



GILBERTSON GUIDE

FOR PAIN MANAGEMENT
AND PERFORMANCE

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Why Managing Pain is Important for Performance

Background:

The prevalence of injury in the National Football League (NFL) is 100%. It is therefore reasonable to assume the prevalence of pain is also 100%. In spite of this, players generally do not seek care for pain unless:

- the pain results in a loss of function/performance; i.e. player has limitations on ability to play;
- the player perceives the cause of the pain to be serious; i.e. threat to career.

Conversely, players will be less likely to seek care if:

- there is no loss in function;
- the player does not want to know the cause of the pain;
- the player believes he can manage the pain on his own.
- The player feels disclosure of pain will adversely affect his employment status

Pain and Pain Management:

There is no universal understanding of pain, nor a universal solution. The best we can do is manage it. As a result, there are thousands of treatments, so it is imperative that players are educated about their options. For most injuries, time coupled with the body's innate wisdom, are the most effective therapies. The role of all treatment modalities is to assist the body in healing and restoring function. Despite extensive research (see references) in pain management, the only formal conclusion that can be made is that most interventions help someone, none help everyone, and few help indefinitely.

It is increasingly accepted that a multimodal, patient-centered approach reflecting the biological, psychological, social, and spiritual needs of the player is the most effective way to restore function after injury. A typical treatment for an athletic injury would include medication and/or a physical modality to decrease pain and inflammation, activity restriction to allow healing, and therapeutic exercise to maintain function and promote safe return to play. It is critical that the treatment plan be tailored to the unique needs of each athlete.

It is important to note that when selecting which treatments to use, a player considers and understands the cost, risk and benefits of the various modalities. There is no treatment that has been ever developed which does not have risks involved, including serious ones such as permanent disability or death. It is common for those providing treatment to neglect to adequately discuss the risks. It needs to also be mentioned that there may be legal barriers for certain options.

When making decisions, it is important to think beyond the immediate and short term. Life is long, playing time short. It is not always the injury that has long term

consequences; certain treatments also have long term ramifications which may seem negligible in the short term but are very harmful in the long term. Too often we here veterans and retirees lament:

“If I only knew then what I know now, I might have done things differently.”

What You Need to Know About Managing Your Pain

Purpose of This Guide:

The NFL Players Association (NFLPA) commissioned a committee to create a best practice guide to better inform current and former NFL players, team officials, health care providers, family members, and trusted friends, on the various modalities used to manage pain. In creating this document, we recognize that the incidence of injury in current players is 100%, that the experience of pain is ubiquitous, and the ability to play is paramount. As a result, our focus is on both pain and function.

An exhaustive, comprehensive assessment of all potential modalities is well beyond the scope of this guide. Instead, we have consolidated the recommendations of committee members, active players, and retired players in deciding what modalities to include. This document is meant to be dynamic and through player feedback, we hope to add modalities to our review. We recognize that the state of the art is constantly changing, and evidence is accumulating. Through regular reviews, this document will be modified to reflect these realities.

Our goal is to be objective. Our purpose is to provide succinct descriptions of each modality coupled with references for each. And our hope is that armed with this information, each player may make a more educated decision about managing his unique situation.

Using This Guide:

This guide is divided into two sections:

1. An introductory overview of concepts related to pain, performance, and its measurement and study.
2. Modalities used to treat pain

A brief description of each modality is provided. References pertinent to each modality accompany that description.

Understand Your Rights and Responsibilities:

Illness, or injury, has been described as: a state of disability or distress which becomes regarded as illness when the sufferer turns to another for care and treatment. This definition implies two things. First, injury of medical significance affects function/performance. Second, when treatment begins, a healthcare provider – patient relationship has been created, one with medical, legal, and human ramifications.

There are three types of the provider-patient relationships: Passivity-Activity, Guidance-Cooperation, and Mutual Participation. It is the third, Mutual Participation, we wish to promote. In this model, the health care provider and the patient work together to figure out what the problem is, what caused it, how to remedy and prevent future occurrences of the problem through a comprehensive treatment approach. In order to do this, the

player must possess sufficient information so that he may actively participate in decision making.

