

[SYSTEMATIC REVIEW]

THE EFFECTIVENESS OF THE OSTEOPATHIC MUSCLE ENERGY TECHNIQUE IN TREATING ARTERIAL HYPERTENSION

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Introduction Arterial Hypertension (AHT) is a chronic disease, characterised by an increase in the normal levels of blood pressure. It has become more common in recent years across the world and is responsible for an increase in spending on health care.

Objectives: To determine whether or not there exists any evidence in the literature to support or refute the effectiveness and safety of applying different osteopathic techniques to treat arterial hypertension. Secondly to analyse the indications of applying the muscle energy technique (MET) to treat this disease. And thirdly to assess whether or not there exists any evidence in the literature related to the seriousness of AHT, based on its epidemiology and the implications it has on the cost of health care. We will also use the JADAD scale to assess the quality of the randomized clinical trials we review.

Materials and Methods: We carried out a systemic review of the Pubmed, Scopus and Teseo databases, as well as a selection of articles in biomedical journals. We applied certain selection criteria (inclusion and exclusion), followed by eligibility criteria, assessing the articles based on title, abstract, key words and the complete text.

Results: 38 articles, that met the required criteria, were selected from the 227 that were included. We scored each of the articles using the JADAD scale for methodological quality and 50% of the articles had an acceptable score.

Conclusions: The relevance of AHT as a disease is evident to see, as are the possibilities that osteopathy offers for reducing the healthcare costs that AHT brings and treating the disease using safe and effective procedures.

KEY WORDS

- › Hypertension.
- › Osteopathic manipulation.
- › Spinal manipulation.

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INTRODUCTION

Arterial Hypertension (AHT) is a truly relevant disease, as it is the most common chronic disease suffered around the world, affecting nearly 40% of all adults in developed countries¹. It is also one of the main modifiable cardiovascular risk factors and presents a serious Public Health issue in Spain and the rest of the world²⁻⁵.

The incidence rate of this disease has increased around the world. In fact, it is estimated that the prevalence of AHT will be 29% by the year 2025. In absolute terms, this would mean that the number of patients with hypertension would increase from 972 million in 2000 to 1.56 billion in 2025 across the world, which is an increase of approximately 160%⁶.

In the scientific literature, there are several studies on the positive (or at least not counter-productive) effects of applying osteopathic techniques to the cervical vertebrae (C0-C7)^{7,8}, on patients with hypertension. This is because of the relationship that exists between this segment of the spine, in which there are three sympathetic cervical ganglia, and the innervation of the heart⁸. Because of this relationship, we know that an osteopathic dysfunction in this area can have negative repercussions on the heart and that osteopathic normalisation of the cervical spine should be the objective in order to resolve the spinal cord facilitation⁹. This term, spinal cord facilitation, was coined by Korr^{10,11}, who described it as being responsible for the hyperexcitability of the neurons in the autonomic nervous system and capable of altering a patient's visceral physiology.

These osteopathic treatments with remote physiological effects are featured in the literature. The studies carried out by Mansilla Ferragud are a good example of this, showing that manipulating C0-C1-C2 immediately increases the patient's range of active mouth opening⁷. Morán Benito showed that maintaining pressure on the aortic valve for 90 seconds, in patients with hypertension, homogeneously reduces their systolic blood pressure¹². However, what we wish to analyse is whether or not any evidence has been published on the effectiveness and safety of applying osteopathic treatment to patients with arterial hypertension.

OBJECTIVES

The objectives of this review were: to determine the relevance of AHT as a disease, based on the healthcare costs it brings and the risk factor it presents for other diseases;

to analyse its high prevalence in developed countries (epidemiology); to look for effective osteopathic studies on AHT with no contraindications; to determine whether there is any published evidence for the effectiveness of the muscle energy techniques (MET) in treating AHT and to analyse the quality of the RCTs used for this systemic review, using the JADAD scale.

MATERIALS AND METHODS

We carried out a systematic literature review in order to establish a possible relationship between osteopathy and AHT. This review was carried out in 2012.

