinical modality in burn physiotherapy programmes

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ABSTRACT

Purpose: The aim of the present study was to investigate the use of matrix rhythm therapy (MRT) as one of the electrotherapeutic modalities in clinics.
Methods: This study was carried out in the Burn and Wound Treatment Department of Dr. Lütfi Kırdar Kartal Education and Research Hospital in Istanbul between October 2010 and August 2011. A treatment protocol including whirlpool, MRT and exercise was applied to a group of patients who had burn injury of upper extremity. The evaluation of each patient included assessment of pain, range of motion, muscle strength, skin flexibility and sensory function at pre- and post-treatment.
Results: There was no significant difference in values of pain, muscle strength and flexibility between pre- and post-treatment assessments ($p > 0.05$). A significant increase was found in the range of motion and sensory function at pre-treatment according to post-treatment ($p < 0.01$).
Conclusion: The usage of MRT in order to maintain and improve the range of motion and to minimise the development of scar tissue was investigated in this study. We suggest conducting randomised controlled studies that carry out a comparison of the MRT with other treatment modalities with more cases and investigate the long-term effects of MRT.

Burn injuries that are caused by hot liquids, flame, electricity and corrosives such as acid are very common [1]. Unprecedented survival rates in burn injuries derived from advances in the medical and surgical management and produced an ever-increasing number of burn survivors with more complex rehabilitation needs [2]. Rehabilitation is a comprehensive process requiring multiple team members who strive to optimise a patient's recovery of their physical and psychosocial skills needed to return to their families, daily lives and community [2].

Burn injuries bring about long-term health problems in burn rehabilitation. General physical symptoms after a burn injury are pain, sensory dysfunction, pruritus and loss of strength [3]. Additionally, hypertrophic burn scar remains a problematic challenge for burn survivors and providers [2]. Burn scars are treated by means of pressure therapy, application of physical agent modalities, massage and exercise [4]. One of the therapeutic modalities used in burn rehabilitation is matrix rhythm therapy (MRT). A treatment device that activates and rebalances specific physiological vibrations of skeletal muscles and nervous system was improved by Dr. Ulrich Georg Randoll [5] and settles on the fact that cells rhythmically oscillate as long as they are alive [6]. Hence, characteristics of oscillation, frequency and

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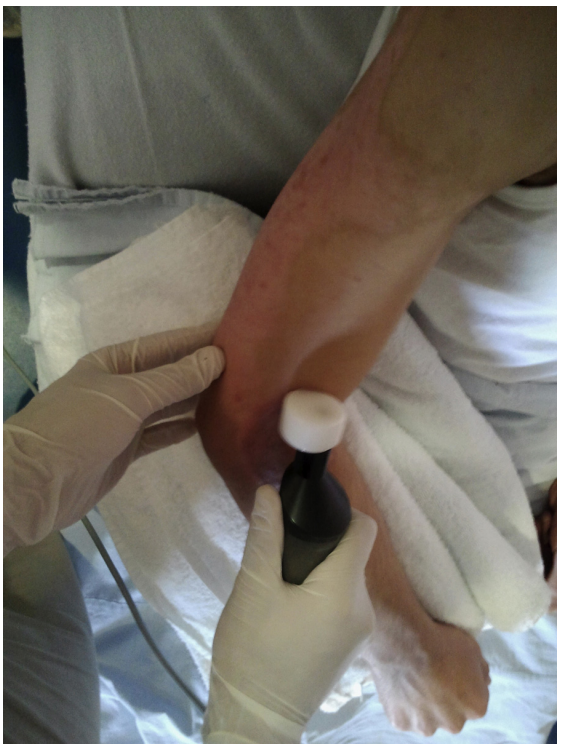

Fig. 1 – The application of Matrix Rhythm Therapy.

amplitude spectrum of 8–12 Hz are used therapeutically [6]. It has been proposed that the MRT device rebalances the cellular micro-processes depending on entire cellular regeneration and healing acting on the basis of cell biology by way of rhythmic micro-stretching [7]. The application of MRT is shown in Fig. 1. The overall goals of burn rehabilitation when it comes to scar management are to depress the scar's height, which is attempted by exerting pressure on the scar, and to maintain scar pliability, which in turn contributes to maintaining the patient's mobility and range of motion [4].

The practices of physical therapy vary widely among institutions. 'Best practice' or 'standard of care' for physiotherapy and rehabilitation evaluation and treatment for patients who have burn injuries have still been uncertain [2]. Therefore, the lack of burn rehabilitation guidelines forces the burn therapists to select therapy modalities in the process of rehabilitation and causes them to form their own treatment plans. Holavanahalli et al. [8] stated that 97% of burn therapists who were administered a survey in four countries reported formulating their own treatment plans, whereas only 3% reported taking directions from someone [8,9].