A player has both rights and responsibilities when participating in his healthcare. All decisions have an effect on the player, his family, and teammates in the immediate term (today's game or practice), short term (the rest of the season/career), and long term (life after football). The rights and responsibilities include, but are not limited to:

1. **Take an active role in preventing injury.** The best treatment of an injury is to prevent it from happening. While it may be impossible to completely prevent injury in football, many injuries can be prevented by learning and practicing proper technique, ensuring proper nutrition before and during all activities, maintaining proper fluid, choosing and wearing the ideal protective equipment, etc.
2. **Understand your limits.** Elite athletes have high tolerance for pain. This can be both good and bad. It is good because it allows you to push beyond what most others can tolerate so you and your team can accomplish something great. It is bad because it is easy to go too far when seeking such an accomplishment or when putting the needs of the team above your own. Going beyond your own limits may be helpful to your team, but ultimately harmful to you and your family.
3. **Understand your body.** Pain, as described below, is a signal. What does it mean for you; how much are you willing to tolerate; how is it affecting your function, etc.?
4. **Take an active role in your treatment.** As mentioned throughout this document, no treatment works for everyone, and treatment plans must involve multiple individualized interventions. All treatments have the potential to harm, and decisions including when to return to play can have significant ramifications. Ask questions; be informed!
5. **Understand your priorities for the immediate, short, and long term.** It is normal that these priorities will change over time, so they should periodically be reviewed.
6. **Seek the advice of others.** It is always best to seek the counsel of several people. This includes family and friends and others who know you (consult with team union rep). When making medical decisions, it is important to have an understanding of what **best practices and evidence-based medicine** actually mean and how to obtain that information (see below).
7. **Know what you are putting in your body.** You should never take a medication, a supplement, an IV, or put anything in, on, or around your body without knowing what it is, what its potential to help is, and what the risks are. It is unethical to provide care to an uninformed patient.
8. **Know the laws of the state in which you play.** While injury is more the rule than the exception in the NFL, it is a workplace injury that falls under the local workers' compensation statutes. These vary state by state. If you have questions about your rights, consult the NFL PA for information.

Defining Pain and Performance:

When planning treatment for pain, then, it is important to understand what is causing the pain. We can think of the cause of pain in many different ways. For our purpose, we can think of it in terms of the following.

1. The structure of the body injured
2. The mechanism of the injury
3. The time element of the injury.

In creating a treatment plan, it is important to know what structure has been injured, how it was injured, and how long it has been injured. For example, one would treat a 3-day old knee injury very differently from a 3-month-old knee injury or a 30-year-old knee injury.

Structure and Pain

When we think of **structure**, we can simplify diagnosis and treatment into three groups, somatic, visceral, and nerve. The following are the sub-groups for each:

- Somatic structures: bone, cartilage, ligament, tendon, muscle, skin, other soft tissue.
- Visceral Structures: internal organs, blood vessels, sweat glands.
- Nerves: brain, spinal cord, peripheral nerves

The way we feel pain is very different for each of these structural types, as such they will require different treatment approaches. In football, most injuries of consequence occur to somatic structures. However, visceral injuries do occur. For example, in 2001, Drew Bledsoe suffered a ruptured blood vessel in his chest that threatened his life.

Neurological injuries such as concussion, post-concussive syndrome, cumulative traumatic encephalopathy (CTE), spinal cord injury, stingers (brachial plexopathy, nerve root injury), and other nerve injuries are common, and all can include a sensation of pain. There is considerable overlap between each of these, and one can look very much like another. It takes a thorough examination to differentiate between these.

Mechanisms of Pain

There are three major mechanisms of pain: nociceptive, inflammatory, and neuropathic.

Nociceptive pain is what we usually think of when we think of pain. A structure is irritated or damaged, a nerve signal is created, and our brain is informed that something is wrong, something we feel as pain. This signal can last anywhere from seconds to forever. If there is sufficient tissue injury, the body responds with an inflammatory response to heal the injured structure. This is a good thing. Increased blood flow brings repair cells and proteins to the area to fix the problem. The acute symptoms of inflammation include pain, swelling, stiffness, and loss of function. As the structure heals, the inflammation goes away, and function is restored. Rest, ice, compression, and elevation (RICE) is the standard treatment for acute inflammation from injury and is used to minimize inflammation not eliminate it.

Inflammatory pain is the result of the inflammatory process going crazy either because of an abnormal neurological response to the acute injury (see chronic pain below), referred to as neurogenic inflammation, or as its own disease. In nociceptive pain, tissue damage causes inflammation. In inflammatory pain, the reverse happens, and inflammation causes tissue damage. This is the case in diseases such as osteoarthritis, Reflex Sympathetic Dystrophy (RSD), Guillain Barre syndrome, and hundreds of other conditions. While these conditions are not common in football players and are not caused by injury, they do play a role in sports. Travis Frederick of the Dallas Cowboys was diagnosed with Guillain-Barre. The golfer Phil Mickelson has psoriatic arthritis. These challenge their ability to participate.

