

 Cleveland University
KANSAS CITY
Chiropractic and Health Sciences

Current Trends in the Use of Therapeutic Modalities in the Treatment of Sports Injuries
Stuart D. McIntosh, DC, MS, CSCS

Competencies and Proficiencies

1. What are therapeutic modalities and why are they used in the treatment of sports injuries

 2

Competencies and Proficiencies

1. What are therapeutic modalities and why are they used in the treatment of sports injuries
2. Transitioning from passive modalities to active care

 3

Competencies and Proficiencies

1. What are therapeutic modalities and why are they used in the treatment of sports injuries
2. Transitioning from passive modalities to active care
3. Overview of cryotherapy and the controversies in the treatment of sports injuries

 4

Competencies and Proficiencies

1. What are therapeutic modalities and why are they used in the treatment of sports injuries
2. Transitioning from passive modalities to active care
3. Overview of cryotherapy and the controversies in the treatment of sports injuries
4. Introduction to extracorporeal shock wave therapy

 5

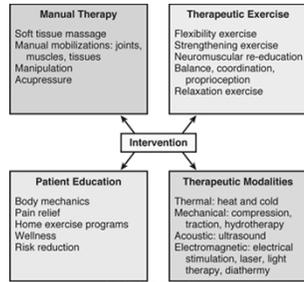
Competencies and Proficiencies

1. What are therapeutic modalities and why are they used in the treatment of sports injuries
2. Transitioning from passive modalities to active care
3. Overview of cryotherapy and the controversies in the treatment of sports injuries
4. Introduction to extracorporeal shock wave therapy
5. Introduction to laser therapy

 6



Therapeutic Modalities in Rehabilitation



Bellew, James W., Susan L. Michlovitz, and Thomas P. Nolan Jr. Michlovitz's Modalities for Therapeutic Intervention. FA Davis, 2016.



7

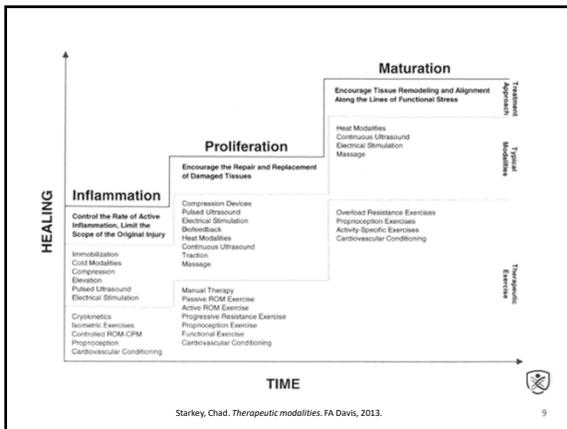
Part of a Comprehensive Plan

- Modalities are used to improve or ameliorate alterations in body function such as loss of ROM, pain, and tissue damage
- If a practitioner cannot explain the physiological and clinical reasoning for using a specific therapeutic modality, then perhaps the practitioner should not be using the technique!

Bellew, James W., Susan L. Michlovitz, and Thomas P. Nolan Jr. Michlovitz's Modalities for Therapeutic Intervention. FA Davis, 2016.



8



Starkey, Chad. Therapeutic modalities. FA Davis, 2013.



9

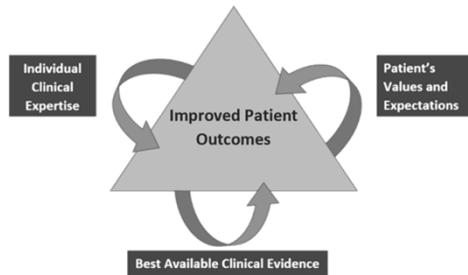
Part of a Comprehensive Plan

- ACA and Choosing Wisely
 - Avoid protracted use of passive or palliative physical therapeutic modalities for low-back pain disorders unless they support the goal(s) of an active treatment plan



10

Evidence-Based Practice



'Integrating the best available research evidence with clinical expertise and the patient's unique values and circumstances'



11

Cryotherapy



12

Quiz

- True or False: Ice is used decrease edema 2-3 days following trauma to the tissue.



13

Quiz

- True or False: Ice is used decrease edema 2-3 days following trauma to the tissue.
 - **False**



14

Quiz

- True or False: Ice is used decrease edema 2-3 days following trauma to the tissue.
 - **False**
- What does the RICE acronym stand for?



15

Quiz

- True or False: Ice is used decrease edema 2-3 days following trauma to the tissue.
 - **False**
- What does the RICE acronym stand for?
 - **Rest, Ice, Compression, Elevation**



16

Quiz

- True or False: Ice is used decrease edema 2-3 days following trauma to the tissue.
 - **False**
- What does the RICE acronym stand for?
 - **Rest, Ice, Compression, Elevation**
- True or False: When applying the RICE protocol using a bag of crushed ice, the practitioner must apply a thin layer of toweling between the ice and the skin.



