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Perceptions of Iontophoresis amongst Mississippi Athletic Trainers

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Perceptions of Iontophoresis amongst Mississippi Athletic Trainers

by

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Abstract

Research in the field of modalities is growing quickly, however there is a substantial lack of evidence for the use of iontophoresis, especially in the field of Athletic Training. Due to this, the perceptions of iontophoresis have been impacted amongst clinically practicing athletic trainers. Per this survey, while Mississippi licensed athletic trainers are aware of, and have a general knowledge of how to use iontophoresis, there is a lack of uniformity amongst the parameters and pathologies, consistent with those found in the literature. Of the 37.5 athletic trainers who utilize iontophoresis in their clinical setting, none of them reported using the same parameters. While there was evidence in the free-write questions that the main pathologies treated were musculoskeletal in nature, this by no means narrows down the various ones that these participants treated with iontophoresis. A surprising 88 percent of participants stated that would like to use iontophoresis in their settings, and several participants stated in the final free-write question that they felt more research was necessary to further their knowledge on this modality. Iontophoresis is on the forefront of therapeutic modalities in the field of athletic training, and more research should be completed in order that athletic trainers across the globe may benefit from its many benefits.

Key terms: iontophoresis, Athletic Training, modalities

Dedication

To Christ my Savior:

For giving me the opportunity and ability to glorify You

To my Parents:

For always believing I could excel at anything

To my late Mentor, Greg Zelden:

For convincing to follow my dream of being an Athletic Trainer,

For always pushing me beyond my self-perceived limits,

For being that constant voice in my head to never stop reaching,

For always being proud of me, no matter what.

Acknowledgment

A huge thank you to my family, who time and time again sacrificed spending time with me in order that I could accomplish this research. A special thank you to my advisor, Dr. Evelyn Gordon, who came into the project halfway through and helped keep it from crashing to the ground, and kept me sane throughout the entire process. It was a pleasure and an honor to work with you.

Thank you also to those members in the Mississippi Athletic Training Association (MATA) who participated in this study. May this research benefit you and all other Athletic Trainers in the future.

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Chapter 1

Introduction

Evidence-based practice (EBP) is the driving factor behind almost every medical practice. EBP involves the combination of commonly used practices in the field, along with clinically relevant research and literature. Over the past few years, the use of EBP has risen, especially in therapeutic modalities (McCarty, Hankemeier, Walter, Newton, & Van Lunen, 2013). Therapeutic modalities have the potential to be powerful resource tools for athletic trainers in the therapeutic rehabilitation field. While physical therapists and athletic trainers have been using cryotherapy, thermotherapy, and ultrasound for many years, there are new methods of electrotherapy being researched and implemented. One such modality is iontophoresis. Since it is new, literature surrounding this topic is limited at best. Due to the number of unknowns associated with this form of electrotherapy, and the inconsistent research findings, there is a lack of clinical evidence to support its use.

Several projects have been done recommending specific guidelines for using specific treatments, however there is much conflicting evidence (Gangarosa & Hill, 1995). Differences and inconsistencies in length of treatment, class of drugs, area treated, intensity of the electrical charge, and what injuries can be treated are common. New information is being developed regularly on exactly how iontophoresis works, such as the changes that occur in skin permeability when using different currents (Roustit, Blaise, & Cracowski, 2013). A study was done by athletic training researchers to define how far this modality can propel medication through soft tissue, but their study only tested two specific drugs, and no significant differences were found in the intensity or duration of the treatment (Draper, Coglianese, & Castel 2011).

Varying electrical currents have also been researched, however the results between alternating and direct currents were inconclusive (Bhatia, & Banga, 2014).

Most of the laboratory research findings to date have been inconsistent, and not much of it has been easily available to practicing athletic trainers. There is also little to no evidence to support the idea that clinicians even utilize iontophoresis. This research will seek to narrow some of these gaps in the clinical aspect of the literature. It will answer the question of what are clinically practicing athletic trainers' perceptions of iontophoresis.

Chapter 2

Literature Review

The aim of this study is to clarify the perceptions of iontophoresis amongst athletic trainers. The field of athletic training is heavily based on evidence based practice (EBP), however there are major missing components to this concept that could affect the perceptions of iontophoresis. The first of these is the inconsistencies in the literature, the second is the lack of clinical knowledge about iontophoresis.

