

Neuromuscular taping reduces blood pressure in systemic arterial hypertension



M. Shah^{a,b}, P.O.O. Julu^{a,b}, J.A. Monro^a, J. Coutinho^c, C. Ijeh^a, B.K. Puri^{d,*}

^a Breakspare Medical Group, Hemel Hempstead, Hertfordshire, UK

^b Queen Mary University of London and the William Harvey Research Institute, Barts and the London School of Medicine, UK

^c School of Physiotherapy, Escola Superior de Saúde – Politécnico do Porto, Portugal

^d Department of Medicine, Imperial College London, UK

ARTICLE INFO

Keywords:

Hypertension
Neuromuscular taping
Autonomic nervous system

ABSTRACT

Systemic arterial hypertension, a well-known cause of morbidity, is associated with dysfunction of the autonomic nervous system. Neuromuscular taping (also known as kinesio taping, medical taping and Vendje neuromuscular) allows movement and muscle activity to treat pain, muscle disorders and lymphoedema, in which its mode of action may involve muscular stimulation leading to increased local blood circulation or stimulating dermatological, muscular and fascial structures with a form of passive massage. We hypothesised that neuromuscular taping may reduce blood pressure in systemic arterial hypertension. This hypothesis was tested by carrying out the first pilot study of its kind to determine whether the non-invasive technique of neuromuscular taping can reduce blood pressure in patients suffering from systemic arterial hypertension. Neuromuscular taping was symmetrically applied to the back, between C1 and T2, of seven hypertensive patients for 5–7 days. Cardiovascular autonomic parameters were assessed at baseline and at the end of the study. Taping was associated with falls in mean arterial blood pressure ($p = .001$), mean systolic blood pressure ($p < .01$), mean diastolic pressure ($p < .01$) and cardiac vagal tone at rest ($p = .063$). The beneficial effects on blood pressure appeared to last for at least five days post-neuromuscular taping. There is an indication, given the reduction in cardiac vagal tone at rest, that the mechanism of action of this intervention involves modulation of the brainstem parasympathetic system during cardiovascular control. Further studies are indicated to replicate the present findings, further investigate the effects of taping on autonomic functioning, and establish the optimum time-period and taping positioning.

Introduction and background

Systemic arterial hypertension, which is a well-known cause of morbidity, is associated with dysfunction of the autonomic nervous system [1]. Kase and colleagues pioneered the use of neuromuscular taping (also known as kinesio taping, medical taping and Vendje neuromuscular) to allow movement and muscle activity to treat pain, muscle disorders and lymphoedema [2,3]. The mode of action of neuromuscular taping in such cases may involve muscular stimulation leading to increased local blood circulation or simply stimulating dermatological, muscular and fascial structures with a form of passive massage [4].

The hypothesis

In light of the fact that neuromuscular taping affects the autonomic

nervous system, and may lead to increased local blood circulation, we hypothesised that neuromuscular taping may reduce blood pressure in systemic arterial hypertension.

Evaluation of the hypothesis

This hypothesis was tested by carrying out a pilot study (the first study of its kind) to determine whether or not the non-invasive technique of neuromuscular taping can reduce blood pressure in patients suffering from systemic arterial hypertension.

Seven hypertensive patients (two male, five female; mean (standard error) age 57.3 (8.1) y) were studied. Their summary baseline systemic systolic, diastolic and mean arterial blood pressures are given in Fig. 1 and Table 1. Two of the patients had been taking antihypertensive medication and were asked not to change this during this study. The study followed the Helsinki Declaration regarding clinical research on

* Corresponding author at: Imaging Directorate, Hammersmith Hospital, Du Cane Road, London W12 0HS, England, UK.
E-mail address: basant.puri@imperial.ac.uk (B.K. Puri).