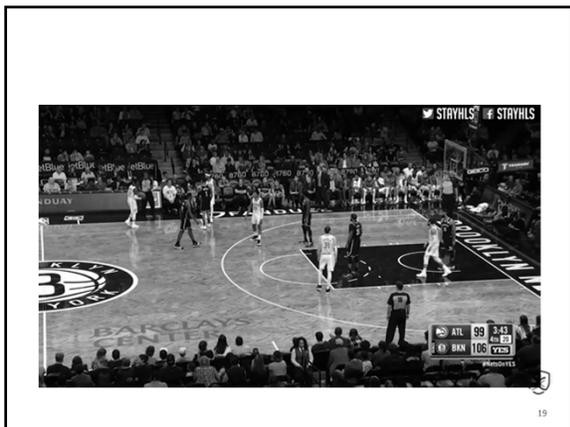
17

Quiz

- True or False: Ice is used decrease edema 2-3 days following trauma to the tissue.
 - **False**
- What does the RICE acronym stand for?
 - **Rest, Ice, Compression, Elevation**
- True or False: When applying the RICE protocol using a bag of crushed ice, the practitioner must apply a thin layer of toweling between the ice and the skin.
 - **False**



18



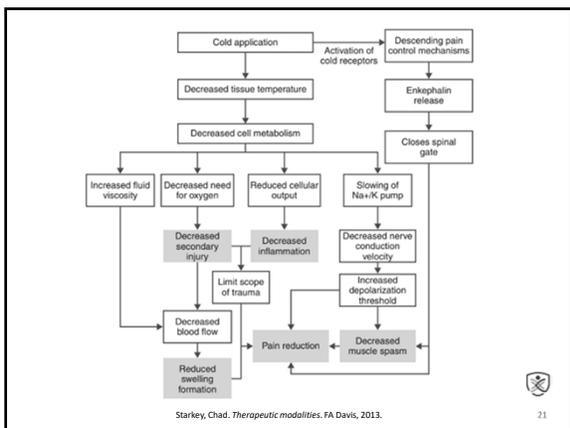
19

Cryotherapy

- Application of cold results in:
 - ↓ tissue temperature, cell metabolism, and blood flow
- Types
 - Ice, cold water, cold packs, vapocoolant sprays



Bellew, James W., Susan L. Michlovitz, and Thomas P. Nolan Jr. *Michlovitz's Modalities for Therapeutic Intervention*. FA Davis, 2016. 20



Starkey, Chad. *Therapeutic modalities*. FA Davis, 2013. 21

Cryotherapy: Indications / Safe

- Superficial cold can be used on**
- tissues over active epiphysis
 - intact skin overlying implants containing metal, plastic, or cement
 - skin overlying electronic devices
 - regions of known or suspected malignancy
 - the low back and abdomen of pregnant women
 - recently radiated tissues
 - reproductive organs
 - areas affected by skin diseases
 - the chest, heart, and head
 - tissues inflamed as result of recent injury or exacerbation of chronic inflammatory condition

Brooks, D. C. C., et al. "Electrophysical agents: Contraindications and precautions." *Canada: Physiotherapy, Canada* (2010). 22

Cryotherapy: Contraindications

- Superficial cold should not be applied**
- to persons with cold urticaria (also called cold allergy or cold hypersensitivity)
 - to persons with Raynaud's disease
 - to persons with cryoglobulinemia
 - to persons with hemoglobinemia
 - to areas of impaired circulation
 - to areas near chronic wounds
 - over regenerating nerves
 - to tissues affected by tuberculosis
 - to haemorrhaging tissue or in persons with untreated haemorrhagic disorders
 - to areas with impaired circulation
 - to persons with active deep vein thrombosis or thrombophlebitis
 - to anterior neck and carotid sinus

Home cold-therapy programmes should NOT be prescribed for

- persons with cognition or communication problems that interfere with their ability to follow directions.

Brooks, D. C. C., et al. "Electrophysical agents: Contraindications and precautions." *Canada: Physiotherapy, Canada* (2010). 23

Cryotherapy: Precautions

- Superficial cold can be applied with caution to**
- areas of impaired sensation that prevent people from giving accurate and timely feedback
 - infected tissues
 - tissue near or over eyes
 - damaged or at-risk skin
- Cold therapy that is intense or applied to a large surface sufficient to produce generalized peripheral vasoconstriction should be applied with caution to**
- people with hypertension
 - people with cardiac failure

Brooks, D. C. C., et al. "Electrophysical agents: Contraindications and precautions." *Canada: Physiotherapy, Canada* (2010). 24

Cryotherapy

➤ NBCE Practice Analysis of Chiropractic 2015

- 89.9% of chiropractors report using cryotherapy
- 55.4% of chiropractors indicated that they currently employ one or more CAs to perform direct patient contact duties in their offices
 - 71.5% of CAs are asked to perform cryotherapy



25

Cryotherapy

➤ Therapeutic Modalities Present in the Athletic Training Clinics Surveyed:

- Ice machine 99%
- Hydrocollator 99%
- Ultrasound 97%
- Game Ready 69%
- Paraffin 63%
- Laser 39%
- Diathermy 20%

Hawkins, Jeremy R., and Shawn W. Hawkins. "Clinical Applications of Therapeutic Modalities Among Collegiate Athletic Trainers, Part II: Thermotherapy." *International Journal of Athletic Therapy and Training* 21.1 (2016): 68-74.