Treatment Inconsistencies

Iontophoresis can be used to treat a wide variety of pathologies. The following musculoskeletal injuries, such as TMJ, plantar fasciitis, myositis ossificans, and lateral epicondylitis, are the most frequently treated along with hyperhidrosis, a skin condition. . Temporomandibular joint dysfunction is a condition where the jaw musculature becomes inflamed due to the constant rubbing together of the two jaw bones. It is commonly seen amongst juveniles and young adults. A study was done to observe how effective dexamethasone iontophoresis treatments were in reducing pain and restoring range of motion in those affected by this disease. Treatments of 1.5ml of dexamethasone, applied at 4mA for 40mA/min was administered 8-10 times over the course of three days. The treatment durations were 15-30 minutes per session, and a direct current was utilized to push the drug across the skin. Pain reduction and range of motion were recorded before and after treatments and showed that using dexamethasone iontophoresis with these parameters significantly reduced pain, especially in those with large range of motion deficits (Mina etal,, 2011). Furthermore, they concluded that iontophoresis restored lost range of motion. Conversely, a second study that reviewed the

treatment methods for TMJ found that no modality was superior than any other in terms of side effects and consequences for temporomandibular joint dysfunctions (Buescher, 2007).

Plantar fascia is a common ailment, especially amongst athletes. It is an inflammatory condition of the fascia covering the arch of the foot. This inflammation can be aggravated by overuse or improper body mechanics. Current treatments include ice, oral non-steroidal anti-inflammatories (NSAIDs), and stretching. These methods, however, are generally non-effective and can have a longer healing timeframe (Costa & Dyson, 2007). A study was done comparing 5% acetic acid and .4% dexamethasone iontophoresis as possible treatments for this pathology. A 4mA current of dexamethasone was administered at 40mA/min, however the authors did not mention the dosage of the drug. They administered six treatments over a period of two weeks, and each session's duration was determined by patient comfort, not a set parameter guideline. This iontophoresis treatment was also combined with a taping technique designed to take stress off the fascia. While it showed significant results in reducing pain and inflammation over the course of the acetic acid treatment, it cannot be determined if this was due to being delivered by iontophoresis or some other fashion, since that information was not noted in the study (Osborne & Allison, 2006). Acetic acid was used in a separate case study on a patient with chronic plantar fascia. Iontophoresis treatments were combined with rehabilitation and stretching to regain full function and decrease pain. This study was done over a period of six weeks, three times longer than the previous study. The frequency of this treatment was three times a week for two weeks, then decreased to twice a week for the following two weeks. It was not utilized during the last two weeks of the study. This time, the 4mL of 5% acetic acid was delivered at 80-90mA/min over the origin of the plantar fascia. This study also combined pulsed ultrasound immediately after the iontophoresis treatment, a common practice to further "push" the drug across the skin.

This study showed that combining iontophoresis with typical rehabilitation techniques allowed for faster recovery and a reduction in pain (Costa & Dyson, 2007). This is not consistent with the previous study which showed that dexamethasone is a more effective treatment method for plantar fascia, however it cannot be determined if this is due to the differences in parameters as there were no follow-up studies done for either.

Myositis ossificans is a chronic injury that results in a bony mass forming within a muscle belly. The current standard practice for treating this is to wait until the mass fully ossifies (six-12 months) then remove it surgically and have the patient follow a rigorous rehabilitation protocol to regain muscle size and strength. A case study was done to determine if acetic acid iontophoresis could counteract the ossification of the bony mass. A patient with an 8X5 cm mass in the bicep was given nine 2% acetic acid treatments of 80mA/min over the course of 29 days along with range of motion exercises. At the conclusion of this study, the patient had made a full recovery and no mass was detected by diagnostic imaging and/or palpation (Gard & Ebaugh, 2010). A similar case study was completed in which the patient had a 7X4 cm bony mass in the quadriceps muscle. This study also utilized 2% acetic acid iontophoresis, with a dosage of 3mL. The treatment was administered three times a week for four weeks at 4mA for 80mA/min, which was applied for 20 minutes per session. This treatment also proved effective in that there was a 98.9% decrease in the size of the mass at the end of the treatment period. While both treatments found that iontophoresis was effective clinically, their parameters differed (Weider, 1992). Most notably the time over which the treatments took place were significantly different. The latter study also utilized pulsed ultrasound in conjunction with iontophoresis, which could have influenced the patient's rate of healing as well.

Tennis elbow, or lateral epicondylitis, is a common workplace and athletic injury. It is simply inflammation of the epicondyle due to overuse. Two separate studies were done in which dexamethasone iontophoresis was utilized as a treatment option. One of the studies compared an iontophoresis group with a Cyriax-type exercise group. Both completed conservative rehabilitation protocols along with these treatment types. The group which received .4% dexamethasone treatments for 20 minutes per rehab session showed faster recovery rates than the group which performed Cyriax-type exercises along with the established protocol (Fathy, 2015). The other study compared 10mg dexamethasone iontophoresis with 10mg dexamethasone injection and 10mg triamcinolone injection for the treatment of tennis elbow. The patients in the iontophoresis group were given a 10mg dexamethasone patch to be worn for two days. All the patients were put through strengthening protocols after their respective treatments. While the iontophoresis group experienced less discomfort and side effects than the other two treatment groups, their returns were similar in time and strength gains (Stefanou, Marshall, Holdan, & Siddiqui, 2012). Again, a comparison of the two studies is difficult to make, because while they used the same drug to treat the same pathology, the other parameters were either different or not mentioned, so a conclusion cannot be made regarding which of the two is a better choice in treatment.

