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Original Research

Mechanical Percussion Devices: A Survey of Practice Patterns Among Healthcare Professionals

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Background

Mechanical percussion devices have become popular among sports medicine professionals. These devices provide a similar effect as manual percussion or tapotement used in therapeutic massage. To date, there are few published studies or evidence-based guidelines for these devices. There is a need to understand what professionals believe about this technology and how they use these devices in clinical practice.

Purpose

To survey and document the knowledge, clinical application methods, and use of mechanical percussion devices among healthcare professionals in the United States.

Design

Cross-sectional survey study.

Methods

A 25 question online survey was emailed to members of the National Athletic Trainers Association, Academy of Orthopedic Physical Therapy, and American Academy of Sports Physical Therapy.

Results

Four hundred twenty-five professionals completed the survey. Most professionals (92%, n=391) used devices from two manufacturers: Hyperice® and Theragun®. Seventy-seven percent directed clients to manufacturer and generic websites (n=329) to purchase devices. Most respondents used a medium and low device speed setting for pre- and post-exercise (62%, n=185), pain modulation (59%, n=253), and myofascial mobility (52%, n=222). A large proportion of respondents preferred a total treatment time between 30 seconds and three minutes (36-48%, n=153-204) or three to five minutes (18-22%, n=76-93). Most respondents (54-69%, n=229-293) believed that mechanical percussion increases local blood flow, modulates pain, enhances myofascial mobility, and reduces myofascial restrictions. Most respondents (72%, n=305) were influenced by other colleagues to use these devices. Sixty-six percent used patient reported outcomes (n=280) to document treatment efficacy. Live instruction was the most common mode of education (79%, n=334).

Conclusion

These results are a starting point for future research and provide insight into how professionals use mechanical percussion devices. This survey also highlights the existing gap between research and practice. Future research should examine the efficacy of this technology and determine consensus-based guidelines.

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Level of Evidence

3

INTRODUCTION

Mechanical percussion devices have become common myofascial interventions used among sports medicine professionals.[1–3] Mechanical percussion is often applied with electric or battery powered devices that utilize differently shaped tips to provide a rapid compression force to the myofascia (e.g., similar to a small jackhammer used to break up cement). Currently, several commercial manufacturers, such as Hypervolt® or TheraGun®, manufacture different mechanical percussion devices (Figure 1). Many manufacturers have a variety of models with various settings that may include different speeds/frequencies (i.e., 17-53 Hz), amplitudes, and applicator tips (e.g., large and small ball, flat tip, bullet/pointy tip, fork) (Figure 2). Device percussion settings are often within the range of frequencies and amplitudes (e.g., 5 to 300Hz) found to produce positive myofascial outcomes.[1,4] Mechanical percussion therapy devices are marketed in different healthcare and fitness settings to be used as part of a pre-activity warm-up, post-activity recovery, or part of a myofascial treatment.[1]

The mechanical and vibrational action of these devices is similar to manual percussion or tapotement which is a specific technique in therapeutic massage.[5] Manual percussion requires the clinician to apply a rapid, compressive striking of the myofascia with the edge of the hands (e.g. chop), tips of fingers, or a cupped hand.[5,6] Manual percussion may create vibration throughout the myofascial tissues being treated.[7] This technique has been found to reduce spinal reflex excitability in muscles without affecting their contractile properties[6] and increasing ankle flexibility while not affecting muscle power.[8] Mechanical percussion devices may produce similar or greater effects as manual percussion by impacting the myofascia at a different frequency, amplitude, and force with higher friction, reduced therapist upper extremity stress, and larger areas covered in shorter treatment periods.[4] The mechanical percussion devices also allow for longer treatment durations with reduced clinician upper extremity stress with varied frequencies and amplitudes which may influence outcomes differently than other application methods.[1]

The application of mechanical vibration stimulus using specific treatment parameters may produce different mechanical and neurophysiological effects by targeting afferent receptors through the myofascial tissue vibration. For example, targeted local muscle vibration may provide a more cost-effective alternative to whole body vibration because targeted vibration is less likely to stimulate both agonist and antagonist tissue.[1] Mechanical percussion devices may also effect cutaneous and myofascial mechanoreceptors, such as the Ruffini receptors and Pacinian corpuscles, differently than clinical applied manual percussion therapy. For instance, receptors with a greater response to high frequency vibration or low amplitude frequencies for longer durations (i.e., 15-60 minutes) may be more stimulated by the devices to inhibit sympathetic activity[9] or produce positive clinical outcomes.[1,10] Other receptors, however, such as the Merkel receptors, Meissner corpuscles, Ruffini cylinders, and Pacinian corpuscles possess a spectrum of receptor field areas and[11,12] may respond better to other interventions (e.g., myofascial rolling) or different vibrational parameters.[13] Thus, professionals should consider that mechanical percussion to different parts of the body may produce various effects given the distribution of afferent receptors in the treatment area. Future research is warranted to examine these theories because of the inconsistencies in parameters of vibration application in the literature and the paucity of research exploring the mechanism of action.[1]

Figure 1: The Hyperice Hypervolt (Hyperice, Inc, Irvine, CA) mechanical percussion device.