26

Cryotherapy

➤ Therapeutic Modalities Present in the Athletic Training Clinics Surveyed:

- **Ice machine 99%**
- Hydrocollator 99%
- Ultrasound 97%
- Game Ready 69%
- Paraffin 63%
- Laser 39%
- Diathermy 20%

Hawkins, Jeremy R., and Shawn W. Hawkins. "Clinical Applications of Therapeutic Modalities Among Collegiate Athletic Trainers, Part II: Thermotherapy." *International Journal of Athletic Therapy and Training* 21.1 (2016): 68-74.

27

Cryotherapy

➤ Therapeutic Modalities Present in the Athletic Training Clinics Surveyed:

- **Ice machine 99%**
- Hydrocollator 99%
- Ultrasound 97%
- **Game Ready 69%**
- Paraffin 63%
- Laser 39%
- Diathermy 20%

Hawkins, Jeremy R., and Shawn W. Hawkins. "Clinical Applications of Therapeutic Modalities Among Collegiate Athletic Trainers, Part II: Thermotherapy." *International Journal of Athletic Therapy and Training* 21.1 (2016): 68-74.

28

Scenario #1: Acute Ankle Sprain

"The center on the men's basketball team went up for a rebound and landed awkwardly during practice. An initial evaluation was performed and it was determined that he suffered a grade II lateral ankle sprain. He was pulled from practice to begin treatment. Which treatment do you perform?"

Hawkins, Jeremy R., and Shawn W. Hawkins. "Clinical Applications of Therapeutic Modalities Among Collegiate Athletic Trainers, Part I: Cryotherapy." *International Journal of Athletic Therapy and Training* 21.1 (2016): 62-67.

29

Scenario #1: Acute Ankle Sprain

- 49% chose Game Ready as the modality of choice
- 30% chose RICE with an ice pack
- 11% chose ice immersion with cryokinetics
- 10% chose other

Hawkins, Jeremy R., and Shawn W. Hawkins. "Clinical Applications of Therapeutic Modalities Among Collegiate Athletic Trainers, Part I: Cryotherapy." *International Journal of Athletic Therapy and Training* 21.1 (2016): 62-67.

30

Scenario #2: Subacute Ankle Sprain

“The basketball player with a grade II lateral ankle sprain has moved past the acute care phase (0-4 days) and is now moving into the subacute phase (4-14 days). You begin a before-practice rehabilitation protocol to remove any swelling that is left over from the injury and to facilitate range of motion exercises. The athlete is full weight bearing and is able to walk unassisted. Which cryotherapy modality would you choose for the rehab?”

Hawkins, Jeremy R., and Shawn W. Hawkins. "Clinical Applications of Therapeutic Modalities Among Collegiate Athletic Trainers, Part I: Cryotherapy." *International Journal of Athletic Therapy and Training* 21.1 (2016): 62-67.



31

Scenario #2: Subacute Ankle Sprain

- 34% chose ice immersion + cryokinetics
- “A common goal of ice application is to cool the area to the point of numbness which will in turn facilitate pain-free range of motion exercises and the muscle pump to remove residual swelling.”
 - “Ice is nice, but motion is the potion.”
- 15% chose other
 - Most treatments included manual therapy, such as massage and IASTM

Hawkins, Jeremy R., and Shawn W. Hawkins. "Clinical Applications of Therapeutic Modalities Among Collegiate Athletic Trainers, Part I: Cryotherapy." *International Journal of Athletic Therapy and Training* 21.1 (2016): 62-67.



32

Why Ice Delays Recovery

- Dr. Gabe Mirkin
 - Coined the term RICE
 - Rest, Ice, Compression, Elevation
 - *Sportsmedicine Book*, 1978

<https://www.drmirkin.com/fitness/why-ice-delays-recovery.html>



33

RICE Protocol

TABLE 2-5. PRICE (Protection, Rest, Ice, Compression, and Elevation and Stabilization)

Intervention	Technique	Rationale
Protection	<ul style="list-style-type: none"> • Avoid activity that may cause additional harm • Splints or braces for immobilization or relative immobilization 	<ul style="list-style-type: none"> • Prevention of further injury or harmful stresses on inflamed tissues • Avoid unwanted motion of injured area
Rest	<ul style="list-style-type: none"> • Immobilization, limited weight bearing • Limited-range active motion 	<ul style="list-style-type: none"> • Limit irritation of inflamed tissues • Provides opportunity to ice, compress, and elevate
Ice	<ul style="list-style-type: none"> • Ice packs • Ice baths • Controlled-cold devices 	<ul style="list-style-type: none"> • Reduce bleeding • Control pain • Reduce microvascular permeability • Reduce metabolism to limit secondary hypoxic injury • Limit edema
Compression	<ul style="list-style-type: none"> • Light compressive bandages • Cold compression devices 	<ul style="list-style-type: none"> • Limit edema • Maintain gains in edema reduction
Elevation	<ul style="list-style-type: none"> • Extremity positioned above heart level 	<ul style="list-style-type: none"> • Reduce hydrostatic pressure to limit edema formation
Stabilization	<ul style="list-style-type: none"> • Use of splints, braces, wraps, or casts 	<ul style="list-style-type: none"> • Provide support to allow surrounding musculature to relax • Prevent unwanted or unexpected motion

Bellew, James W., Susan L. Michlovitz, and Thomas P. Nolan Jr. *Michlovitz's Modalities for Therapeutic Intervention*. FA Davis, 2016.