Hyperhidrosis, excessive sweating of the hands and/or feet, is another common ailment treated with iontophoresis. Even with the treatments for hyperhidrosis, there are still inconsistencies in what drug types are utilized for the best results. One study found that aluminum chloride iontophoresis with a direct current at 5-20mA three times a week was not as effective as botulinum toxin (Botox) injections, however the authors did report fewer side effects and discomfort for the patients (Rajagopal & Mallya, 2014). Yaghobi, Goljarian, and Oskouei

(2014) compared tap water and saline iontophoresis. These authors reported using tap water in one trial, and .9% saline in the other. Eight treatments were done over the 28 days of the study, and both trials were completed at the same time. Their study participants used one hand for each water type. The treatment sessions were 30 minutes each at 20mA for both treatments. While both methods were effective for reducing the amount of sweat on the palms, the saline was shown to be almost twice as efficient in inhibiting sweat gland production. Both treatment methods were effective, however only one set of parameters for each of the iontophoresis treatments were utilized with no further parameters investigated. There was also no uniformity of the parameters across the studies, such as treatment duration, dosage, or drug type.

Parameter Inconsistencies

Consistent conclusions are difficult to draw from the literature. There are many inconsistent findings within these studies, not just in treatments, but in parameters in general that cause athletic trainers concern when attempting to use this modality in the clinical setting. One of the issues in the literature is the effects of different electrical current types on skin penetration. One study was done which tested the differences between direct and alternating currents on lidocaine delivery. This study found no difference between the two methods of current, and there were no follow-up studies done with different parameters or drug types (Bhatia & Banga, 2014).

A two-part study was done to determine the depth of penetration of lidocaine into the gastrocnemius muscle. When done in the first trial, it was shown to penetrate 3mm into the muscle belly (Coglianese, Draper, Shurtz, & Mark, 2011). In the second part, the researchers added epinephrine into the lidocaine compound, which they found increased the depth to 5mm

within the same muscle (Draper, Coglianese, & Castel, 2011). However, simply knowing the depth of penetration of one medication does not determine the parameters for all drug types.

While there is serious promise in the use of iontophoresis in combination with rehabilitation for treating injuries, there is only evidence to support its usage for a few specific pathologies within the literature. One such pathology is tennis-elbow. A common injury in the workplace, this pathology is usually slow-progressing during rehab and can be quite painful. One researcher found that when iontophoresis was incorporated into the protocol, it caused a decrease in pain and a faster return-to-work (Fathy, 2015). However, there were no other medications and/or injuries discussed as far as this type of treatment is concerned. The same drug used in the aforementioned study was again implemented to treat temporomandibular joint pain in teenagers, however the methodology did not include any other interventions, and the researchers utilized different parameters for their iontophoresis treatments (Mina et.al, 2011). There was no concurrent evidence on which set of parameters was more effective in treating inflammatory conditions, nor was there much literature on other drugs being used instead of dexamethasone in these conditions.

Carpal tunnel syndrome is a common pathology seen both in the workplace and in athletics, and treatment rehabilitations generally follow the same protocol. A comprehensive research study was done to determine the best courses of treatment for this ailment and iontophoresis was listed among them as a "good modality". It did not make mention of any specific parameters or even how to use iontophoresis as a treatment method (Zimmerman, 1994). However, there have been a few studies done that showed the effects of different electrical current types used in the delivery of certain drug compounds that can help give athletic trainers a

sense of to how to apply this modality in a limited amount situations (Saliba, Teeter-Heyl, McKeon, Ingeroll, & Saliba, 2011).

Osteoporosis affects much of the elderly population, especially females. It is a degeneration of bone tissue caused by a lack of calcium absorption into the skeletal system. Gomez et al. (2011) showed that a calcium iontophoresis treatment in which calcium ions were directly diffused into the bone tissue during an *in vivo* procedure, resulted in a calcium absorption rate that was significant. Therefore, this research was considered a success. While this brand-new iontophoresis technology has been used for other purposes, follow-up studies and further research on calcium iontophoresis have not been conducted. In addition, this study was done on rats, not human tissue, therefore the full effects are unknown and need to be studied further.