Figure 2: Various application tips for mechanical percussion.

The marketing and utilization of local mechanical percussion devices has grown despite the paucity of studies on exploring the mechanism of action or clinical outcomes in patient care. To date, there is currently one published peer reviewed study on mechanical percussion devices. The researchers measured the acute post-treatment effects of a five minute mechanical percussion session on calf muscle range of motion (ROM) and plantar flexor maximal voluntary contractions (MVC). The researchers found acute in-

creases in ROM but no changes in plantar flexor MVC.[14] This research is similar to other myofascial interventions such as vibrating foam rollers. Researchers have reported similar post-treatment acute increases in ROM but insignificant changes in muscle performance after the vibrating roller intervention.[15,16] Other research on local vibration therapy has reported improvements in maximum isometric forces, ROM, and muscle performance when used as part of a traditional training program.[1,2] Peer et al. reported local vibration therapy produced acute improvements in ROM and muscle stiffness compared to ice, compression and elevation following a hamstring or ankle soft tissue injury.[17,18] The research on mechanical percussion devices is still emerging with only one study currently published. Future studies are needed to further validate mechanical percussion when compared to other local vibration therapy and myofascial interventions.

Currently there are no evidence based clinical guidelines for the use of mechanical percussion devices. Further laboratory-based and clinical outcomes studies are needed to best guide clinical practice regarding these devices; however, research should also be informed based on how the devices are utilized by clinicians when providing care to patients. Understanding the knowledge and current trends in the use of mechanical percussion devices among healthcare professionals may help guide researchers in developing guidelines for research and/or practice. Thus, the purpose of this study was to survey and document the knowledge, clinical application methods, and use of mechanical percussion devices among healthcare professionals in the United States.

METHODS

STUDY TYPE AND PARTICIPANTS

This cross-sectional survey study was approved by Institutional Review Board at California State University Dominguez Hills (# 20-065). Healthcare professionals were recruited via convenience sampling for this study. Participants of three professional organizations were sent a group email requesting participation in an online survey between the months of September to November 2019. A random sample of members from the National Athletic Trainers Association (N=3,000) and all members of the Academy of Orthopedic Physical Therapy (N=17,811) and American Academy of Sports Physical Therapy (N=6,597) were contacted.

SURVEY DESIGN

The online survey (SurveyMonkey® www.surveymonkey.com) included 25 questions that represented three distinct areas: 1) demographics and percussion device information, 2) clinical application methods, and 3) beliefs, clinical measures, and education. For respondent demographics, the goal was to document age, credentials, practice setting/s, and experience. For mechanical percussion device information, the goal was to document the types of commercial devices, applicator tips used by professionals, and common places clients may be directed to purchase such devices.

For clinical application methods, the goal was to document how professionals used the devices in three practice scenarios: 1) pre- and post-exercise, 2) pain modulation, and 3) to enhance myofascial mobility. Respondents were also asked questions regarding preferred device speed, treatment time, and movement rate for the device. For beliefs, the goal was to document respondent beliefs on using the devices in practice: choosing percussion devices as an intervention, therapeutic effects, variables that influence treatment, preferred clinical measures, and preferred modes of education. Appendix A provides a summary of survey questions.

After initial survey development was completed, the first survey draft underwent two rounds of pilot testing with five independent athletic training and physical therapy professionals to establish face validity. Based upon reviewer feedback, revisions were made, and a final set of survey items was identified.[19,20] The final survey was further tested for readability using the Flesch reading-ease test and Flesch-Kincaid grade level test. The survey's 25 questions scored 70.0 on the Flesch Ease of Reading Test and 6.0 on the Flesch-Kincaid Grade level test which indicated the English used in the survey was fairly easy to read and at the 6th grade level.[21] These methods have been used in prior myofascial intervention survey research.[19,20,22]

DATA ANALYSIS

Data were downloaded from SurveyMonkey for analysis. Statistical analysis was performed using SPSS version 25.0 (IBM SPSS, Armonk, NY, USA). Descriptive data including total responses, frequency count, and percentages were calculated. Data were treated conservatively, and any respondent who failed to answer an item, excluding demographic items, was removed from the data set.

RESULTS

A total of 27,408 healthcare professionals were recruited. Five hundred and ten professionals began the survey for a 1.9% overall response rate (510/27,408). A total of 425 respondents completed the survey (83.3% completion rate) which were included in the data analysis. Incomplete surveys were eliminated. This section discusses the majority of respondent answers for each question within the three distinct survey areas using rounded values for ease of interpretation. A more detailed description of respondent answers can be found in Tables 1-4.