34

PRICE Needs Updating, Should We Call The POLICE?

- Protect
- Optimally Load
- Ice
- Compression
- Elevation



Bleakley, C. M., P. Glasgow, and D. C. MacAuley. "PRICE needs updating, should we call the POLICE?." (2012): 220-221.



35

Why Ice Delays Recovery

- Dr. Gabe Mirkin
 - Coined the term RICE
 - Rest, Ice, Compression, Elevation
 - *Sportsmedicine Book*, 1978
- In 2014:
 - “It appears that both ice and complete rest may delay healing, instead of helping.”
 - “ There is no reason to apply ice more than six hours after you have injured yourself.”

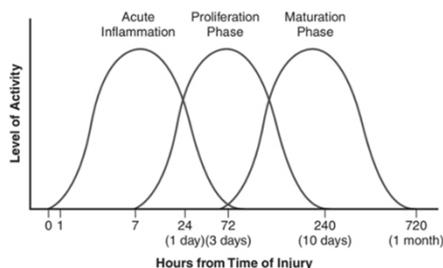
<https://www.drmirkin.com/fitness/why-ice-delays-recovery.html>



36



Stages of Healing



Starkey, Chad. *Therapeutic modalities*. FA Davis, 2013.

37

NATA: Conservative Management and Prevention of Ankle Sprains in Athletes

Management of Lateral Ankle Sprains

- Rest, ice, compression, and elevation (RICE) is almost universally accepted as best practice by athletic trainers and other health care professionals immediately after acute ankle sprains
- The acute phase of injury is defined as the period from the time of injury until the signs of inflammation (pain, heat, swelling, redness, and loss of function) peak and then begin to diminish

Kaminski, Thomas W., et al. "National Athletic Trainers' Association position statement: conservative management and prevention of ankle sprains in athletes." *Journal of athletic training* 48.4 (2013): 528-545.

38

NATA: Conservative Management and Prevention of Ankle Sprains in Athletes

- Cryotherapy should be applied to acute ankle sprains to reduce pain, minimize swelling formation, and decrease secondary injury.

Kaminski, Thomas W., et al. "National Athletic Trainers' Association position statement: conservative management and prevention of ankle sprains in athletes." *Journal of athletic training* 48.4 (2013): 528-545.

39

NATA: Conservative Management and Prevention of Ankle Sprains in Athletes

- Cryotherapy should be applied to acute ankle sprains to reduce pain, minimize swelling formation, and decrease secondary injury. **Evidence Category: C**

Kaminski, Thomas W., et al. "National Athletic Trainers' Association position statement: conservative management and prevention of ankle sprains in athletes." *Journal of athletic training* 48.4 (2013): 528-545.

40

NATA: Conservative Management and Prevention of Ankle Sprains in Athletes

- Cryotherapy should be applied to acute ankle sprains to reduce pain, minimize swelling formation, and decrease secondary injury. **Evidence Category: C**
- Compression should be applied to acute ankle sprains to minimize swelling.

Kaminski, Thomas W., et al. "National Athletic Trainers' Association position statement: conservative management and prevention of ankle sprains in athletes." *Journal of athletic training* 48.4 (2013): 528-545.

41

NATA: Conservative Management and Prevention of Ankle Sprains in Athletes

- Cryotherapy should be applied to acute ankle sprains to reduce pain, minimize swelling formation, and decrease secondary injury. **Evidence Category: C**
- Compression should be applied to acute ankle sprains to minimize swelling. **Evidence Category: C**

Kaminski, Thomas W., et al. "National Athletic Trainers' Association position statement: conservative management and prevention of ankle sprains in athletes." *Journal of athletic training* 48.4 (2013): 528-545.

42

NATA: Conservative Management and Prevention of Ankle Sprains in Athletes

- Cryotherapy should be applied to acute ankle sprains to reduce pain, minimize swelling formation, and decrease secondary injury. **Evidence Category: C**
- Compression should be applied to acute ankle sprains to minimize swelling. **Evidence Category: C**
- The limb with the acute ankle sprain should be elevated to minimize swelling.