Perceptions of Athletic Trainers

Studies focusing on the perceptions of iontophoresis by athletic trainers were not found. New medical practices are viewed by clinicians with skepticism, as their profession relies heavily on the commonly used practice aspect of EBP. For a new theory or modality to become a standard practice, it should have verified positive outcomes in the literature, but more importantly must show results in the clinical field as reported by athletic trainers (McCarty, Hankemeier, Walter, Newton, & Van Lunen, 2013). Since there are few studies on iontophoresis executed by athletic trainers, the research that is available is considered inconsequential. They practice with a specific patient population and limited resources, which inhibits the amount of new techniques they can utilize in their clinical settings. In theory, iontophoresis should be most beneficial to athletic trainers as most of the injuries they treat are musculoskeletal. The purpose

of this study is to define the perceptions of iontophoresis amongst clinically practicing athletic trainers to hopefully encourage its use in the clinical athletic training setting.

Chapter 3

Methodology

This chapter will discuss the methods utilized for this project. It will also address the participants, instrumentation, and hypotheses. The methods discussed here seek to answer the question of the perceptions of iontophoresis amongst Mississippi certified athletic trainers (AT's).

Participants and Participant Selection

The target population invited to participate in this survey was Mississippi certified athletic trainers from The Commission on Accreditation of Athletic Training Education (CAATE) accredited academic programs with experience in the clinical field. Since the research question dealt solely with filling in clinical knowledge and data about iontophoresis, it will be limited to clinically practicing athletic trainers only.

Instrumentation

The data for this project was collected via a cross-sectional survey. The variables in this survey were modified versions of those used in the McCarty et.al (2013) study on AT's views on Evidence-Based practice (EBP) (See Appendix B). McCarty's format served as the tool with which the questions were based. The questions included the attitudes towards the modality, belief about the utility of the modality, access to information about the modality, access to the modality itself, and barriers to its usage in their clinical setting. A Yes/No type answer set was utilized to answer items, as well as open-ended questions for qualitative data. Demographic questionnaires were used to narrow down the response pool to useful information. These questions included information such as how many years the AT's were certified, what state they

obtained their certification from, how many years they have spent working in the clinical field, the level in athletics they work in, and how and why they use iontophoresis, if at all.

Procedures

This project used the Qualtrics software system to format the survey. After obtaining IRB approval (See Appendix A), certified athletic trainers from the MATA mailing list were invited to partake in the survey. There was a brief description of the researcher's role as an undergraduate conducting research and the purpose behind this project, as well as the attached link to the survey. Through the Qualtrics software the researcher could obtain consent from the participants that completed the survey. The data will be secured via the researcher's personal password protected PC and evaluated after enough data has been collected. Five years after the completion of this project the data will be destroyed via deletion from both the researcher's PC and the Qualtrics software.

Analysis

After sufficient data was been collected, an analysis of the data occurred. Participant completion was roughly twenty to thirty percent of the population who received the email, which was approximately seventy participants. The study compared and contrasted answers from those who participated, to determine the current barriers and/or benefits of this modality that practicing athletic trainers have found. Conclusions were drawn about how and why they use iontophoresis from their open response answers in the survey, and possible reasons for those who do not utilize it were determined.

Problem Statements

There are four problem statements that had been made from reading the literature before starting this study which will be listed here, and discussed in Chapter five. The first is that the

grand majority of the participants are aware of, and know how to use iontophoresis. The second statement is that despite this knowledge, they are unable to utilize iontophoresis in their setting, whether this be due to no access to materials, cost, or lack of standing orders from a physician. The third problem statement, is that if this modality is being utilized, there will be no uniformity in the parameters. Finally, the last problem statement is that the injuries this modality would or is being used for will be mostly musculoskeletal, as these are the main types of injuries that AT's treat.

The survey was completed by approximately 50 participants, and included questions of both qualitative and quantitative designs. These questions focused on answering the research question, and in turn addressing the problem statements that the researcher made prior to the study.

Chapter 4

Results

The four problem statements that were formulated prior to this project will be discussed in this chapter along with the main research question. The first problem statement is that the majority of participants will be aware of and know how to use iontophoresis. The second is that despite having this knowledge, the participants will be unable to use this modality in their clinical setting. Thirdly, that if participants do utilize iontophoresis there will be no guidelines to their treatments or uniformity amongst them. Lastly, most of the iontophoresis treatments will be for musculoskeletal injuries or conditions. These four problem statements all support the main research question of the perceptions of iontophoresis amongst clinically practicing Athletic Trainers in Mississippi. There is both quantitative and qualitative data from this project to answer the problem statements and research question.

Quantitative Results

Participants

A total of 61 out of approximately 300 athletic trainers responded to this survey, giving this project a response rate of 20.1%. Out of those 61, 51 completed the entire survey, which resulted in a completion rate of 83.6%. The largest percent of the responses came from athletic trainers (AT's) who had been practicing for 10+ years, at 43.64%. Those practicing for 5-10 years made up 27.27%, the second highest percentage of participants. Out of all the participants, 61.5% got their certification from and are still practicing in Mississippi, while the rest received their certification outside of Mississippi from Alabama and Louisiana, to Iowa and South Dakota, but are now practicing here (Figure 1). As far as clinical settings, 33.93% of the participants work in a high school, while 23.21% work at a university. Somewhat surprisingly,

14.29% of the participants work in affiliation with a clinic, while only 10.71% work in a junior/community college setting.