RESPONDENT DEMOGRAPHICS AND MECHANICAL PERCUSSION DEVICES

Fifty-nine percent (n=251) of respondents were men and 41% (n=172) were women. Fifty-two percent (n=222) reported being a certified athletic trainer, 40% (n=170) a physical therapist, 3% a chiropractor, 1% a personal trainer, and 4% reported having a medical degree or other credential such as massage therapist. A substantial proportion of respondents reported working in an outpatient facility (36%, n=152) or university setting (31%, n=133). The reported average years in practice was approximately 16 years (Table 1).

Table 1: Demographics and devices (N=425)

Gender	**Frequency % (N)**
Male	59.06% (251)
Female	40.47% (172)
Prefer not to answer	00.47% (002)
Primary Profession	
Physical Therapist	40.00% (170)
Chiropractor	3.05% (13)
Certified Athletic Trainer	52.24% (222)
Occupational Therapist	0.00% (000)
Massage Therapist	0.71% (003)
Certified Personal Trainer	1.41% (6)
MD, DPM, DO	0.24% (1)
Other	2.35% (10)
Primary practice setting	
Outpatient facility	35.76% (152)
Hospital based facility	4.24% (18)
University sports medicine or athletic training facility	31.29% (133)
High school athletic training facility	15.76% (67)
Fitness or wellness facility	3.53% (15)
Other	9.41% (40)
Years in practice	
Average years in professional practice	15.60 ±11.78 years
***Type of commercial brands devices used in practice**	
Hyperice® Hypervolt	54.12% (230)
Theragun® original/GS Pro/G3	37.88% (161)
TimTam Power Massager™	2.59% (11)
KraftGun	0.24% (1)
Other commercial devices	5.17% (22)
Preferred mechanical percussion applicator tips	
Large round ball	33.88% (144)
Small round ball	43.53% (185)
Flat tip	14.12% (60)
Bullet or cone tip (pointy)	3.06% (13)
Fork	0.47% (2)
Other tips	4.95% (21)
Place where clients are directed to purchase devices	
Manufacturer website	39.06% (166)
Generic website (e.g. Amazon)	38.35% (163)
Store (brick and mortar)	3.29%(14)
Sell in my facility	3.29% (14)
I don't recommend	16.01`% (68)

* Respondents chose all options that applied to them; M.D= Medical Doctor; D.O= Doctor of Osteopathy; D.P.M= Doctor of Podiatric Medicine

Most respondents reported using mechanical percussion devices from the manufacturers Hyperice® (54%, n=230) and Theragun® (38%, n=161). The most popular applicator tips used were the small round ball (44%, n=185) and large round ball (34%, n=144 tips). Respondents most often directed clients to manufacturers websites (39%, n=166) or generic websites (38%, n=163) to purchase devices for self-care (Table 1).

Table 2: Clinical application: pre and post-exercise intervention (N=425)

Which percussion speed level is preferred for *pre-exercise* (based upon specific brand models)	**Frequency % (N)**
High speed (level 3) (range: 47-53Hz)	09.65% (41)
Medium speed (level 2) (range: 33-40 Hz)	37.65% (160)
Low speed (level 1) (range: 17-29 Hz)	23.52% (100)
I don't use a specific speed	20.00% (85)
I don't use percussion for a pre-intervention treatment	09.18% (39)
Which percussion time is preferred for *pre-exercise*	
5 to 30 seconds	05.88% (25)
30 seconds to 3 minutes	47.53% (202)
3 to 5 minutes	17.88% (76)
5 minutes or greater	02.35%(10)
I don't use a specific treatment time	17.18% (73)
I don't use percussion for a pre-intervention treatment	09.18% (39)
How fast is the device moved for *pre-exercise*	
1 to 2 seconds along the body region (up and down)	06.59% (28)
2 to 5 seconds along the body region (up and down)	34.12% (145)
5 to 10 seconds along the body region (up and down)	20.00% (85)
10 seconds or greater along the body region (up and down)	08.00% (34)
I don't use a specific cadence (speed)	22.11% (94)
I don't use percussion for a pre-intervention treatment	09.18% (39)
Which percussion speed level is preferred for *post-exercise* (based upon specific brand models)	
High speed (level 3) (range: 47-53Hz)	06.35% (27)
Medium speed (level 2) (range: 33-40 Hz)	32.71% (139)
Low speed (level 1) (range: 17-29 Hz)	27.53% (117)
I don't use a specific speed	24.94% (106)
I don't use percussion for a post-intervention treatment	08.47% (36)
Which percussion time is preferred for *post-exercise*	
5 to 30 seconds	05.65% (24)
30 seconds to 3 minutes	35.76% (152)
3 to 5 minutes	21.88% (93)
5 minutes or greater	05.65% (24)
I don't use a specific treatment time	22.59% (96)
I don't use percussion for a pre-intervention treatment	08.47% (36)
How fast does the device move for *post-exercise*	
1 to 2 seconds along the body region (up and down)	06.12% (26)
2 to 5 seconds along the body region (up and down)	28.94% (123)
5 to 10 seconds along the body region (up and down)	26.82% (114)
10 seconds or greater along the body region (up and down)	09.42% (40)
I don't use a specific cadence (speed)	20.23% (86)
I don't use percussion for a pre-intervention treatment	08.47% (36)