Neuropathic pain is the third mechanism of pain. There are two major types. The first is caused by direct injury to the peripheral nerve, spinal cord, or brain. While this injury will result in inflammation and all the symptoms that go with that, it also can result in a short circuit in the nervous system in which false sensory information is transmitted to the brain. For example, after amputation, phantom pain frequently occurs. The sufferer feels pain coming from a limb that is no longer there.

The second type of neuropathic pain is **chronic, pathological pain**. It is not a signal, but rather a signal gone crazy. It can occur with any type of structural injury. When a structure is injured and inflammation is created, the pain nerves that supply that structure become hypersensitive. Once they are sensitized, they start firing more regularly and communicate with the spinal cord and brain much more frequently. This excess stimulation has the potential to “wind up” relay centers in the spinal cord and brain, making them more sensitive. Think of the hypersensitivity of touch that occurs with sunburn. When this occurs, sensory stimulation, which would not normally be interpreted as painful, becomes interpreted as pain. In pathological pain, the tissue may have healed, but the sensation of pain persists. Use of the affected area creates pain leading the sufferer to believe he is causing further injury. This creates dis-use which aggravates the problem.

For more information on mechanisms of pain, see: “Explore the Pain Pathway,” <https://www.chronicpaindrivers.com/explore-the-pain-pathway>

Treatment for all pain must be multimodal and bio-psycho-social (see below). Treatments focused only on the site of pain and not the whole of the pain perception system are bound to fail.

Time and Pain

Whether pain is from injury to a somatic, visceral, or nerve structure, or is nociceptive, inflammatory, or neuropathic in origin, all pain can be thought of in a time element as **acute or chronic**.

For the first ninety days, the pain is considered **acute**. It is generally informative, nociceptive pain and is part and parcel of the healing process. With appropriate treatment, most of the time, these injuries will resolve.

If pain persists after longer than 90 days, the likelihood of full recovery drops substantially, and the pain is subsequently classified as **chronic**. Chronic pain can be nociceptive, inflammatory, or neuropathic. Of greater concern is that approximately 10% of all injuries will go on to create chronic, pathologic pain. The neurological process which creates chronic pain in this 10% group is poorly understood, not clearly preventable and begins shortly after the injury.

A unique type of pain NFL players typically experience is referred to as **acute pain chronically**. Acute pain chronically implies that the player is **always** feeling pain somewhere from some injury. It can be repetitive injury to one structure, or it can be injuries to one or more structures simultaneously or at different times. The pain is considered acute and nociceptive in origin and can be treated with site-of-injury specific treatments. We recognize that the incidence of pain and injury is 100% in active NFL players, and, similarly, the incidence of acute pain chronically also approaches 100%. What complicates this issue is that these injuries can adversely affect each other. For example, a quarterback develops a rotator cuff strain due to impaired push off during his throwing motion from a persistent untreated high ankle sprain. Once the ankle sprain is treated successfully, the rotator cuff problem resolves.

Pain and Suffering

It is important to make a distinction between these two. Pain, or nociception, is a neural signal transmitted through the nervous system to the brain informing the brain of active or potential tissue injury. Suffering is the biological, social, psychological, functional, and spiritual reaction to that signal. The level of the suffering is dependent on the meaning of the pain for the individual, and it occurs with both acute and chronic pain. An injury, especially a severe one, for an NFL player has many meanings. In the early phases, there may be denial of its significance. Over time, though, reality may sink in. The player may fear the meaning of the injury.

Even when the injury heals, the suffering may not end. Worry about re-injury is very reasonable and may take time to resolve. Such concerns, by themselves, may prevent a player from returning to play. Most injuries also create residual disability which impairs function both in playing and non-playing activities.

There are many other problems which may occur secondary to pain which also create/add to suffering.

- Sleep is often impaired.
- Psychological problems such as grieving and depression are very common.
- Emotions associated with grieving such as anger, worry and depression can interfere with personal relationships, creating a vicious and downward spiral. In one study of patients with chronic pain, 60.8% met criteria for probable

depression 33.8% met the threshold for severe depression (<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4912238/>)

- In desperation, players may turn to any and all treatments which may, in turn, create additional problems such as drug addiction.
- Failure of a treatment also creates its own psychological problem, and when treatment after treatment fails to **eliminate the problem**, depression is common.
- The final act of desperation is suicide, and the risk of successful suicide in chronic pain sufferers is 3x that of the normal population.