Kaminski, Thomas W., et al. "National Athletic Trainers' Association position statement: conservative management and prevention of ankle sprains in athletes." *Journal of athletic training* 48.4 (2013): 528-545. 43

NATA: Conservative Management and Prevention of Ankle Sprains in Athletes

- Cryotherapy should be applied to acute ankle sprains to reduce pain, minimize swelling formation, and decrease secondary injury. **Evidence Category: C**
- Compression should be applied to acute ankle sprains to minimize swelling. **Evidence Category: C**
- The limb with the acute ankle sprain should be elevated to minimize swelling. **Evidence Category: C**

Kaminski, Thomas W., et al. "National Athletic Trainers' Association position statement: conservative management and prevention of ankle sprains in athletes." *Journal of athletic training* 48.4 (2013): 528-545. 44

NATA: Conservative Management and Prevention of Ankle Sprains in Athletes

- Cryotherapy should be applied to acute ankle sprains to reduce pain, minimize swelling formation, and decrease secondary injury. **Evidence Category: C**
- Compression should be applied to acute ankle sprains to minimize swelling. **Evidence Category: C**
- The limb with the acute ankle sprain should be elevated to minimize swelling. **Evidence Category: C**
- Functional rehabilitation is more effective than immobilization in managing grade I and II ankle sprains.

Kaminski, Thomas W., et al. "National Athletic Trainers' Association position statement: conservative management and prevention of ankle sprains in athletes." *Journal of athletic training* 48.4 (2013): 528-545. 45

NATA: Conservative Management and Prevention of Ankle Sprains in Athletes

- Cryotherapy should be applied to acute ankle sprains to reduce pain, minimize swelling formation, and decrease secondary injury. **Evidence Category: C**
- Compression should be applied to acute ankle sprains to minimize swelling. **Evidence Category: C**
- The limb with the acute ankle sprain should be elevated to minimize swelling. **Evidence Category: C**
- Functional rehabilitation is more effective than immobilization in managing grade I and II ankle sprains. **Evidence Category: A**

Kaminski, Thomas W., et al. "National Athletic Trainers' Association position statement: conservative management and prevention of ankle sprains in athletes." *Journal of athletic training* 48.4 (2013): 528-545. 46

NATA: Conservative Management and Prevention of Ankle Sprains in Athletes

Management of Lateral Ankle Sprains

- Most of the rationale for using RICE or individual components is based largely on low-quality clinical trials and laboratory studies with uninjured participants or animal models
- Although the clinical evidence is sparse, cryotherapy has been a mainstay of clinical practice for rehabilitation specialists

Kaminski, Thomas W., et al. "National Athletic Trainers' Association position statement: conservative management and prevention of ankle sprains in athletes." *Journal of athletic training* 48.4 (2013): 528-545. 47

Soft Tissue Injuries Simply Need PEACE & LOVE

P	PROTECTION Rest and avoid any movements that increase pain during the first few days after injury.
E	ELEVATION Elevate the injured limb higher than the heart as often as possible.
A	AVOID ANTI-INFLAMMATORIES Avoid taking any medications that inhibit the inflammatory response, such as NSAIDs.
C	COMPRESSION Use an elastic bandage or wrap to reduce swelling.
E	EDUCATION Get the right advice from your healthcare provider and understand the importance of rest and protection.
&	
L	LOAD If you can, avoid physical activity to normal activities. Your body will tell you when it's safe to return to work.
O	OPTIMISM Optimism can lead to better recovery by being confident and positive.
V	VASCULARISATION Increase blood flow to the injured area to reduce swelling and help with recovery.
E	EXERCISE Start with gentle, low-impact exercises and gradually increase as you feel better.

<https://blogs.bmj.com/bjbm/2019/04/26/soft-tissue-injuries-simply-need-peace-love/> 48

Extracorporeal Shock Wave Therapy



49

Quiz

- What is the frequency range of human hearing?



50

Quiz

- What is the frequency range of human hearing?
 - **20 to 20,000Hz**



51

Quiz

- What is the frequency range of human hearing?
 - **20 to 20,000Hz**
- A frequency of 1 MHz produces _____ sound waves per second.



52

Quiz

- What is the frequency range of human hearing?
 - **20 to 20,000Hz**
- A frequency of 1 MHz produces _____ sound waves per second.
 - **Ultrasound – 1 million sound waves per second**



53

Quiz

- What is the frequency range of human hearing?
 - **20 to 20,000Hz**
- A frequency of 1 MHz produces _____ sound waves per second.
 - **Ultrasound – 1 million sound waves per second**
- Name three clinical applications of acoustical energy in medicine:



54

Quiz

- What is the frequency range of human hearing?
 - **20 to 20,000Hz**
- A frequency of 1 MHz produces _____ sound waves per second.
 - **Ultrasound – 1 million sound waves per second**
- Name three clinical applications of acoustical energy in medicine:
 - **Diagnostic imaging, therapeutic ultrasound, LIPUS, lithotripsy**



55

Quiz

- What is the frequency range of human hearing?
 - **20 to 20,000Hz**
- A frequency of 1 MHz produces _____ sound waves per second.
 - **Ultrasound – 1 million sound waves per second**
- Name three clinical applications of acoustical energy in medicine:
 - **Diagnostic imaging, therapeutic ultrasound, LIPUS, lithotripsy**
- What are the stages of tissue healing?