*Respondents chose all options that applied to them

CLINICAL APPLICATION: PRE- AND POST-EXERCISE INTERVENTION

For pre-exercise treatment, most respondents used a medium (38%, N=160) or low device speed (24%, n=100), while 20% (n=85) reported not using a specific speed setting. A portion of respondents preferred a treatment time of 30 seconds to three minutes (48%, n=202); a relatively equal amount of respondents reported using a treatment time of three to five minutes (18%, n=76) or reported not using a specific amount of time for treatment (17%; n=73). Most respondents indicated they moved the device at a rate ranging between two to 10 seconds (54%, n=230) along the treatment region during a treatment session (Table 2).

For post-exercise treatment, the majority of respondents also used a medium (33%, N=139) or low device speed (28%,

n=117); however, 25% (n=106) of respondents reported not using a specific speed setting. A portion of respondents (36%, n=152) preferred a total treatment time of 30 seconds to three minutes. It was also common for professionals to use treatment times of three to five minutes (22%, n=93) or to not use a specific treatment time post-exercise (23%; n=96). Most respondents reportedly moved the device at a rate ranging between two to 10 seconds (56%, n=237) along the treatment region (Table 2).

CLINICAL APPLICATION: PAIN MODULATION AND MYOFASCIAL MOBILITY

For pain modulation, the majority of respondents reported using a medium (23%, N=98) or low device speed (36%, n=155); however, a portion of respondents (21%; n=89) reported not using a specific speed setting. A subset of respondents preferred a treatment time of 30 seconds to three minutes (35%, n=151), but a treatment time of three to five minutes (21%, n=88) was also common. A number of respondents (17%; n=71) indicated they did not use a specific treatment time for pain modulation. A large portion of respondents moved the device at a rate ranging between two to 10 seconds (55%, n=235) along the treatment region for pain modulation.

For myofascial mobility, a medium speed device setting was used by the largest subset (34%, N=145) of respondents. Substantial portions of respondents, however, reported using either a high device speed (18%, n=77), a low device speed (16%, n=69), or non-specific device speed (24%; n=103) setting during treatment. A portion of respondents preferred a total treatment time of 30 seconds to three minutes (36%, n=152), but using a three to five-minute (22%, n=93) time was also common. A portion of respondents (23%; n=100) reported not using a specific treatment time. A large portion of respondents (54-56%, n=230) moved the device at a rate ranging between two to 10 seconds (54%, n=229) along the treatment region to improve myofascial mobility (Table 3).

BELIEFS, CLINICAL MEASURES, AND EDUCATION

For beliefs about percussion devices, most respondents indicated using the devices for therapeutic treatment (86%, n=365). The respondents indicated they chose to utilize the devices pre-exercise (46%, n=194) and post-exercise (43%, n=182) with their clients. Most respondents believed that mechanical percussion increases local blood flow (69%, n=293), modulates pain (65%, n=276), enhances myofascial mobility (62%, n=262), and reduces myofascial restrictions (54%, n=229). A portion of respondents indicated the percussion devices could enhance post-exercise recovery (32%, n=165), enhance pre-exercise neuromyofascial excitation (37%, n=156), and increase joint ROM (31%, n=133) (Table 4).

Most respondents reported that collaboration with other professionals (72%, n=305) and their prior empirical experience using the devices (48%, n=202) were substantial influencers of their use of mechanical percussion devices in practice. Other cited factors included social media (22%, n=97), manufacturer instructions (24%, n=100), and continuing education (23%, n=99). The clinical measures most often used by respondents to assess the effectiveness of mechanical percussion devices were patient reported outcomes (66%, n=280) and joint ROM (34%, n=144); however, 17% (n=71) of the respondents indicated not using any clinical measures to assess treatment efficacy. The most common mode of client education was live instruction (79%, n=334) and a smaller portion of respondents recommended a self-guided program (13%, n=56) (Table 4).

DISCUSSION

Mechanical percussion devices are an emerging type of myofascial intervention used by sports medicine professionals. Despite their popularity, there is little published peer-reviewed research on these devices which creates a gap between the evidence and clinical practice. Clinical practice recommendations or evidence-based reviews to guide clinical practice are lacking and little is known regarding the utilization of these devices by practicing healthcare professionals.[1,14] This survey was the first study to document healthcare professionals beliefs and clinical application of mechanical percussion devices which might guide future research. The subsequent sections will further discuss the survey responses.