It is critical that the treatment of pain must be aggressive, comprehensive, multi-modal and bio-psycho-social. Trivializing someone's experience of pain is an assault on his self-esteem and creates needless, additional suffering

For more information on pain and suffering, see Nagel, D, *Needless Suffering, How Society Fails Those with Chronic Pain*, University Press of New England, 2016, <https://www.press.uchicago.edu/ucp/books/book/distributed/N/bo44312254.html>.

How can we prevent acute pain from becoming chronic pain?

In the field of pain management, our primary focus is the **prevention and treatment** of chronic, pathological pain, no matter the structure of origin. In active NFL players, this focus is important, but less common. For them, the focus is on somatic acute pain and acute pain chronically. In retired players, both chronic non-pathological and chronic pathological pain are of greater interest.

It is generally agreed that the transition of acute pain to chronic pain can be minimized/prevented through:

- Early mobilization
- Early, aggressive treatment
- Comprehensive, integrative, patient centered, multimodal, bio-psycho-social care
- Avoiding reinjury/repetitive trauma

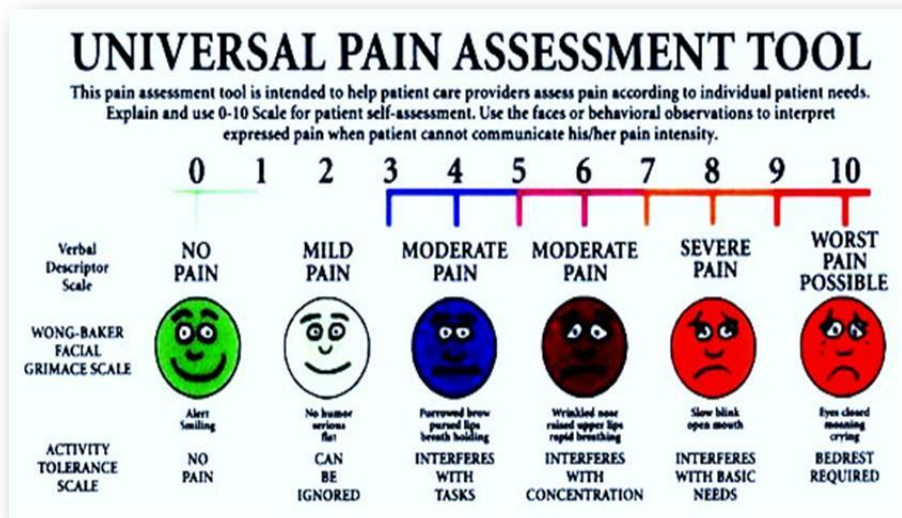
For more information, see:

https://www.iprcc.nih.gov/sites/default/files/HHSNational_Pain_Strategy_508C.pdf

Measuring Pain

There really is no reliable, objective measure of pain. Therefore, we must rely on what the sufferer tells us as to measure how severe the pain is. Measuring pain is important because the treatment plan varies depending on the severity of pain.

Historically, we have done this by using a variety of numeric rating scales in which we ask someone, on a scale of 0 – 10, how severe their pain is. There are a variety of these scales; The Universal Pain Assessment Tool incorporates several different scales into one and is the most widely accepted tool.



For more information on the Universal Pain Assessment Tool, see: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5217503/>

Despite our best attempts to accurately measure pain, our current scales have several limitations. They do not measure function, have little value in comparing one person's pain to another, they do not differentiate between the concepts of nociception and suffering and they are of less value for those with variable pain tolerances who will over/underrate their pain. It is observed that NFL players tend to underrate pain, so, for them, the scales are less reliable. To get around these problems, an important focus is on how pain affects performance. This can be measured through the use of various functional scales and tests.