Variable Questions

The results for questions six through fifteen are listed in Table 1 below, and the specific survey questions are listed in the Appendix, however it can be noted that these questions dealt with the specific barriers and attitudes towards iontophoresis to gauge the validity of the free-write questions later in the study.

Figure 1 State of Certification Map

United States map depicting the participant diversity

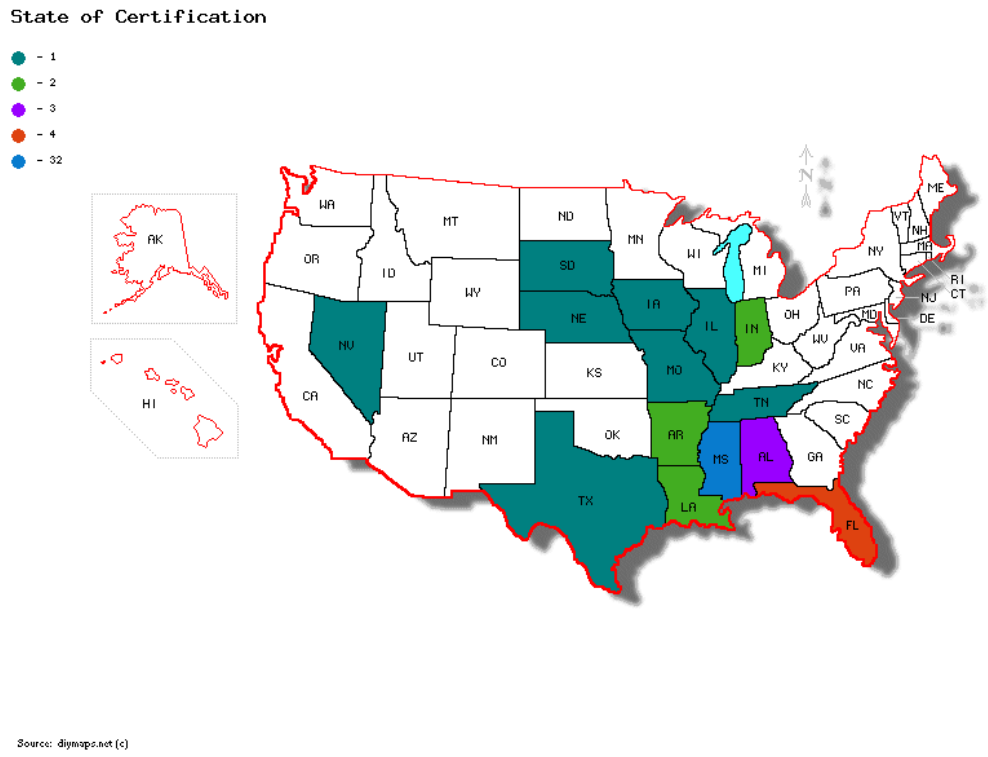

Table 1

Survey Results Q 6-15

Question	% Yes	% No	% N/A
Q6	37.5	62.5	
Q7	88.24	11.76	
Q8	23.53	76.47	
Q9	29.41	70.59	
Q10	62.75	37.25	
Q11	76.47	23.53	
Q12	74.51	25.49	
Q13	43.14	56.86	
Q14	29.41	33.33	37.25
Q15	43.14	0	56.86

Questions 6-15 can be found in appendix B, percentages are based on those who completed the entire survey, N/A options are for those who do not utilize iontophoresis therefore those questions did not apply to them

Qualitative Results

There were a total of three free-write questions, not including those in the demographic section of the survey. These questions were used to determine the ways in which iontophoresis is currently being used in the field of Athletic Training, and what common parameters are utilized, if any. Question 16 determined what injuries this modality is used for. While all the responses were different, including some N/A for those who do not use iontophoresis, the majority of the answers included some form of an anti-inflammatory condition, or overuse injury. Tendonitis, plantar fasciitis, and joint pain were the most common, while patellar tendonitis, lateral epicondylitis, and tendinopathies were also frequent answers.

The next question dealt with common parameters used to treat these and other conditions. As expected, there were no two answers alike. However, the drug dexamethasone and hybrid style patches were repeatedly mentioned. There was also a large number of participants who

stated that the parameters were usually determined by the prescribing physician or physical therapist who applied the patch, if the AT was not legally allowed to do so.