RESPONDENT DEMOGRAPHICS AND MECHANICAL PERCUSSION DEVICES

A substantial proportion of respondents (67%) reported working in an outpatient facility or university setting. The most utilized percussion devices (92%) reported were from two manufacturers: Hyperice® and Theragun®. The most popular applicator tips used were the small round ball (44%) and large round ball (34%) tips (Table 1). These finding are similar to self-myofascial rolling surveys which revealed similar respondent demographics and clinical use of the devices.[19,20] Prior research revealed that professionals tend to follow recommendations supported by research in their clinical practice when using self-myofascial rollers;[20,23] however, clinicians do not have a similar body of knowledge to follow to guide clinical application of mechanical percussion devices. The majority of local muscle vibration therapy research has been focused on resistance training outcomes and the inconsistencies in utilized parameters in outcomes prevents the creation of evidence-based guidelines or an understanding of potential mechanisms of muscle response post-treatment.[1] Mechanical percussion researchers may want to utilize a similar research strategy to self-myofascial rolling research, which attempts to connect clinical practice and research. Researchers should consider the clinical setting, preferred devices, and applicator tips revealed in this survey when designing future studies. Replication of commonly utilized clinical parameters would provide a more representative sample of treatment effect that reflects current clinical practice and application of these devices. Similarly, more standardized approaches to laboratory-based research would better inform our knowledge of how musculoskeletal structures respond to local vibration therapy.[1,14]

Table 3: Clinical application: pain modulation and myofascial mobility (N=425)

Which percussion speed level is preferred for *pain modulation* (based upon specific brand models)	**Frequency % (N)**
High speed (level 3) (range: 47-53Hz)	09.41% (40)
Medium speed (level 2) (range: 33-40 Hz)	23.06% (98)
Low speed (level 1) (range: 17-29 Hz)	36.47% (155)
I don't use a specific speed	20.94% (89)
I don't use percussion for a pain modulation treatment	10.12% (43)
Which percussion time is preferred for *pain modulation*	
5 to 30 seconds	08.24% (35)
30 seconds to 3 minutes	35.53% (151)
3 to 5 minutes	20.71% (88)
5 minutes or greater	06.59% (28)
I don't use a specific treatment time	18.81% (80)
I don't use percussion for a pain modulation	10.12% (43)
How fast is the device moved for *pain modulation*	
1 to 2 seconds along the body region (up and down)	10.82% (46)
2 to 5 seconds along the body region (up and down)	32.00% (136)
5 to 10 seconds along the body region (up and down)	23.29% (99)
10 seconds or greater along the body region (up and down)	07.06% (30)
I don't use a specific cadence (speed)	16.71% (71)
I don't use percussion for a pain modulation treatment	10.12% (43)
Which percussion speed level is preferred for *myofascial mobility* (based upon specific brand models)	
High speed (level 3) (range: 47-53Hz)	18.12% (77)
Medium speed (level 2) (range: 33-40 Hz)	34.12% (145)
Low speed (level 1) (range: 17-29 Hz)	16.24% (69)
I don't use a specific speed	24.24% (103)
I don't use percussion for a myofascial mobility treatment	07.29% (31)
Which percussion time is preferred for *myofascial mobility*	
5 to 30 seconds	05.65% (24)
30 seconds to 3 minutes	35.77% (152)
3 to 5 minutes	21.88% (93)
5 minutes or greater	05.88% (25)
I don't use a specific treatment time	23.53% (100)
I don't use percussion for a myofascial mobility treatment	07.29% (31)
How is the device moved for *myofascial mobility*	
1 to 2 seconds along the body region (up and down)	06.59% (28)
2 to 5 seconds along the body region (up and down)	26.82% (114)
5 to 10 seconds along the body region (up and down)	27.29% (116)
10 seconds or greater along the body region (up and down)	05.42% (23)
I don't use a specific cadence (speed)	26.59% (113)
I don't use percussion for a myofascial mobility treatment	07.29% (31)

*Respondents chose all options that applied to them

DEVICE CLINICAL APPLICATION

The initial data regarding the clinical application of these devices among healthcare professionals can be used to help inform future laboratory studies. These results revealed that most respondents (52-62%) used a medium and low device speed setting for pre-exercise, post exercise, pain modulation, and myofascial mobility treatment. Most respondents preferred a total treatment range between 30 seconds and three minutes (36-48%) followed by three to five minutes (18-22%) for all four conditions. A large portion of respondents (54%) moved the device at a rate ranging between two to 10 seconds for all four conditions. Interestingly, twenty to twenty-two percent of respondents did not use a specific device speed setting, treatment time, or moving speed for all four conditions. The results suggest

Table 4: Beliefs, clinical measures, and education (N=425)