Research Strategy

This research was carried out using databases and biomedical journals. We searched for the terms hypertension, osteopathic medicine, muscle energy and thrust in both English and Spanish, across all of the articles selected for the study. The terms would be found if they appeared in the title, the key words or the abstract of the article.

We also searched the PUBMED, TESEO and SCOPUS (Scencedirect) databases, for the terms cervical manipulation, spine manipulation, osteopathic manipulative treatment, AHT and muscle energy technique either in isolation or combining them using the Boolean operators «AND», «OR» and «NOT».

Initial Search Results

We found a million articles across the three databases (Pubmed, Teseo and Scopus) by searching for the term AHT only so we had to use the Boolean operators to limit the results of the search. We found 69 articles in the *Osteopatía Científica* journal. Of these, we selected 3 studies containing the term AHT, 16 articles containing the term osteopathy and 9 containing the term thrust. We found 1,023 articles in the *Journal of Manipulative and Physiological Therapeutics (JMPT)*. We selected 9 studies containing the term thrust, 12 containing the term osteopathy and 3 containing the term muscle energy. We found 583 articles in *Manual Therapy*. Of these, we used 5 studies containing the term thrust. We found 143 articles from the *International Journal of Osteopathic Medicine (IJOM)*: 1 containing the term hypertension, 46 containing the term osteopathy and 7 containing the term thrust. We found 846 articles in *Medicina Clínica*. Of these, 52 contained the term hypertension.

Selection Strategy

In the first selection phase, we applied inclusion and exclusion criteria and in the second selection phase, we applied eligibility criteria. The articles selected in phase one ($n = 227$) met the following inclusion criteria: studies published in both Spanish and English, containing the terms osteopathy, manipulation, muscle energy, hypertension and/or thrust. We excluded articles published in any language other than Spanish or English, articles on a topic other than those listed in the inclusion criteria, articles unrelated to the objectives of this review, articles that included interventions carried out on animals and duplicates from another of the databases. In the second phase, we selected a total of ($n = 173$) articles that would be suitable for this study, excluding the remaining articles ($n = 54$). Finally, after reading the abstract and/or the entire text and analysing the content of each article, we selected 38 studies ($n = 38$). The rest ($n = 135$) were excluded on the grounds that they did not meet the objectives of our review (figure 1).

Assessing the scientific quality of the articles

The JADAD scale¹³ was used to assess the quality of the methodology used in each of the articles selected for this review, looking at features of the article related to bias, such as randomisation, blinding and clinical testing as the JADAD scale is known and has been credited for being simple, effective and easy to use. It is used to assess whether the methods of randomisation used in a study are appropriate, whether the study is double-blinded and whether the blinding is appropriate, as well as whether the study contains a description of the loss to follow-up. The way the JADAD scale is structured can be seen in table 1.

The maximum score for the JADAD scale is 5 points and the higher the score, the better the quality of the methodology of the RCT analysed. (5/5 Excellent, 4/5 Good, 3/5 Acceptable, 2/5 Poor).

RESULTS

We began with a sample of 173 studies ($n = 173$), after applying the selection criteria. We then applied the eligibility criteria, excluding a further

79.19%, leaving us with a sample size of 38 studies ($n = 38$)-20.81%. These 38 studies were then classified by theme into three categories: The relevance of AHT as a disease, based

on the healthcare costs it brings and its epidemiology; the effectiveness of the osteopathic approach to treating AHT and the effectiveness of applying the MET to treat AHT.

The relevance of AHT as a disease, based on the healthcare costs it brings and its epidemiology.