56

Quiz

- What is the frequency range of human hearing?
 - **20 to 20,000Hz**
- A frequency of 1 MHz produces _____ sound waves per second.
 - **Ultrasound – 1 million sound waves per second**
- Name three clinical applications of acoustical energy in medicine:
 - **Diagnostic imaging, therapeutic ultrasound, LIPUS, lithotripsy**
- What are the stages of tissue healing?
 - **Inflammation, proliferation, maturation**



57

Extracorporeal Shock Wave Therapy

- Most are familiar with the use of lithotripsy
- Concept of using high-energy shock waves is not new
- Single-impulse, focused acoustical sound waves having a rapid rise in pressure are used for ESWT
- Used to treat chronic musculoskeletal conditions such as calcific tendinopathy, lateral epicondylopathy, and plantar fasciopathy



Bellew, James W., Susan L. Michlovitz, and Thomas P. Nolan Jr. *Michlovitz's Modalities for Therapeutic Intervention*. FA Davis, 2016. 58

Extracorporeal Shock Wave Therapy

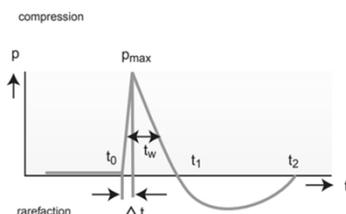
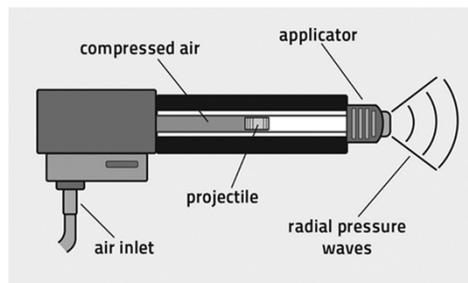


Fig 16 • 6 A single shock wave used for extracorporeal shock wave therapy. Note parameters of focused shock wave. T (change in time); P_{max} pressure maximum; Δt pressure rise time; t_w half width time; P_i negative peak pressure. (Diagram courtesy of Sonorex, Inc., Fayetteville, NC)



Bellew, James W., Susan L. Michlovitz, and Thomas P. Nolan Jr. *Michlovitz's Modalities for Therapeutic Intervention*. FA Davis, 2016. 59

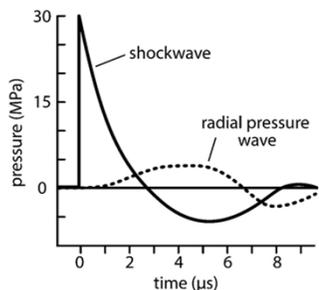
Radial Pressure Wave



Moya, Daniel, et al. "The role of extracorporeal shockwave treatment in musculoskeletal disorders." *JBSIS* 100.3 (2018): 251-263. 60



ESWT versus RPW



Moya, Daniel, et al. "The role of extracorporeal shockwave treatment in musculoskeletal disorders." JBIS 100.3 (2018): 251-263. 61

Extracorporeal Shock Wave Therapy

- Contraindications:
 - Bleeding conditions
 - Pacemakers
 - Medications that prolong blood clotting
 - Children
 - Pregnancy
 - Acute injuries



Bellew, James W., Susan L. Michlovitz, and Thomas P. Nolan Jr. Michlovitz's Modalities for Therapeutic Intervention. FA Davis, 2016. 62

Extracorporeal Shock Wave Therapy

- Based upon a systematic review of nine placebo-controlled trials involving 1006 participants
 - There is "platinum" level evidence that shock wave therapy provides little or no benefit in terms of pain and function in lateral elbow pain
 - There is "silver" level evidence based upon one trial involving 93 participants that steroid injections may be more effective than ESWT

Buchbinder R, Green S, Youd JM, Assendelft WJ, Barnsley L, Smidt N. Shock wave therapy for lateral elbow pain. Cochrane Database of Systematic Reviews 2005, Issue 4. Art. No.: CD003524. DOI: 10.1002/14651858.CD003524.pub2 63

ESWT for Lower Limb Tendinopathy

- Accumulating evidence for the effectiveness of ESWT when treating lower limb tendinopathies
 - Greater trochanteric pain syndrome (GTPS), patellar tendinopathy (PT), and Achilles tendinopathy (AT)
- Conclusion:
 - An effective intervention
 - Should be considered for lower limb tendinopathy when other nonoperative treatments have failed

Mani-Babu, S., Morrissey, D., Waugh, C., Screen, H., & Barton, C. (2015). The Effectiveness of Extracorporeal Shock Wave Therapy in Lower Limb Tendinopathy: A Systematic Review. The American Journal of Sports Medicine, 43(3), 752-761. https://doi.org/10.1177/0363546514531911 64

Extracorporeal Shock Wave Therapy

- ESWT has been proven an effective and safe non-invasive treatment option for tendon and other pathologies of the musculoskeletal system in a multitude of high-quality RCTs
- Optimum treatment protocol identified in this systematic review
 - Three treatment sessions at 1-week intervals, with 2000 impulses per session and the highest energy flux density that can be applied

Schmitz, Christoph, et al. "Efficacy and safety of extracorporeal shock wave therapy for orthopedic conditions: a systematic review on studies listed in the PEDro database." British medical bulletin 116.1 (2015): 115. 65

Light Amplification by Stimulated Emission of Radiation

66



Quiz

- What is the speed of light?