Pain Interference

One way that people assess how pain affects performance is to ask about pain interference. That is, people are asked to rate how much pain interferes with different activities. For example, the Brief Pain Inventory is commonly used to assess pain in medical settings and in research. An example of questions from the Brief Pain Inventory are below:

Circle the number that describes how during the past 24 hours PAIN HAS INTERFERED with you:

<p>Does Not Interfere</p>	<p>Completely Interferes</p>
----------------------------------	-------------------------------------

General Activity	0	1	2	3	4	5	6	7	8	9
------------------	---	---	---	---	---	---	---	---	---	---

10

	Does Not Completely Interfere										
											Interferes
Walking Ability	0	1	2	3	4	5	6	7	8	9	

10

Pain interference is important to know in addition to pain severity since players may either underestimate their level of pain or have high pain (6 or above on a 10-point scale) that does not interfere very much with their performance. So, by asking people about their pain interference, medical providers have a better understanding of the overall pain experience and can help treat pain with attention to how it affects performance.

Tracking Pain and Performance

One way to better understand how pain interferes with performance is through tracking. Tracking performance, recovery, injury and nutrition status has progressed significantly over the last several years. Utilization of force plates, 3D movement analysis, load monitors, heart rate variability, nervous system fatigue, hydration levels, blood panels, tracking strength, power, speed, acceleration, sleep, the list goes on. Applied correctly this information can be very powerful for positively impacting performance and recovery. This technology fails if the impact of pain and its influences on performance is not addressed. There is much research to support the importance of acceptable fundamental movement patterns and its role on the athlete being able to effectively run, jump, cut, decelerate and demonstrate the agility and speed to compete at a high level on Sundays.

When movement dysfunction occurs, it can lead to pain or vice versa. Pain encourages changing one's movement strategy resulting in other muscles, tendons, and/or joints working overtime, resulting in strength and power deficits, range of motion limitations, poor loading strategies, etc. Further, new movement compensations arise which can result in further pain or injury and are ultimately detrimental to performance. An example of this is a player dealing with knee pain - when he has to be able to jump or cut off that side to make a play, he is unable to create force through that leg appropriately which results in decreased glute loading and weight shift. This produces excessive stress on his other leg. Highlighted in this example is the damaging cycle that begins if pain is not

addressed, directly impacting performance and over time often leading to further injury.

As mentioned earlier, the biopsychosocial model of pain is multidimensional and can be very complex, but we do know level of pain is often not directly related to tissue damage. It is of paramount importance to be able to place emphasis on function and, as a player, become empowered through education. There are several movement screens and evaluations clinicians utilize to assess functional movements through different ranges of motion. It is recommended to seek out trusted and qualified rehabilitation clinicians who maintain a patient-centric approach.

The Basic Treatment Plan

As stated before, the basic treatment plan for both acute and chronic pain is an integrative, aggressive, patient-centered, multi-modal, bio-psycho-social model.

The plan begins with **prevention of injury**. This involves a team of individuals working together to make the environment as safe as possible. Like treatment, prevention needs to be patient centered. What may be good for the average player may not be good for a particular individual. That is why players prepare for a game differently, wear different types of equipment, train differently, etc.

When acute injury occurs, diagnosis and treatment is separated into different phases: on site, acute, sub-acute, rehabilitation, and return to play. An appropriate treatment plan consists of the following interventions:

- Medication
- Psychological
- Physical/Restorative
- Interventional
- Complimentary/Alternative.

We will also look at sleep management and its relationship to pain management. Finally, we will also look at the **potential** role of medical cannabis in pain management.

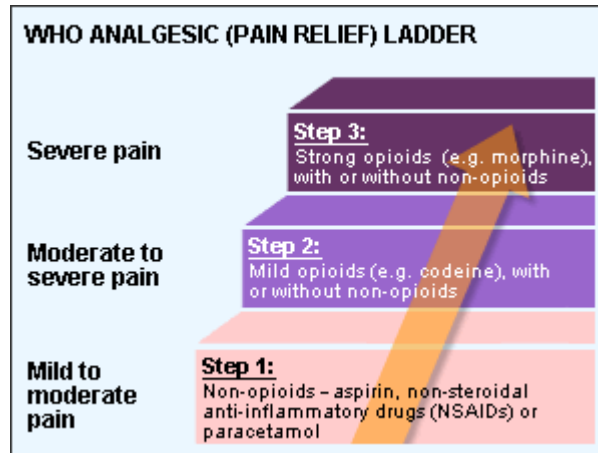
As a reminder, pain management must include multiple modalities working in concert with each other.

- The system must be integrative, bio-psycho-social, and multimodal
- There must be communication between each of the providers.
- The provider must explain diagnosis, treatment options, and expectations of that treatment with the player and his family.
- Outcomes of treatment must be monitored regularly
- The system must be adaptive when expectations are not met.
- Providers must respect the player's rights to confidentiality.