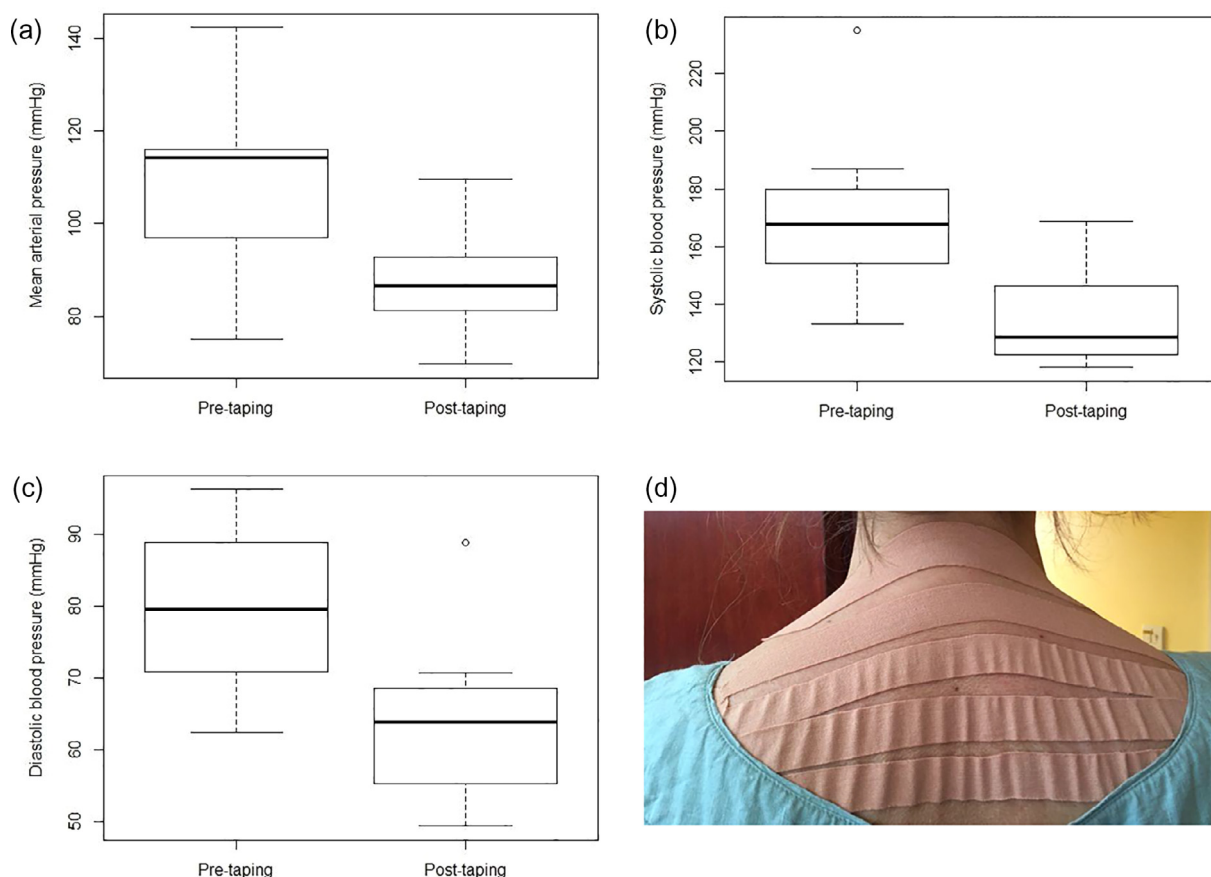


Fig. 1. Boxplots of pre- and post-neuromuscular taping (A) mean arterial blood pressure, (B) systolic blood pressure and (C) diastolic blood pressure. (D) shows the positions of the neuromuscular tapes after application, when the patient is at rest.

Table 1
Cardiovascular autonomic parameters pre- and post-taping.

Autonomic measure	Pre-taping mean (standard error)	Post-taping mean (standard error)	<i>p</i>
Arterial systolic blood pressure (mmHg)	172.0 (12.6)	136.1 (7.1)	.0099
Arterial diastolic blood pressure (mmHg)	79.7 (4.6)	64.3 (5.0)	.0032
Mean systemic arterial blood pressure (mmHg)	108.2 (8.0)	87.7 (4.8)	.0014
Cardiac rate (min ⁻¹)	69.8 (4.8)	67.9 (4.9)	.1595
Cardiac sensitivity to baroreflex (ms mmHg ⁻¹)	3.67 (1.21)	3.47 (1.13)	.6043
Cardiac contractility (arbitrary units)	857.1 (84.0)	869.7 (93.3)	.9138

human subjects, and all participants gave their written informed consent to the neuromuscular taping.

The skin over and between the scapulae was cleaned, and, if present, coarse hair was removed by shaving. This area was maximised by movement of the shoulder joints and four to five strips (the number depending on the height of the patient) of neuromuscular tape (Cure Tape® (www.aneid.com)) were firmly applied, without stretching. The rostral strips stretched laterally between the skin covering the resting positions of the left and right supraspinatus muscles, as rostral as C1, while the caudal strips stretched between the skin covering the resting positions of the infraspinatus muscles, as caudal as T2 (see Fig. 1). Each neuromuscular strip was 3.75 cm in width and composed of elastic cotton with an anti-allergic acrylic adhesive layer. Following application, the shoulders were relaxed.

Cardiovascular autonomic assessment was carried out immediately

before application of the neuromuscular tapes using the NeuroScope™ (MediFit Instruments Ltd, London, UK) [5]; the assessment was repeated at the end of the study, five to seven days later. The subjects were examined in a quiet laboratory with subdued lighting at a room temperature of 24 °C ± 1 °C. The patients were in a relaxed state before blood pressure measurements were carried out while the patients were reclined, while they were supine and during deep breathing. The following autonomic parameters were also recorded while the patients were at ease and fully relaxed in a supine position: arterial systolic and diastolic blood pressures, cardiac rate, cardiac vagal tone at rest, cardiac sensitivity to baroreflex, and cardiac contractility.