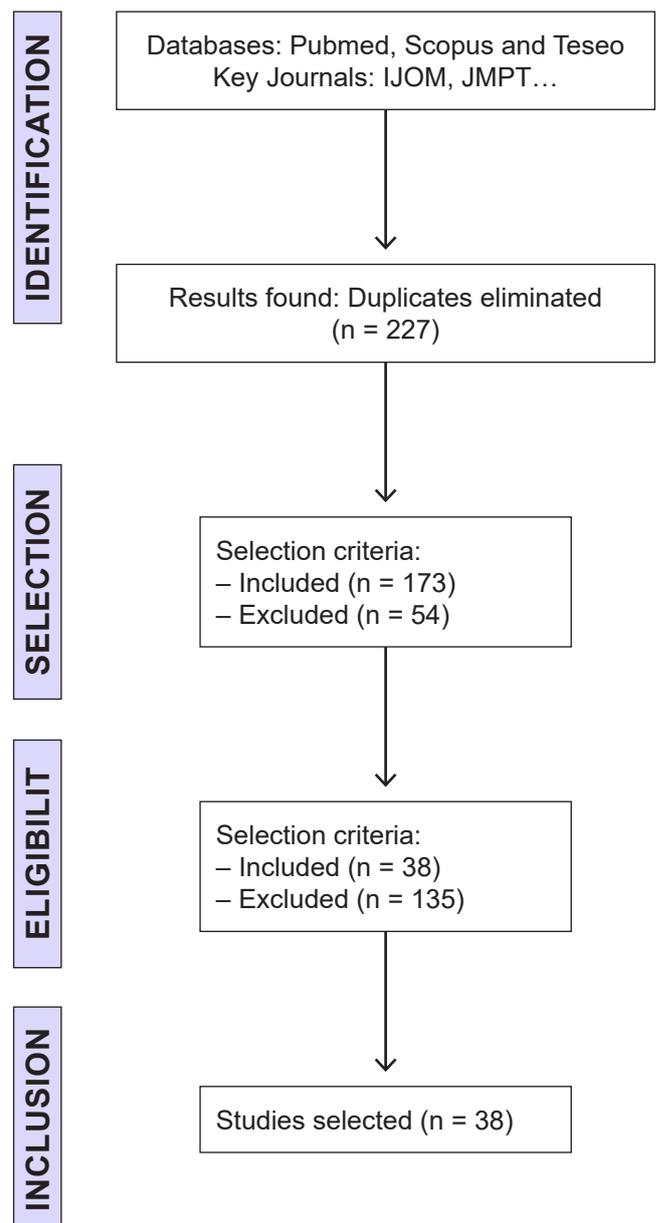


Figure 1. Flow diagram of articles, in accordance with the PRISMA statement for systemic reviews and meta-analyses, related to health care. Source: Own source.

QUESTION	YES	NO	INCORRECT
Is the study described as randomised?	1 point	0 point	
Is the method of generating a random allocation sequence described and is it correct?	1 point	0 point	-1 point
Is the study described as being double-blinded?	1 point	0 point	
Is the method of blinding described and is it correct?	1 point	0 point	-1 point
Is the loss to follow-up described?	1 point	0 point	

Table 1. JADAD scale scoring system.

AHT is one of the main risk factors for cardiovascular disease in any of its manifestations: cerebrovascular disease, coronary heart disease, heart failure, kidney failure and peripheral artery disease. Its prevalence among the adult Spanish population is 35%. This figure increases with age and reaches 68% in adults aged 60 or above. AHT is therefore a serious public health problem, especially in primary care where the majority of these patients are diagnosed and treated. These are the findings of authors such as Castiñeira and Banegas^{3,14}, Martín-Baranera¹⁵, Manuel Anguita¹⁶ and José L. Llisterri¹⁷. And beyond Spain, Benítez Camps¹⁸ has stated that AHT is one of the most prevalent risk factors for cardiovascular disease in the world. Banegas and Castiñeira cite that in Spain, 35-40% of the population suffers with AHT, its high morbimortality rate and its relationship with diabetes mellitus- 80% of the population with diabetes mellitus also has AHT. Banegas affirms that in Spain as of 1990, the percentage of patients with hypertension aged between 36 and 65 years ranges from 27% (when the criteria for AHT were systolic blood pressure [SBP] \geq 160mmHg and diastolic blood pressure [DBP] \geq 95mmHg) to 45% (when the AHT figures were 140/90 mmHg). He agrees that AHT is a serious public health problem in Spain as it contributes to half of all deaths caused by cerebrovascular disease in the country and to a significant percentage of all the deaths caused by coronary diseases, heart failure, kidney failure etc.