The aim of the present study was to investigate the use of MRT as one of the electrotherapeutic modalities in clinics.

1. Methods

This study was carried out in the Burn and Wound Treatment Department of Dr. Lütfi Kırdar Kartal Education and Research Hospital in Istanbul between October 2010 and August 2011. Patients who were included in this study were those with second- and third-degree burns and in the period between 1 and 3 months post burn trauma. The distribution of burned areas and status of skin grafting of burn-injured patients is shown in Table 1.

When the trauma histories of cases are examined, there were four flame burns, six scald burns, one electrical burn and one hot surface burn of 12 total cases, which were different types of burns. All subjects had been using pressure garments throughout the treatment.

A treatment protocol was applied to a group of patients who had burns of the upper extremity and registered in the hospital during this period. The treatment protocol included whirlpool, MRT and exercise therapy. The details of the physiotherapy treatment programme are shown in Table 2.

The treatment protocol was initiated with whirlpool (WhirlpoolBath, Carci, São Paulo, Brazil) application. After whirlpool application, MRT (MaRhyThe® Applikator&Steuergerat, MaRhyThe® Systems GmbH, Gröbenzell, Germany) was performed by the physiotherapists who participated in the training programme on MRT and were certificated. A new therapeutic and clinical modality, matrix rhythm treatment, which activates and rebalances specific physiological vibrations of skeletal muscles and nervous system, was improved by Dr. Ulrich Georg Randoll [5]. It is applied by an electrically powered oscillator (resonator) comprising an asymmetric

Table 1 – The distribution of burned areas of burn injured patients.

Subjects	Age (year)	Skin grafting	Burn area					
			Right hand	Left hand	Right forearm	Left forearm	Right arm	Left arm
1	39	+	+	+	+	+	+	+
2	39	+	+	+	+	+	+	+
3	41	+	–	+	–	–	–	–
4	24	–	+	+	–	–	–	–
5	39	+	–	–	–	–	+	–
6	36	+	+	–	+	–	+	–
7	45	+	+	–	+	–	–	–
8	40	+	+		+	–	+	–
9	60	+	–	+	–	+	–	+
10	50	+	+	–	–	–	–	–
11	55	+	+	–	+	–	–	–
12	35	+	+	–	+	–	–	–

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Table 2 – Physiotherapy treatment points.

Days per week	5 (except for Saturdays and Sundays)
Duration of therapy	3 weeks
Duration of whirlpool	15 min
Duration of matrix rhythm therapy	Variable depending on the size of the region (15–45 min)
Exercise therapy	Particular active and passive range of motion exercises in order to reduce limitations of joints, stretching and strengthening exercises, proprioceptive neuromuscular stimulation techniques when needed

(cam-type) head whose mechanical oscillations are supplemented by a magnetic sinusoidal phase-synchronised field. These mechanical oscillations produce a visually detectable longitudinal motion in the musculature similar to that under muscle strain [10]. It was implemented to surrounding tissues and all tissues including scar tissue as a principle of basic application. During the therapy, care was taken not to implement application to on an open wound. After MRT, the treatment was finalised with exercise therapy. The exercise therapy consisted of particular active range of motion (AROM) and passive range of motion (PROM) exercises, stretching and strengthening exercises and proprioceptive neuromuscular stimulation techniques, and this was maintained for approximately 15 min.

Each patient was evaluated by the same physiotherapist twice at the beginning of 15 sessions of treatment and post-treatment. First assessments of all cases were evaluated within at least 1 month of the burn incident. The evaluation included pain assessment by visual analogue scale [1–10], range of motion by goniometer and muscle strength by myometer (Powertrack Commander II, ABD, J-Tech [11]). Of the therapists who measure extremity contracture, almost all (99%) reported using a goniometer often or sometimes in burn injury units of rehabilitation centres [12]. Therefore, a goniometer was used to evaluate the difference in the range of motion in our study. Skin flexibility was measured using a durometer (Schmidt Control Instruments, Waldkraiburg, Germany [13]) in millimetres and an increase in this measurement indicated a decrease in skin flexibility. Sensory function was measured by monofilament (Touch-Test™ Sensory Evaluator [14]) in grams and an increase in this measurement indicated a decrease in sensory function. For the monofilament measurement, it measures the weight at which the sensation of touch of the monofilament is realised.

Table 3 – Physical characteristics of patients.

	Age (years)	Weight (kg)	Height (cm)
Mean	41.91 ± 8.56	73.99 ± 15.87	168.33 ± 8.91
Range (minimum–maximum)	24–60	50–100	156–185

The statistical software of Statistical Product and Service Solutions (SPSS) for Windows was used for analysis. Wilcoxon signed-rank test was deemed appropriate to investigate the significant difference between variables instead of the Paired Samples T Test due to the number of cases (12 subjects). A value of $p < 0.05$ was considered as statistically significant. The results were expressed as mean value ± standard deviation ($X \pm SD$). The means of data of all repetitive measurements belonging to the same extremity were calculated in strength and flexibility assessments, and the mean of values of all assessed parts was calculated in range of motion and sensory assessments of each patient. This study was approved by the ethical committee of the Istanbul Dr. Lütfi Kırdar Kartal Education and Research Hospital, and informed consent was obtained from each patient for participation in the study. It was conducted in accordance with the rules of the Declaration of Helsinki.