*Reasons for choosing mechanical percussion devices for their clients	Frequency % (N)
Injury prevention	25.18% (107)
Performance enhancement	18.35% (78)
Therapeutic treatment (e.g. pain modulation)	85.88% (365)
Pre-exercise warm-up	45.65% (194)
Post-exercise treatment	42.82% (182)
Other (please specify)	14.82% (63)
***Therapeutic effects respondents believe occur with mechanical percussion**	
Enhanced myofascial	61.79% (262)
Pain modulation	65.09% (276)
Increased joint range of motion	31.37% (133)
Enhanced post-exercise recovery	38.29% (165)
Enhanced pre-exercise neuromyofascial excitation	36.79% (156)
Increase in local blood flow	69.10% (293)
Breaking up scar adhesions	29.95% (127)
Breaking up myofascial trigger points	54.01% (229)
Other	09.67 % (41)
***Variables that influenced philosophy for using percussion treatment devices**	
Peer reviewed research articles	18.40% (78)
Continuing education courses and conference	23.35% (99)
Manufacturer instructions	23.58% (100)
Social medial posts or videos (e.g. YouTube)	22.88% (97)
Collaboration with other professionals	71.93% (305)
My prior empirical experience	47.64% (202)
Other (please specify)	11.56% (49)
***Clinical measures used to assess the effects of percussion treatment**	
Joint range of motion	33.88% (144)
Pressure pain threshold (e.g. algometer)	13.65% (58)
Patient reported outcomes (e.g. NPRS, VAS pain scales)	65.88% (280)
Movement based testing (e.g. FMS?, SFMA)	23.76% (101)
Muscle performance (strength testing)	8.71% (37)
No, I do not evaluate	16.71% (71)
Other	12.00% (51)
Common modes of educating clients about mechanical percussion	
Live instruction	78.59% (334)
Video instruction	02.59% (11)
Self-guided program (e.g. client chooses parameters)	13.18% (56)
Education materials (e.g. handouts with exercises)	05.65% (24)

*Respondents chose all options that applied to them
NPRS= Numerical pain rating scale; VAS= Visual analog scale; FMS™= Functional Movement Screen™; SFMA= Selective Functional Movement Assessment

that clinicians may be non-specific or inconsistent with the utilized treatment parameters when providing local mechanical percussion therapy.

Inconsistent treatment parameters have also been reported across the literature examining the effectiveness of local muscle vibration therapy with vibration frequencies ranging from 5-300Hz and treatment duration ranging from six seconds to 60 minutes.[1] Researchers examining strength training protocols and local vibration therapy have reported that lower frequencies (i.e., 65Hz)[24,25] were not as effective as higher frequencies (e.g., 100Hz, 300Hz)[26,27] for improving muscle performance. Other researchers[2,10,17] have also reported that low frequencies (i.e., 5-50Hz) can be effective for improving muscular performance with short treatment durations (i.e., 1-2 minutes). This has led some researchers to suggest that a relationship between frequency and treatment duration (i.e., high frequency and long treatment duration or low frequency and short treatment duration) may exist which could guide clinicians in setting treatment parameters in an attempt to maximize treatment effectiveness.[1]

Before using the literature to guide clinical practice, clinicians and researchers should consider three questions: 1) Are training protocols utilized in studies examining vibrational therapy matching similar practices found in clinical rehabilitation or fitness settings? 2) Are treatment duration and vibrational frequency equally weighted variables in determining treatment effect? and 3) Do reported or calculated effect sizes support or refute the potential reported results thought to contrast each other in the literature? Future research should utilize specific treatment parameters to help determine treatment effectiveness and yield greater understanding on potential tissue adaptations and mechanisms of action.

BELIEFS, CLINICAL MEASURES, AND EDUCATION

Research should also be conducted to assess the effect of mechanical percussion treatment on various clinical outcome measures. Most respondents (54-69%) believed that mechanical percussion increases local blood flow, modu-

lates pain, enhances myofascial mobility, and reduces myofascial restriction. A smaller portion believed these devices could enhance pre-exercise neuromyofascial excitation (37%) and increase joint range of motion (31%). The only published mechanical percussion study reported acute post-treatment increases in ROM but no changes in plantar flexor MVC.[14] This study provides some initial data supporting the effects of mechanical percussion devices on ROM. Other related research has been focused on muscle performance when combining local vibration therapy with strength training protocols as opposed to clinical outcomes research.[1] The paucity of mechanical percussion research highlights the need for more clinically controlled studies examining clinical outcomes. While research is lacking on mechanical percussions devices, our survey findings of respondent beliefs are not unexpected given the perceived benefits of other myofascial therapies (e.g., self-myofascial rolling, instrument assisted soft-tissue mobilization), which have been purported to produce similar clinical outcomes.[13,23,28,29]

The largest variable (72%) reported to influence respondents' use of mechanical percussion was collaboration with other professionals. These findings are consistent with other myofascial interventions studies that suggest clinicians will seek out or utilize informal training or peer feedback to guide practice.[29,30] The majority of professionals (66%) used patient reported outcomes (e.g. VAS, NPRS) to measure the efficacy of their treatment, which is expected given the literature evidence suggesting similar interventions are thought to improve patient reported outcomes such as pain.[28,31] A smaller portion of respondents (34%) used joint ROM as an outcome which reflects the respondent beliefs and mechanical percussion study discussed in the aforementioned section.[14] The most common mode of client education included live instruction with the devices. The use of patient outcomes and education is consistent with other myofascial interventions such as self-myofascial rolling.[19]