The healthcare costs of AHT in 1994 were 1.2 billion EUR³. In another study, Banegas's results revealed that 42% of deaths caused by coronary disease, 46.4% of deaths caused by cerebrovascular disease and 25.5% of the total number of deaths were related to AHT ($>$ = 140/90 mmHg), and patients mostly relapsed in stages 1 and 2. Following those, 8.3% of deaths caused by coronary disease, 10.2% of deaths caused by cerebrovascular disease and 6.2% of the total number of deaths were related to normal-high and normal

blood pressure. There were 17,266 deaths in total and 4,502 deaths per year caused by cardiovascular diseases related to AHT and three quarters occurred in men. Of these, 65.5% were caused by coronary diseases and 34.5% were caused by cerebrovascular diseases. Coronary diseases dominated in both sexes. Eight out of ten of the total number of deaths and the deaths caused by cardiovascular disease related to blood pressure occurred in patients who relapsed in AHT and two out of ten relapsed in normal-high or normal blood pressure. Banegas therefore concludes that one in three of the total number of deaths and one in two of deaths caused by cardiovascular diseases were related to blood pressure (BP). A quarter of all deaths and one in every 2.5 deaths caused by cardiovascular disease were related to AHT and a large proportion of those occurred in patients who relapsed in stages 1 and 2 and in normal-high and normal blood pressure¹⁹. Banegas and Jovell²⁰ looked beyond Spain and found that in the rest of the developed world, AHT affects 40% of adults, and is one of the main causes of death and disability in the world, due to the cardiovascular, renal and neurological complications it can cause. They also cite the epidemiology of AHT in Spain, and their findings were ratified by Wolf-Maierk and Llisterri^{17,21}. They describe the increased prevalence of AHT, which continues to grow around the world, becoming a global pandemic. Some experts have predicted that in 2025, the prevalence of AHT will have increased by 24% in developed countries and up to 80% in developing countries⁶.

Gorostidi and Marín²² have studied the relationship between AHT and chronic kidney disease and concluded that controlling BP and levels of proteinuria can slow the development of the disease. Sicras-Mainar²³ also studied the increased healthcare costs of patients with hypertension, mostly in the area of pharmacy. The total cost increases with age and overall morbidity. AHT should be considered alongside other cardiovascular risk factors. Costs incurred as a result

of patients' inability to work were low. In accordance with the *Sociedades Españolas de Cardiología* (Spanish Societies of Cardiology), the European Society of Cardiology and Hypertension, the 2003 WHO/ISH and the British and Canadian guidelines, Coca recommends reducing BP, as it is directly associated with cardiovascular risk factors. Coca also recommends controlling AHT using non-pharmacological methods such as giving up smoking, losing weight, doing physical exercise and reducing salt intake. Only 30.1% of the patients studies employed these methods. Similarly, Grilo²⁴ states that AHT is a serious public health problem that affects 10 million people in Spain and that the etiology of AHT is essential in 90-95% of cases while there is also a hereditary factor. There are other hereditary vascular risk factors associated with essential hypertension as well, such as metabolic syndrome. The risk of suffering a stroke or developing a coronaropathy is tripled in patients with metabolic syndrome and deaths caused by cardiovascular disease are 12% more common than in patients without metabolic syndrome.

Lozano²⁵ shares the data he has gathered indicating that strokes are a cardiovascular risk factor for hypertension and one of the main causes of death in Spain. Cosín Aguilar²⁶ found that excess weight increases the cardiovascular risk factor in patients with hypertension by around 20% and increases the association between hypertension and diabetes and congestive heart failure. Stiefel²⁷ arrived at the same conclusion, observing a higher incidence of glucidic anomalies in association with AHT and therefore emphasising the importance of carrying out an oral glucose tolerance test (OGTT) to stop vascular deterioration in patients with AHT and type 2 MD diabetes mellitus and to slow down diabetes mellitus in patients with oral glucose intolerance.