2. Results

The mean age of 12 patients (eight male and four female) who participated in the study was 41.91 ± 8.56 (Table 3). The physical characteristics of patients with burns who were 66.67% male and 33.33% female are shown in Table 3.

There was no statistically significant difference in values of pain, muscle strength and flexibility between pre-treatment and post-treatment assessments ($p > 0.05$, Table 4). Although there was no significant difference, pain levels decreased and muscle strength and flexibility increased.

There was a statistically significant difference in values of AROM, PROM and sensory function between pre-treatment and post-treatment ($p < 0.01$, Table 4). There were an increase in AROM (13.40°) and an increase in PROM (12.56°) between pre-treatment and post-treatment assessments. There was a little but significant difference of 0.38 g in the values of sensory function between pre-treatment and post-treatment assessments. The delta of pre- and post-treatment data is also shown in Table 5.

Table 4 – Mean ± standard deviation values of pre and post-treatment assessments.

	Pre-treatment (mean ± SD)	Post-treatment (mean ± SD)	Delta (Δ)	%	Z	p
Pain (centimeter)	4.65 ± 2.39	3.78 ± 3.02	−0.87	−18.7	−1.258	0.209
Active range of motion (degree)	53.04 ± 32.37	66.44 ± 31.98	13.4	25.26	−2.934	0.003*
Passive range of motion (degree)	71.01 ± 26.67	83.57 ± 26.05	12.56	17.68	−2.803	0.005*
Muscle strength (Newton)	65.80 ± 26.64	72.70 ± 19.95	6.9	10.48	−1.490	0.136
Flexibility (millimeter)	18.10 ± 6.90	17.34 ± 3.53	−0.76	−4.19	−0.314	0.754
Sensory function (gram)	0.71 ± 0.64	0.37 ± 0.33	−0.34	−47.88	−2.432	0.015*

* $p < 0.05$.

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Table 5 – Data of pre and post-treatment assessments of the cases.

Subject	Pain		Active ROM (degree)		Passive ROM (degree)		Muscle strength (Newton)		Flexibility (millimeter)		Sensory function (gram)	
	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post
1	6.7	4.2	82.0	97.0	91.0	106.0	31.2	44.7	27.3	21.2	0.925	0.519
2	6.7	4.2	137.0	137.0	137.0	137.0	43.1	56.2	30.4	23.5	0.815	0.330
3	8.2	9.8	36.7	47.5	48.1	61.5	46.5	47.6	10.0	11.7	0.302	0.106
4	0.9	4.4	60.9	72.2	85.4	85.4	114.8	93.9	17.4	16.8	0.235	0.140
5	6.6	4.8	72.5	106.2	90.0	116.2	34.2	76.8	17.4	17.0	1.866	2.133
6	1.5	0	40.9	64.7	59.5	81.6	89.4	92.6	21.1	17.6	0.130	0.085
7	2.1	1.7	44.1	46.8	57.7	62.7	96.1	107.0	12.3	15.2	2.052	0.760
8	4.5	2.8	34.4	47.3	65.5	87.2	65.6	55.0	21.7	22.7	0.235	0.336
9	5.8	3	49.1	63.6	62.5	86.5	84.5	77.2	10.2	16.5	0.571	0.702
10	6.2	8.7	36.8	46.4	68.5	74.1	44.3	61.9	14.0	16.0	0.287	0.070
11	2.8	0	17.1	42.5	48.4	57.5	69.6	72.5	11.1	13.3	0.261	0.157
12	3.9	1.8	25.0	26.1	38.6	47.2	70.4	87.0	24.3	16.6	0.780	0.161

3. Discussion

Scar tissues of cases including in the research were in the hand (25.0% of cases), hand and forearm (25.0% of cases), hand, forearm and arm (41.6% of cases) and only arm (8.4% of cases). The majority of contractures were shown to occur in the hand, head, neck and axilla in a research that investigated the regional distribution of scar tissue improving in burn cases [15]. The hand is more susceptible to burn injuries than other organs (83% of our patients suffered from hand injury), because its use as a functional tool brings it into contact with potentially hazardous activities. In addition, hands are used to protect the rest of the body from injury or assault [1]. Similar to the study by Goel et al., there were patients who had the scar tissue mostly in their hand in the research that included only the patients with upper extremity burns [16].