PRACTICE IMPLICATIONS AND FUTURE RESEARCH

This descriptive survey documented professional beliefs and clinical application methods that may help guide researchers. The results of this study should be considered a starting point for future research with respect to who is using these devices, settings used, as well as postulated benefits. There is a gap between the research and professional practice that should be used to ignite both scientific and clinical investigation. It is important to develop scientific guidelines to prescribe the most effective program for clients that considers appropriate outcomes that are feasible based on biophysiological processes. Furthermore, clinical studies are needed to determine the efficacy of these interventions regarding both merits and limitations. Future research is needed to study these topics and bring the industry closer to a consensus on optimal programming and application parameters for healthy and injured individuals.

LIMITATIONS

Several limitations need to be discussed for this investigation. First, this survey was sent to a sample of healthcare professionals, predominantly in an outpatient setting with a 1.5% response rate. A larger sample with a higher response rate may have produced different results and the current results could be influenced by non-response error. However, this is the first survey study on these devices which currently lack published evidence regarding their use or application parameters. Second, the survey contained a limited number of items. Different questions may have revealed different ideas of how professionals use mechanical percussion devices; for example, the mechanical percussion devices noted in the survey may not have represented all available commercial devices. Also, respondents with different training or practice settings may have interpreted questions differently which could influence responses. Finally, these results can only be generalized to the healthcare professionals surveyed. This survey was sent to members of three professional organizations. The results may not fully represent the perceptions and practices from other non-member healthcare professionals. However, the results do provide insight into responses among different professionals.

CONCLUSION

This is the first survey to document mechanical percussion beliefs and clinical application methods of healthcare professionals. The lack of research has forced professionals to use self-preferred treatment methods supported by recommendations from device manufactures, anecdotal evidence, or other informal sources. This is a concern because the clinical efficacy and safety of mechanical percussion is currently unknown. This survey is a starting point to guide future research on this topic.

CONFLICT OF INTEREST STATEMENT

The authors have no conflict of interest with this manuscript.

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REFERENCES

1. Germann D, El Bouse A, Shnier J, Abdelkader N, Kazemi M. Effects of local vibration therapy on various performance parameters: a narrative literature review. *J Can Chiropr Assoc*. 2018;62(3):170-181.

2. Goebel RT, Kleinöder H, Yue Z, Gosh R, Mester J. Effect of segment-body vibration on strength parameters. *Sports Med Open*. 2015;1(1):14. doi:10.1186/s40798-015-0022-z

3. Karacan I, Cidem M, Yilmaz G, Sebik O, Cakar HI, Türker KS. Tendon reflex is suppressed during whole-body vibration. *J Electromyogr Kinesiol*. 2016;30:191-195. doi:10.1016/j.jelekin.2016.07.008

4. Comeaux Z. Dynamic fascial release and the role of mechanical/vibrational assist devices in manual therapies. *J Bodyw Mov Ther*. 2011;15(1):35-41. doi:10.1016/j.jbmt.2010.02.006

5. Poppendieck W, Wegmann M, Ferrauti A, Kellmann M, Pfeiffer M, Meyer T. Massage and performance recovery: a meta-analytical review. *Sports Med*. 2016;46(2):183-204. doi:10.1007/s40279-015-0420-x

6. Behm DG, Peach A, Maddigan M, et al. Massage and stretching reduce spinal reflex excitability without affecting twitch contractile properties. *J Electromyogr Kinesiol*. 2013;23(5):1215-1221. doi:10.1016/j.jelekin.2013.05.002

7. McKechnie GJB, Young WB, Behm DG. Acute effects of two massage techniques on ankle joint flexibility and power of the plantar flexors. *J Sports Sci Med*. 2007;6(4):498-504.

8. McKechnie GJB, Young WB, Behm DG. Acute effects of two massage techniques on ankle joint flexibility and power of the plantar flexors. *J Sports Sci Med*. 2007;6(4):498-504.

9. Wu G, Ekedahl R, Stark B, Carlstedt T, Nilsson B, Hallin RG. Clustering of pacinian corpuscle afferent fibres in the human median nerve. *Exp Brain Res*. 1999;126(3):399-409. doi:10.1007/s002210050746

10. Tankisheva E, Bogaerts A, Boonen S, Delecluse C, Jansen P, Verschueren SM. Effects of a six-month local vibration training on bone density, muscle strength, muscle mass, and physical performance in postmenopausal women. *J Strength Cond Res*. 2015;29(9):2613-2622. doi:10.1519/jsc.0000000000000895

11. Schleip R. Fascial plasticity - A new neurobiological explanation: Part 1. *J Bodw Mov Ther*. 2003;7:11-19. doi:10.1016/S1360-8592(02)00067-0

12. Schleip R. Fascial plasticity - A new neurobiological explanation. Part 2. *J Bodw Mov Ther*. 2003;7:104-116. doi:10.1016/S1360-8592(02)00076-1

13. Behm DG, Wilke J. Do self-myofascial release devices release myofascia? rolling mechanisms: a narrative review. *Sports Med*. 2019;49(8):1173-1181. doi:10.1007/s40279-019-01149-y

14. Konrad A, Glashüttner C, Reiner MM, Bernsteiner D, Tilp M. The acute effects of a percussive massage treatment with a hypervolt device on plantar flexor muscles' range of motion and performance. *J Sports Sci Med*. 2020;19(4):690-694.