The cardiac sensitivity to baroreflex is defined as the increase in pulse interval per unit increase in systolic blood pressure and quantifies the negative feedback control of blood pressure beat by beat. The method allows detection of rapid changes in cardiac sensitivity to baroreflex in real time within a continuous measurement. It therefore facilitates the measurement of sudden changes in responses and is useful for monitoring whether or not this parasympathetic function of the brainstem is fully engaged during cardiovascular control at any one moment. The cardiac vagal tone, defined as “pulse synchronised phase shifts in consecutive cardiac cycles”, is a form of pulse interval variability that is quantified in real time by the NeuroScope as previously described [6]. These are also continuous data measured in real time and allow measurements of sudden or rapid changes in responses and can be used for monitoring the activity of the brainstem parasympathetic system during cardiovascular control. The electrocardiogram for deriving all the cardiovascular indices was recorded via three chest leads conforming to Einthoven’s Lead II. Non-invasive blood pressure waveform was quantified continuously using volume-clamp photoplethysmography through a finger cuff, which is part of the Finapres™ system (Ohmeda, Eagleswood, USA). All raw data including the arterial

blood pressure waveform were fed into the NeuroScope for further processing and derivation of the autonomic indices in real time using the VaguSoft™ software (Medifit Instruments Ltd, London, UK). The blood pressure waveform provided values for the systolic, diastolic, lowest (just before the ejection period of cardiac cycle) and mean arterial pressures (arithmetic mean arterial pressure during the whole cardiac cycle). The instantaneous cardiac rate was calculated from the intervals between consecutive electrocardiographic R-waves (R-R intervals).

The software package used for the statistical analyses was R version 3.0.1, running on an x86_64-w64-mingw32/x64 (64-bit) platform [7]. All tests were two-tailed.

The results of the pilot study are shown in Table 1 and Fig. 1. Neuromuscular taping was associated with a significant reduction in mean systolic blood pressure ($t = 3.716$, $df = 6$, $p < .01$), mean diastolic pressure ($t = 4.7414$, $df = 6$, $p < .01$) and mean arterial blood pressure ($t = 5.6195$, $df = 6$, $p = .001$).

The data for the cardiac vagal tone at rest were not normal. The median (interquartile range) pre-neuromuscular taping vagal tone was 4.510 (3.240–4.985) (arbitrary units), while the corresponding post-neuromuscular taping figures were 2.910 (2.440–4.535) (Wilcoxon signed rank test, $V = 25$, $p = .063$).

Discussion

The results of this first pilot study of the effects of neuromuscular taping on systemic arterial blood pressure in hypertensive individuals provide evidence that this non-invasive intervention is associated with a reduction in systolic, diastolic and mean arterial blood pressures. The beneficial effects on blood pressure appeared to last for at least five days post-neuromuscular taping.

There is an indication from this study, given the reduction in cardiac vagal tone at rest associated with the neuromuscular taping, that the

mechanism of action of this intervention involves modulation of the brainstem parasympathetic system during cardiovascular control.

Further studies are indicated in order to replicate the present findings and further investigate the effects of neuromuscular taping on autonomic functioning. It would also be useful to establish the optimum time-period and positioning of neuromuscular taping for the treatment of systemic arterial hypertension.

Grant support

Nil.

Conflicts of interest

JC is an instructor on the use of neuromuscular taping, for example in speech therapy.

References

- [1] Iscen S. Autonomic nervous system and hypertension. *Eur Rev Med Pharmacol Sci* 2016;20:201.
- [2] Kase K, Stockheimer KR. *Kinesio taping for lymphoedema and chronic swelling*. Albuquerque, N.M.: Kinesio USA; 2006.
- [3] Kase K, Hashimoto T, Okane T. *Kinesio Taping Association. Kinesio taping perfect manual: amazing taping therapy to eliminate pain and muscle disorders*. Japan: Kinesio USA; 1998.
- [4] Gonzalez-Iglesias J, Fernandez-de-Las-Penas C, Cleland JA, Huijbregts P, Del Rosario Gutierrez-Vega M. Short-term effects of cervical kinesio taping on pain and cervical range of motion in patients with acute whiplash injury: a randomized clinical trial. *J Orthop Sports Phys Ther* 2009;39:515–21.
- [5] Julu PO, Witt Engerstrom I. Assessment of the maturity-related brainstem functions reveals the heterogeneous phenotypes and facilitates clinical management of Rett syndrome. *Brain Dev* 2005;27(Suppl 1):S43–53.
- [6] Little CJ, Julu PO, Hansen S, Reid SW. Real-time measurement of cardiac vagal tone in conscious dogs. *Am J Physiol* 1999;276:H758–65.
- [7] R Development Core Team. *R: A language and environment for statistical computing*. Vienna, Austria: R Foundation for Statistical Computing; 2013.