Quiz

- What is the speed of light?
 - **299,792,458 meters per second or 3.00×10^8 m/s**



Quiz

- What is the speed of light?
 - **299,792,458 meters per second or 3.00×10^8 m/s**
- Name three examples of photoreceptors found in the human body or found in nature:



Quiz

- What is the speed of light?
 - **299,792,458 meters per second or 3.00×10^8 m/s**
- Name three examples of photoreceptors found in the human body or found in nature:
 - **Chlorophyll, rods and cones in the eye, cytochrome C oxidase of the mitochondria**



Light Amplification by Stimulated Emission of Radiation



- Originally theorized by Albert Einstein in 1917
- Not produced until the 1950's
- FDA approval for MSK conditions in early 2000's

Bellew, James W., Susan L. Michlovitz, and Thomas P. Nolan Jr. Michlovitz's Modalities for Therapeutic Intervention. FA Davis, 2016.



Light Amplification by Stimulated Emission of Radiation

- All light is composed of photons, which are packets of light energy in the form of waves
- Lasers produce light that is highly refined
- Photons stimulate chromophores in a process known as photobiomodulation
- The stimulation of chromophores results in beneficial therapeutic outcomes
 - Pain relief, accelerated healing, immunomodulation, wound healing, tissue regeneration, muscle relaxation, local vasodilation

Bellew, James W., Susan L. Michlovitz, and Thomas P. Nolan Jr. Michlovitz's Modalities for Therapeutic Intervention. FA Davis, 2016. 73

Light Amplification by Stimulated Emission of Radiation

- NBCE Practice Analysis of Chiropractic 2015
 - 23.5% of chiropractors report using cold laser
 - 55.4% of chiropractors indicated that they currently employ one or more CAs to perform direct patient contact duties in their offices
 - 16.3% of CAs are asked to perform cold laser

Bellew, James W., Susan L. Michlovitz, and Thomas P. Nolan Jr. Michlovitz's Modalities for Therapeutic Intervention. FA Davis, 2016. 74

Light Amplification by Stimulated Emission of Radiation

- Therapeutic Modalities Present in the Athletic Training Clinics Surveyed:
 - Ice machine 99%
 - Hydrocollator 99%
 - Ultrasound 97%
 - Paraffin 63%
 - **Laser 39%**
 - Diathermy 20%

Hawkins, Jeremy R., and Shawn W. Hawkins. "Clinical Applications of Therapeutic Modalities Among Collegiate Athletic Trainers, Part II: Thermotherapy." International Journal of Athletic Therapy and Training 21.1 (2016): 68-74. 75

Laser Classifications

- Class II: Produces an output up to 1mW
- Class IIIa: Produces an output up to 5mW
- Class IIIb: Produces an output between 5mW and 500mW
- Class IV: Produces an output greater than 500mW



Bellew, James W., Susan L. Michlovitz, and Thomas P. Nolan Jr. Michlovitz's Modalities for Therapeutic Intervention. FA Davis, 2016. 76

Wavelength vs. Power vs. Energy

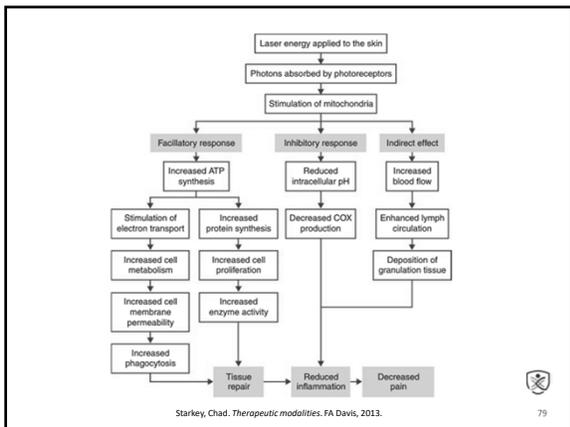
- Wavelength determines depth of penetration
 - In nanometer (nm)
- Power determines saturation at the targeted depth
 - In watt (W)
 - Consider 'spot size'
 - Power density (W/cm²)
- Total energy delivered
 - In joule (J)
 - Energy density (J/cm²)



Bellew, James W., Susan L. Michlovitz, and Thomas P. Nolan Jr. Michlovitz's Modalities for Therapeutic Intervention. FA Davis, 2016. 77



Bellew, James W., Susan L. Michlovitz, and Thomas P. Nolan Jr. Michlovitz's Modalities for Therapeutic Intervention. FA Davis, 2016. 78



Laser: Contraindications

LLLT/non-coherent light should not be applied to

- tissues infected with tuberculosis or other forms of virulent bacteria
- the low back or abdomen of pregnant women
- regions of known or suspected malignancy
- actively bleeding tissue or persons with untreated haemorrhagic disorders
- regions with active deep vein thrombosis or thrombophlebitis
- eyes
- reproductive organs (testes)

Brooks, D. C. C., et al. "Electrophysical agents: Contraindications and precautions." *Canada: Physiotherapy, Canada* (2010). 80