Fernández Villaverde²⁸ states that left ventricular hypertrophy is a compensatory response to increased BP or volume overload and is the first stage in the development of a clinical disease such as heart failure, coronaropathy, arrhythmia or a stroke. The effects of left ventricular hypertrophy have been widely studied, both in the general population and in patients with cardiopathies and is the most common cardiac anomaly to occur with AHT. Patients with hypertrophy present with a higher cardiovascular risk factor and higher mortality rates, particularly caused by ventricular arrhythmia or sudden death.

The effectiveness of the osteopathic approach to treating AHT

In terms of the effectiveness of the osteopathic approach to treating AHT, Stiefel²⁷ states that blind, controlled studies are needed to assess whether osteopathy alone or osteopathy with conventional pharmacological treatment helps to improve AHT. In response to Stiefel, many authors have carried out studies to demonstrate the effectiveness of osteopathic treatment for AHT and the remote effects that spine manipulation can have^{29,30} Cerritelli³⁰ for example studied patients affected by cardiovascular disease who had received osteopathic treatment and found that the treatment they received was strongly associated with the improvements in intima-media thickness and systolic blood pressure observed after one year. Santiago Alexander²⁹, in his literature review, describes studies that show how upper cervical spine manipulations can affect the mechanisms that regulate the responses of the system controlling blood pressure. He identified a lack of joint stability in the cervical spine and the resulting sympathetic hyperactivity as a common sign in patients with AHT that can affect BP and AHT. Other studies, such as the one carried out by Pilar Mansilla⁷ reaffirm these findings after observing a significant improvement in mouth opening after manipulating joint instability in the craniocervical junction. I. Korr's¹⁰ concept of spinal cord facilitation is once again demonstrated.

An article published in the *Journal of Human Hypertension* in 2007, describes a double-blinded, controlled study with a placebo carried out on a sample of 50 patients with moderate or grade 1 AHT, where systolic and diastolic blood pressure were reduced (-17mmHg and -12mmHg respectively) and remained at that level for 8 weeks³¹. Similarly, Yates et al carried out a study in which they manipulated 21 patients and found that both systolic and diastolic BP dropped significantly in the treatment group, while there were no significant changes in the placebo group³². The same reduction was observed by Mcknight et al after applying a manipulative treatment to the cervical spine in 75 subjects with normotension³³. In her study, Morán Benito¹² showed that applying 6mm pressure onto the projection of the aortic valve for 90 seconds produced a homogeneous reduction in the following parameters: systolic BP, diastolic BP and HR. Bosca⁸ concluded that there are no contraindications for manipulating the craniocervical junction in patients with cardiopathies.

The effectiveness of the MET in treating AHT

Burns DK³⁴ stated that the MET improved range of motion in the cervical spine in asymptomatic patients. Wilson³⁵ showed that the MET with supervised motor control and resistance exercises is more effective than neuromuscular rehabilitation and resistance training for improving functioning for patients with acute low back pain. Smith³⁶ concluded in her study that altering the duration of the passive stretch component does not have a significant impact on the efficacy of MET for short-term increases in muscle extensibility. Selkow reaffirms Smith's results, saying that the studies that have been carried out on the effectiveness of the MET in the long term are limited but the MET does reduce lumbopelvic pain 24 hours after application, measured using a visual analogue scale³⁷.

Ballantyne³⁸ defends the effectiveness of the MET compared to ballistic stretching, explaining that increased flexibility was a result of an increased tolerance to stretch and is not caused by visco-elastic changes. She also affirms that there is limited research validating the use of the MET, despite how widely it is used in the world of osteopathy. In the light of Ballantyne's conclusions and the conclusions of previous authors, Gary Fryer and Luke Hamilton agree on the controversies taking place at the time when the muscle energy technique was developed, the lack of research validating its use and the importance of continuing to research the technique^{39,40}. Gabriela M. Hunt⁴¹ after comparing the effectiveness of the MET and the thrust technique applied to the piriformis muscle, found that the former is more effective at increasing extensibility and reducing pain.