The patients assessed in the study were those with second- and third-degree deep burns. Except for the superficial dermal burns, all deeper burns (second-degree deep dermal and full thickness) heal by scarring. This scarring can only be minimised by various physical therapy approaches and plastic surgical procedures but not eliminated completely [16]. There are no completely effective tools to control hypertrophic scars [17]. The investigators performed studies including ultrasound [18], laser [19], exercise [1] and pressure garments [20] to prevent or reduce the development of scar contractures that investigate the efficiency of therapeutic modalities in the process of burn rehabilitation. There was no study that investigated the effect of MRT on burn rehabilitation.

The most immediate goal of physiotherapy in this period is to preserve the range of motion and function [4]. There was significant difference in values of AROM and PROM between pre-treatment and post-treatment. One of the short-term goals of physiotherapy was obtained by this result. The ineffectiveness of soft tissue mobilisation over a range of motion throughout physiotherapy was demonstrated in the study of Silverberg and colleagues [12]. In another study, it was determined that there was an increase in the range of motion of shoulder joint with MRT in patients with shoulder problems [21].

Stretching exercises with MRT were implemented to improve the range of motion and to provide elongation in scar tissue rather than improving the muscle strength because of MRT accelerating cell regeneration in scar tissue [6]. Gains in AROM and PROM can be also readily attained with whirlpool application or exercise therapy. It is possible that these improvements could have occurred over time without MRT, as no control group without treatment was included. New studies that compare different treatment methods are needed to understand the results and the effects of MRT with the application of stretching exercises.

The aim of our study was to investigate the use of MRT as one of the current electrotherapeutic modalities in clinics. In our study, although there was no statistically significant difference in durometer assessment, there was nearly a 1-mm decrease or, in other words, an increase in flexibility. Scar formation is a result of the wound-healing process in burn patients, and a decrease in flexibility could be observed with scar formation in burn clinics [22]. According to the study by Webb et al., specific ultrasound in an effort to stimulate wound healing seemingly forms no part of burn therapy [19]. Silverberg et al. [12] have showed no benefit to scar massage over scar tissue in the physiotherapy treatment programmes. A slight increase instead of decrease in flexibility assessed at the body parts where scar tissue is consistent showed that flexibility is maintained with the use of MRT in our study, and we thought that this increase is an achievement in accordance with the treatment aims. In addition, the improvement of skin flexibility may be a result of using pressure garments.

Burn patients' problems include pain [23], sensory deficiency [13] and loss of muscle strength [24]. Although there was no statistically significant difference in pain levels, burn patients' pain levels decreased in our study. Stretching exercises that caused pain during therapy could be the reason why the decrease in pain was not remarkable. In a similar study, Byers et al. showed that burn patients report higher levels of pain during procedures than at rest [23].

When the result of the study was examined, an improvement in grams of 0.34 was observed in the monofilament assessment of cases. This improvement in sensory function could be derived from the micro-massage effect of MRT [25]. According to what is claimed, MRT operates on the basis of cell

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biology via micro-stretching and rebalances cellular micro-processes on which cellular healing depends [25]. Furthermore, the gains of patients may be a direct result of MRT modality or a function of the normal healing process. Any study that investigates the effects of treatment modalities on sensory functions in burn-injured patients has not been found in the literature.

Although there was an increase of 6.90 N in muscle strength, there was no significant difference in values between pre-treatment and post-treatment assessments. A significant difference was not expected in muscle strength, because maintaining or improving the range of motion [4] and increasing the flexibility of the scar tissue [2] are the objectives of the short-term physiotherapy programme at the end of 3 weeks. The reason to examine the muscle strength is to find out whether objectives, such as prevention of loss of muscle strength and protection of muscle strength at the best degree, have been achieved or not, in this 3-week period. Muscle strength indicates prominent improvement in a period of 4–6 weeks [26]; therefore, studies need to be performed in order to present alterations in muscle strength of burn-injured patients throughout the physiotherapy programme.

One of the limitations of our study is that it did not compare the effectiveness of MRT with other treatment modalities. Another limitation of the study is the small number of cases.

4. Conclusion

The usage of MRT in order to maintain and improve the range of motion and minimise the development of scar tissue was investigated in this study. The results of the study, that pain, range of motion, flexibility and sensory assessments were realised, pointed out significant improvement in the range of motion and sensory function. Although there was no improvement in the range of motion, any significant change was not observed in flexibility that had been affected by the occurrence of scar tissue.

We suggest conducting randomised controlled studies that carry out a comparison of the MRT with other treatment modalities with more cases. For the purpose of determining the effectiveness of MRT more clearly in burn rehabilitation, the studies investigate the long-term effects in other parts of the body with serious burn scars post burn injuries besides the short-term effects of MRT.

Conflict of interest statement

All authors in this study do not have any financial and personal relationships with other people or organisations that could inappropriately influence their work.

Role of funding source

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