The final free-write question was used to determine the reasons why AT's utilize iontophoresis in general, and over other modalities. Several participants mentioned the ease of application, and lack of a need to supervise the treatment once it is applied. One participant specifically compared iontophoresis to its widely-used counterpart, phonophoresis. This modality is relatively similar. However, it uses an ultrasound head to push the medication through the skin instead of a patch, therefore requiring someone to operate the machine during the entire length of the treatment. This participant stated that they preferred iontophoresis to phonophoresis, as it allowed them more freedom. Others liked how it was a non-invasive treatment, and one participant stated how they prefer it over simply handing out drugs for inflammation. Most of the answers indicated that they simply saw positive outcomes and the athletes seemed to feel better after subsequent treatments. The specificity of the site of action was another response, as drugs for inflammation are typically oral and therefore they work in a systemic capacity, whereas iontophoresis targets specific areas of tissue.

Chapter 5

Discussion

The purpose of this research was to answer questions regarding the perceptions and uses of iontophoresis amongst clinically practicing Mississippi Athletic Trainers. I had several problem statements going into the study, based on previous investigations into this topic via conversations and informal polls, as well as reading the available literature.

Testing of the Problem Statements

The first problem statement is that most of the participants would know how to use iontophoresis. This statement was made based on the CAATE accredited curriculum, which includes a chapter on iontophoresis in the Therapeutic Modalities textbook and classwork. Questions 11 and 12 serve to answer this hypothesis. Question 11 shows that 76 percent of participants had been taught to use iontophoresis in their curriculum, and question 12 which says that 74.5 percent of participants felt that they had a thorough understanding of how this modality works. Thus, this hypothesis was proven to be true.

The second hypothesis is that these participants would be unable to use it, whether that be due to inadequate funding, resources, or lack of standing orders from physicians. The cost of this modality is widely known to be expensive, and it is not in the standard of care for AT's to apply it without standing orders from a physician. Questions nine and 14 dealt with barriers to the use of iontophoresis. When asked if this modality placed unreasonable demands for use, a surprising 70 percent said that it did not (Q9). Financial support was inconclusive, with roughly 30 percent of participants stating they had no financial support, 33 stating that they did, with another 37 responding that this question did not apply to them as they do not utilize it in the first place. However, overall the second hypothesis can be said to have been proved false.

The third hypothesis that the researcher formed is that there would be no uniformity amongst parameters utilized with iontophoresis treatments. This hypothesis was formed due to previous research listed in the literature review, in which there were no set parameters for any of the various treatments studied. This hypothesis, based on question six, was proven true by the 37.5 percent of participants who do utilize iontophoresis, shown in their answers to the free-write question 17 which asked what parameters were used in treatments. No two answers were the same, and while some shared certain components (i.e. utilizing a hybrid style patch), there was never more than one similarity between two answers. Examples would be, a wide range of drugs, the rate of administration, the length of treatments, and dosages are being utilized with iontophoresis across the state of Mississippi. Thus, this hypothesis was proven true.

The final hypothesis was that most of the participants who used iontophoresis would do so for musculoskeletal injuries. This hypothesis was formed because of the knowledge that most of the injuries AT's treat are musculoskeletal in nature. The free-write Question 16 clarified this statement, and it was found that most of the treatments were for inflammatory conditions of joints. Plantar fasciitis, patellar tendonitis, and epicondylitis were the top three most common uses amongst these participants. While joints are not necessarily muscular in nature, they are part of the musculoskeletal system in general. Thus, this hypothesis is proved true.

Findings and the Literature

It was pointed out in the literature review that there were two main obstacles that interfered with the perception of iontophoresis amongst AT's. The first being the inconsistencies that are present in the literature. The second being the lack of clinical knowledge which will be discussed later in this chapter. The inconsistencies in the literature can be divided into the subcategories of treatments and parameters.

Iontophoresis is a versatile modality that can be used to treat a wide range of pathologies. The literature states that musculoskeletal injuries are the most common. This was confirmed by the free-write Question 16 and referenced in the final problem statement. Specifically, inflammatory conditions of the joints were treated using this modality, which is represented throughout the literature in the various pathologies treated.

Parameter inconsistencies are perhaps the most trivial obstacle that AT's face when attempting to utilize iontophoresis for their athletes. This issue was addressed throughout the literature, and the research confirmed this issue with free-write Question 17, in which no two participants stated that they used the same parameters for their treatments of various pathologies. This is referenced in the third problem statement, mentioned that some answers shared a single component that was similar, which is consistent with the literature. For every pathology studied, no parameters were exactly alike, most of them containing only one or two similar elements.

Discussion of Other Results

There was a surprising 88 percent of participants that expressed the belief that iontophoresis would benefit the treatment of their athletes (Q7), despite having a mere 23.5 percent patient interest in the modality (Q8). However, patients who have not been exposed to a modality cannot technically have a preference, so this statistic is slightly flawed. Also, of those 43 percent of AT's that do utilize iontophoresis (Q15), there is a 100% patient cooperation rate. This explicitly shows how easy this modality would be to utilize on athletes.