Laser: Precautions

LLLT/non-coherent light can be applied with caution to

- recently radiated tissues
- persons with photosensitivity disorders (xeroderma pigmentosum) or systemic lupus erythematosus
- persons with infections who have a compromised immune function
- persons with cognition or communication impairments sufficient to prevent them from giving accurate and timely feedback
- active epiphysis
- anterior neck and carotid sinus

Brooks, D. C. C., et al. "Electrophysical agents: Contraindications and precautions." *Canada: Physiotherapy, Canada* (2010). 81

Goggles are Required

82

Additional Considerations

- Protective eyewear must be worn with Class IIIb and Class IV lasers to prevent direct or indirect eye exposure
- Contraindications for Class IV, in addition to those from *Electrophysical Agents*:
 - Active epiphysis or open growth plates
 - Endocrine system, particularly thyroid
- Precautions for Class IV, in addition to those from *Electrophysical Agents*:
 - Tattoos

Bellew, James W., Susan L. Michlovitz, and Thomas P. Nolan Jr. *Michlovitz's Modalities for Therapeutic Intervention*. FA Davis, 2016. 83

Laser Therapy for Carpal Tunnel Syndrome

- Reviewed 22 clinical trials that assessed the safety and benefit of laser when compared to a placebo or another non-surgical treatment for CTS
- Most of these studies had weaknesses that could have compromised their results and caused them to overestimate or underestimate benefits or harms
- There is insufficient evidence to support laser being better or worse than any other type of non-surgical treatment in the management of CTS

Rankin IA, Sargeant H, Rehman H, Gurusamy K. Low-level laser therapy for carpal tunnel syndrome. *Cochrane Database of Systematic Reviews* 2017, Issue 8. Art. No.: CD012765. DOI: 10.1002/14651858.CD012765 84

The Use of Laser Therapy for Musculoskeletal Pain

- According to the more than 4000 studies on pub.med.gov, it can be concluded that the majority of laboratory and clinical studies have demonstrated that laser has a positive effect on acute and chronic musculoskeletal pain
- Laser is beneficial for pain relief and can accelerate the body's ability to heal itself
- Laser does not correct situations involving structural deficits or instabilities whether in bone or in soft tissue

Cotler, Howard B., et al. "The use of low level laser therapy (LLL) for musculoskeletal pain." *MOJ orthopedics & rheumatology* 2.5 (2015).



85

Noninvasive Treatments for Acute, Subacute, and Chronic Low Back Pain

- For patients with chronic low back pain, clinicians and patients should initially select nonpharmacologic treatment:
 - Exercise
 - Multidisciplinary rehabilitation
 - Acupuncture
 - Mindfulness-based stress reduction
 - Tai chi or yoga
 - Motor control exercise
 - Progressive relaxation
 - Electromyography biofeedback
 - **Low-level laser therapy**
 - Operant therapy
 - Cognitive behavioral therapy
 - Spinal manipulation

Noninvasive treatments for acute, subacute, and chronic low back pain: a clinical practice guideline from the American College of Physicians. Gaseem, Amir, et al. -- *Annals of internal medicine* 166.7 (2017): 514-530.



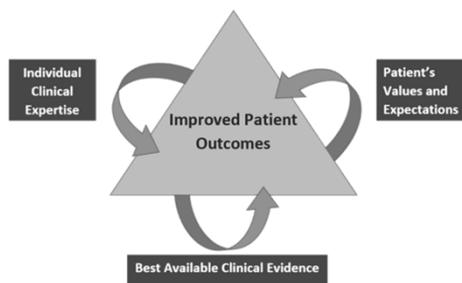
86

In Conclusion



87

Evidence-Based Practice

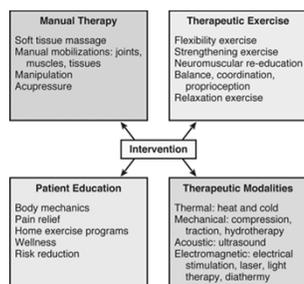


'Integrating the best available research evidence with clinical expertise and the patient's unique values and circumstances'



88

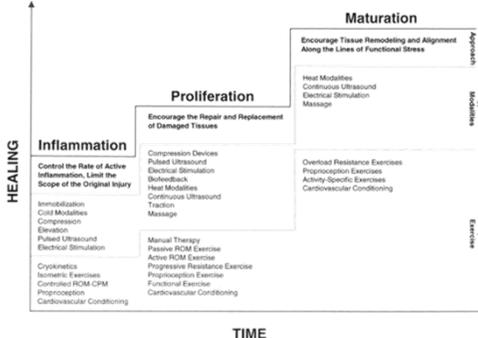
Therapeutic Modalities in Rehabilitation



Bellew, James W., Susan L. Michlovitz, and Thomas P. Nolan Jr. Michlovitz's Modalities for Therapeutic Intervention. FA Davis, 2016.



89



Starkey, Chad. Therapeutic modalities. FA Davis, 2013.



90

Thank You!

➤ Contact:

Stuart D. McIntosh
Assistant Professor
Cleveland University-Kansas City
stuart.mcintosh@cleveland.edu
Office: 913.234.0737



91