DISCUSSION

Of the randomised clinical trials (RCTs) studied, 50% scored less than 3 on the JADAD scale, indicating a weak methodology. Although they were randomised, we cannot verify their findings as they do not describe the method used to generate and safeguard their randomised sequences. They also fail to describe specific aspects of the methodology used, such the methods of blinding or loss to follow-up. However, the other 50% scored 3 on the JADAD scale (acceptable). Some described the generation of the randomised sequence used, others described the method of blinding in detail but none described the loss to follow-up.

The importance of controlling AHT is evident, given its growing epidemiology in developed countries, as well as the rise in spending on controlling and treating the disease^{3,6}.

It is alarming that the prevalence of AHT in people aged 60 and above is 69% as it is one of the main cardiovascular risk factors, contributing to the origins of diseases such as heart failure, ischemic cardiomyopathy, kidney failure etc. This produces worryingly high levels of morbimortality, to the extent that AHT is responsible for half of all deaths caused by cardiovascular disease in the Spanish population. It is considered to be a global pandemic as it is one of the main causes of death and disability due to the cardiovascular, renal and neurological complications it causes. And worse still, it has been predicted that the prevalence of AHT will continue to grow throughout the world, increasing by 24% in developed countries and up to 80% in developing countries by 2025^{1,4,6}. Therefore further osteopathic studies are recommended to demonstrate the safety and effectiveness of AHT treatments.

Cerritelli's³⁰ study analysing patients with cardiovascular disease who received osteopathic treatment is worth mentioning. He carried out a follow-up with the patients after one year. It is very difficult to carry out a long-term study like this, with loss to follow-up being the reason why many RCTs are unsuccessful. Cerritelli's results reveal a significant association between osteopathic treatment and improvements in AHT. Studies like this are rare in the world of osteopathy. Other authors like Bakris³¹ have also demonstrated the effectiveness and safety of certain osteopathic techniques, reducing both systolic BP and diastolic

BP in patients with moderate AHT. Using a different osteopathic technique, Benito¹² achieved similar results to Bakris³¹ reducing BP in her patients but also reducing HR. However, neither Bakris nor Benito's^{12,31} studies were as long term as Cerritelli's³⁰.

It is clear that we need to continue to pursue the osteopathic approach to treating AHT to help to reduce morbimortality rates in Spain and the rest of the world, to reduce healthcare costs and to support other healthcare professionals seeking to control the disease.

We did not find any studies that demonstrated a positive relationship between the MET and AHT. It would be worth studying the relationship further as the technique is safe and could be used to treat patients when there are contraindications to spine manipulation (thrust techniques)⁴².

Studies are being carried out, analysing the results of using different osteopathic techniques to treat AHT. We would recommend studying the effects of applying several of these techniques at the same time to see if treating

multiple segments of the spine simultaneously produces further positive results. However, it is worth pointing out that osteopathy has been growing as a science in recent years, thanks to the large number of studies that have been carried out, demonstrating the safety and effectiveness of using osteopathic techniques to treat serious conditions such as AHT, which have a growing epidemiology, bring higher healthcare costs and have a severe effect on morbimortality rates.

Limitations of the study

The articles we have analysed have all been in Spanish or English. We have not analysed articles in other languages such as French, Italian, German, Chinese, Russian etc. Furthermore we did not search for articles in all of the databases, just in some of them.

CONCLUSIONS

The majority of publications on arterial hypertension mention the healthcare costs it can bring and the fact that it is one of the main cardiovascular risk factors. It is very prevalent in Spanish society, where around 35% of the population has hypertension, a figure which rises to 68% in the population aged 60 and above. Globally, the epidemiology statistics suggest that AHT is pandemic. 50% of the RCTs studied were of an acceptable quality (3), using the JADAD scale.

Different osteopathic techniques can have a positive effect on systolic and diastolic BP, HR and the mobility of various joints and segments of the spine. MET has a positive effect on muscle extensibility and has been shown to reduce pain and normalise spine dysfunctions but there is a great deal of controversy surrounding the development of the technique and its use has not been widely validated.

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CONFLICT OF INTEREST

The authors hereby declare that there are no conflicts of interest associated with this study.

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