The final free-write question, number 18, was included in this survey to act as a justification for the continued and further use of iontophoresis. The majority of participants stated that this modality is essentially easy to use and effective, thus making it more sought after than other modalities. One participant made the note that it would be more beneficial to the

athlete to utilize an effective anti-inflammatory modality than simply taking oral medication. The fact that this modality is non-invasive was brought up in replies several times, as some injuries that might have required injections in the past could be supplemented with iontophoresis treatment instead. All participants agreed that this modality would be beneficial to the treatment of their athletes, especially for anti-inflammatory purposes.

Perhaps the most important information gathered in this study was that from questions 10, 13, and the optional comments section. Question 13 asked if there was a personal interest in iontophoresis. Surprisingly, there was almost a 50/50 divide between those that did and did not have a personal interest. Despite this, an almost 63 percent of participants agreed that the advancement of this modality is important to the furthering of the athletic training profession (Q10). Question 10 is probably the most important one in the survey, as it validates the reasoning for this research project.

There was a space at the end of the survey for optional comments about the project. While most of the answers had to do with the way the survey was presented, there were a few that dealt directly with the heart of the issue surrounding iontophoresis as a viable modality. One response noted the vast expense on a modality that will only be used occasionally and on specific athletes, and then only if they have a prescription from a physician. However, this same participant stated that this modality is quite useful, and will be remembering it more often having taken this survey.

The purpose of this study was to determine the perceptions and uses of iontophoresis amongst this population. However, the motive behind this project lied in the fact that there is little to no research currently be done about the effects and usage of iontophoresis as a worthwhile modality, specifically in the field of athletic training. Two comments best represent

this issue, both stating that they would enjoy using iontophoresis as a modality if they had more education about the best parameters and uses for it. One participant stated that a lack of use has led to a lack of knowledge, while the other voiced that if there were no lack of availability, there would be a higher usage.

Limitations

The delimitations in this study were as follows; participant selection, and the time frame in which the research project must be completed. Participant selection had to be narrowed down to solely AT's who are currently practicing in Mississippi. To do a regional or even nationwide study would have required more time and resources than was available. This survey was also limited to those who were clinically practicing to obtain a more accurate representation of how iontophoresis is being used. The time frame of this project was strictly one academic year; therefore, a wider study could not be accomplished. To have enough time to complete my analysis and discussion of this research, the survey link could only remain active for six weeks. Could it have stayed available for a longer amount of time, more data could have been collected from the increase in responses. The limitations to this study were that only 51 of the 63 people who started the study completed it, and that only people on the MATA mailing list had access.

Conclusion

Iontophoresis has been shown to be a useful modality in the field of athletic training, specifically for anti-inflammatory treatments. While most athletic trainers in the state of Mississippi are aware of this modality and its benefits, they often cannot use it due to a lack of financing, inability to access equipment, and lack of specific parameter knowledge. There is a large base of interest for this modality amongst clinically practicing athletic trainers. More research is needed, more education is needed, and better access to treatment is needed. Should

more compelling and specific research be done, iontophoresis could become the leading modality in the fight against chronic inflammatory conditions. Something not only athletic trainers could benefit from, but anyone in the healthcare field, and specifically the patients. If we can provide them with a targeted, effective, non-invasive solution to treating injuries in a simple way, why would we not pursue that for all intents and purposes? Increasing the knowledge base of iontophoresis and its benefits can help us become better healthcare professionals, in turn leading to better patient care.

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Appendices

Appendix A: IRB Approval Letter

INSTITUTIONAL REVIEW BOARD

118 College Drive #5147 | Hattiesburg, MS 39406-0001 Phone: 601.266.5997 | Fax: 601.266.4377 | www.usm.edu/research/institutional.review.board

NOTICE OF COMMITTEE ACTION

The project has been reviewed by The University of Southern Mississippi Institutional Review Board in accordance with Federal Drug Administration regulations (21 CFR 26, 111), Department of Health and Human Services (45 CFR Part 46), and university guidelines to ensure adherence to the following criteria:

- The risks to subjects are minimized.
- The risks to subjects are reasonable in relation to the anticipated benefits.
- The selection of subjects is equitable.
- Informed consent is adequate and appropriately documented.
- Where appropriate, the research plan makes adequate provisions for monitoring the data collected to ensure the safety of the subjects.
- Where appropriate, there are adequate provisions to protect the privacy of subjects and to maintain the confidentiality of all data.
- Appropriate additional safeguards have been included to protect vulnerable subjects.
- Any unanticipated, serious, or continuing problems encountered regarding risks to subjects must be reported immediately, but not later than 10 days following the event. This should be reported to the IRB Office via the "Adverse Effect Report Form".
- If approved, the maximum period of approval is limited to twelve months. Projects that exceed this period must submit an application for renewal or continuation.