15. Lim JH, Park CB, Kim BG. The effects of vibration foam roller applied to hamstring on the quadriceps electromyography activity and hamstring flexibility. *J Exerc Rehabil*. 2019;15(4):560-565. doi:10.12965/jer.1938238.119

16. Lim JH, Park CB. The immediate effects of foam roller with vibration on hamstring flexibility and jump performance in healthy adults. *J Exerc Rehabil*. 2019;15(1):50-54. doi:10.12965/jer.1836560.280

17. Peer KS, Barkley JE, Knapp DM. The acute effects of local vibration therapy on ankle sprain and hamstring strain injuries. *Phys Sportsmed*. 2009;37(4):31-38. doi:10.3810/psm.2009.12.1739

18. Konrad A, Glashüttner C, Reiner MM, Bernsteiner D, Tilp M. The acute effects of a percussive massage treatment with a hypervolt device on plantar flexor muscles' range of motion and performance. *J Sports Sci Med*. 2020;19(4):690-694.

19. Cheatham SW. Roller massage: A descriptive survey of allied health professionals. *J Sport Rehabil*. 2019;28(6):640-649. doi:10.1123/jsr.2017-0366

20. Cheatham SW, Stull KR, Ambler-Wright T. Roller massage: Survey of physical therapy professionals and a commentary on clinical standards- part 2. *Int J Sports Phys Ther*. 2018;13(5):920-930.

21. Dunne S, Cummins NM, Hannigan A, Shannon B, Dunne C, Cullen W. A method for the design and development of medical or health care information websites to optimize search engine results page rankings on Google. *J Med Internet Res*. 2013;15(8):e183. doi:10.2196/jmir.2632

22. Cheatham SW, Stull KR. Knowledge of self-myofascial release among allied health students in the United States: A descriptive survey. *J Bodyw Mov Ther*. 2018;22(3):713-717. doi:10.1016/j.jbmt.2018.01.015

23. Cheatham SW, Stull KR. Roller massage: A commentary on clinical standards and survey of physical therapy professionals- part 1. *Int J Sports Phys Ther*. 2018;13(4):763-772.

24. Luo J, Clarke M, McNamara B, Moran K. Influence of resistance load on neuromuscular response to vibration training. *J Strength Cond Res*. 2009;23(2):420-426. doi:10.1519/JSC.0b013e318194241c

25. Luo J, McNamara B, Moran K. Effect of vibration training on neuromuscular output with ballistic knee extensions. *J Sports Sci*. 2008;26(12):1365-1373. doi:10.1080/02640410802199771

26. Iodice P, Bellomo RG, Gialluca G, Fanò G, Saggini R. Acute and cumulative effects of focused high-frequency vibrations on the endocrine system and muscle strength. *Eur J Appl Physiol*. 2011;111(6):897-904. doi:10.1007/s00421-010-1677-2

27. Souron R, Besson T, Lapole T, Millet GY. Neural adaptations in quadriceps muscle after 4 weeks of local vibration training in young versus older subjects. *Appl Physiol Nutr Metab*. 2018;43(5):427-436. doi:10.1139/apnm-2017-0612

28. McMurray J, Landis S, Lininger K, Baker R, Nasypany A, Seegmiller J. A comparison and review of indirect myofascial release therapy, instrument-assisted soft tissue mobilization, and active release techniques to inform clinical decision making. *Int J Athl Ther Train*. 2015;20:29-34. doi:10.1123/ijatt.2015-0009

29. Baker R, Start A, Larkins L, Burton D, May J. Exploring the preparation, perceptions, and clinical profile of athletic trainers who use instrument-assisted soft tissue mobilization. *Athl Train Sports Health Care*. 2018;10:169-180. doi:10.3928/19425864-20180201-02

30. Armstrong KJ, Weidner TG. Formal and informal continuing education activities and athletic training professional practice. *J Athl Train*. 2010;45(3):279-286. doi:10.4085/1062-6050-45.3.279

31. Cheatham SW, Lee M, Cain M, Baker R. The efficacy of instrument assisted soft tissue mobilization: a systematic review. *J Can Chiropr Assoc*. 2016;60(3):200-211.

SUPPLEMENTARY MATERIALS

Appendix A: Survey questions

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