PROTOCOL NUMBER: 16082912
PROJECT TITLE: Perceptions of Iontophoresis Amongst Mississippi Athletic Trainers
PROJECT TYPE: New Project
RESEARCHER(S): Jessica Ringo
COLLEGE/DIVISION: College of Health
DEPARTMENT: School of Kinesiology
FUNDING AGENCY/SPONSOR: N/A
IRB COMMITTEE ACTION: Exempt Review Approval
PERIOD OF APPROVAL: 10/11/2016 tp 10/10/2017
Lawrence A. Hosman, Ph.D. Institutional Review Board

Appendix B: Survey

Q1 What is your ethnicity?

Q2 What is your gender?
- ❍ Male
- ❍ Female

Q3 How many years have you been certified?
- ❍ <2
- ❍ 2-5
- ❍ 5-10
- ❍ 10+

Q4 What state did you receive your certification from?

Q5 What clinical setting do you work in?
- ❍ University
- ❍ Junior/Community College
- ❍ High School
- ❍ Health Clinic
- ❍ Other

Q6 Do you use iontophoresis in your clinical setting?
- ❍ Yes
- ❍ No

Q7 Will the use of iontophoresis benefit the rehabilitation of your patients?
- ❍ Yes
- ❍ No

Q8 Is there a patient preference for iontophoresis in your clinical setting?
- ❍ Yes
- ❍ No

Q9 Does iontophoresis require unreasonable demands for use in your clinical setting?
- ❍ Yes
- ❍ No

Q10 Do you believe that the advancement of iontophoresis is important to the furthering of the athletic training profession?

- ❍ Yes
- ❍ No

Q11 Were you taught how to use iontophoresis in your athletic training curriculum?

- ❍ Yes
- ❍ No

Q12 Do you have a thorough understanding of how iontophoresis works?

- ❍ Yes
- ❍ No

Q13 Do you have a personal interest in iontophoresis?

- ❍ Yes
- ❍ No

Q14 Do you have financial support from your administration to utilize iontophoresis?

- ❍ Yes
- ❍ No
- ❍ N/A

Q15 Do your athletes cooperate with iontophoresis treatments?

- ❍ Yes
- ❍ No
- ❍ N/A

Q16 What injuries do you utilize iontophoresis for, if any?

Q17 What are the common parameters you set for your treatments, and why?

Q18 Why do you choose to use iontophoresis as a modality in your clinical setting?

Q19 This space is for optional comments, questions, or concerns with the project. Thank you for your participation!

Appendix C: Informed Consent

Q23 Project Title: Perceptions of Iontophoresis amongst Mississippi Athletic Trainers
Principal Investigator: Jessica Ringo
Phone: 361-816-7368
Email: jessica.ringo@usm.edu
The University of Southern Mississippi, College of Health
Department: School of Kinesiology
Date: 10/17/2016

Purpose: The purpose of this study is to explore the perceptions and uses of iontophoresis in the field of Athletic Training.
Description: In this study, you will be asked to participate in an online survey containing 15 yes/no questions, and 3 open ended short answer questions. The results of the survey will remain anonymous, and the data collected will be kept on a password protected computer for the remainder of the study. Please keep in mind, this is completely voluntary and the research design has been reviewed and approved by the Institutional Review Board and found to be safe for participants. If you feel uncomfortable at any time, you can stop the process. The information provided by you as a participant will add to the current information of iontophoresis in the field of Athletic Training and may be used in presentations of publications. Benefits: This study will help assist the researcher in obtaining deeper insights into the perception and uses of iontophoresis in the field of Athletic Training. The information gathered will assist in the development of ideas to strengthen knowledge and increase awareness and use of this modality. The information provided by you as a participant will add to the current information on modalities for Athletic Training.
Risks: There are no increased risks for the subject more than minimally beyond the ordinary risks of daily life. No liability plan is offered. The research design has been reviewed and approved by the Institutional Review Board and found to be safe for participants. However, you can stop the survey any time if you become uncomfortable.
Confidentiality: No identifiers will be used in collecting data from surveys. The data from the survey will remain anonymous.
Alternative Procedures: No alternative procedures will be offered.
Participants Assurance: This project has been reviewed by the Institutional Review Board, which ensures that research projects involving human subjects follow federal regulations. Any questions or concerns about rights as a participant should be directed to the Chair of the IRB at 601-266-5997. Participation in this project is completely voluntary, and participants may withdraw from this study at any time without penalty, prejudice, or loss of benefits. Any questions about the research should be directed towards the Principal Investigator using the contact information provided in the Project Information Section above.
The study should take you around 5-10 minutes to complete.
Your participation in this research is voluntary. By clicking the button below, you acknowledge that your participation in the study is voluntary, you are 18 years of age, and that you are aware

that you may choose to terminate your participation in the study at any time and for any reason. Please note that this survey will be best displayed on a laptop or desktop computer. Some features may be less compatible for use on a mobile device.

- ❍ I consent, begin the study
- ❍ I do not consent; I do not wish to participate