For more information on a pain management plan, see: Nagel, D, "So, What is Pain Management," The National Pain Report", April 2, 2016, accessed June 30, 2019, <http://nationalpainreport.com/so-what-is-pain-management-8829968.html>

So how should you manage your pain?

With all the options present, how does one decide how to treat his pain? In 1986, the World Health Organization (WHO) created the analgesic step ladder for the management of cancer related pain.¹ The model has been found to have value in managing acute and chronic pain as well.



The ladder is very simple to use for both patients and doctors. To use the WHO system, pain is rated as mild, moderate, or severe. Using the Universal Pain Assessment Tool outlined in the introduction will help guide you.

- For mild, recent onset pain, one would use non-opioid medications and/or physical/restorative modalities for treatment. If the pain does not impact function significantly, one could use time, RICE, stretching and/or activity without any of the modalities.
- For moderate to severe pain, one would continue with the therapeutic options outlined for mild to moderate pain and add a lesser strength opioid. An adjunctive medication could also be considered.
- An opioid would be the drug of choice for severe pain in combination with other modalities.
- In general, one would not use interventional techniques for recent onset pain, meaning pain that has been present for less than 6 weeks and/or under treatment for less than 6 weeks.
- If the pain is not responding after six weeks of treatment, whether it is mild, moderate or severe, one would change or add medications, change or add physical/restorative modalities, or consider an interventional modality which could include surgery.
- Rehabilitation technically accompanies all phases of treatment but begins as the primary focus when pain has been controlled and/or eliminated and the focus becomes return to function.

The timing of alternative therapies such as acupuncture, chiropractic, massage, mind/body therapies, etc. is less clear. Access to these therapies is limited by many factors such as lack of providers and lack of insurance reimbursement. If these barriers are not issues, these treatments could be used at any time in the treatment process.

While treatment should always be patient-centered, comprehensive, and integrative, one would not consider a formal pain management program until all options have failed and the pain is becoming or is chronic.

For more information about the WHO analgesic ladder, see: [1] “Cancer Relief Pain,” World Health Organization, Geneva, 1986, https://apps.who.int/iris/bitstream/handle/10665/43944/9241561009_eng.pdf;jsessionid=336586DAA02A015330D1A52E66D8D80C?sequence=1.

Grading the Evidence

In order to make educated decisions about treatment decisions, patients and health care providers rely on evidence. In making our recommendations, we will share pertinent evidence with the reader. There are four major sources:

1. Evidence Based Medicine
2. Best Practices
3. FDA Approval
4. Word of Mouth

Evidence Based Medicine

“Evidenced-based medicine requires the integration of the best research evidence with our clinical expertise and our patient’s unique values and circumstances.” (Glasziou, P, Strauss, S, “Evidence-based medicine: how to practice and teach EBM,” Elsevier/Churchill Livingstone, 2005). This mode is highly adaptive but has challenges when assessing options for managing pain. Virtually every evidence-based review has found evidence to be lacking for nearly all modalities. The strongest evidence for pain management is for comprehensive, integrative, pain management programs. It is also important to note that most evidence only looks at relatively short-term outcomes of less than 12 – 18 months. It rarely looks at long term outcomes. This is a problem when using medical evidence to plan the rest of one’s life. The player must be made aware of the risks and benefits when planning a treatment program and the player needs to be a part of this process.

Best Practices

Best practices are often used when evidence is lacking, but the provider needs some sort of guidance in making clinical decisions. The quality of the recommendations is dependent on who the authority is. Examples of ‘authorities’ are regulatory bodies, governing bodies and assembled panels of professionals who are widely recognized experts in the field.

FDA Approval

The primary role of the FDA is protecting public health by ensuring the safety and effectiveness of drugs, vaccines, medical devices and food products. In order to become FDA approved, a medical product must prove relative safety and efficacy. That means the product can do what it says it will do so in a relatively safe manner.

Any medical product that is not FDA approved cannot make structure or function claims. This includes many devices, supplements, herbal products, etc. To make such claims is considered fraud and is illegal. Many studies of supplements and herbal products have shown little reliability in the amount of active ingredient present. This includes CBD products (see: Humphreys' K, Saltz, R, "Should Physicians Recommend Replacing Opioids with Cannabis?" JAMA, February 19, 2019 Volume 321, Number 7 639 – 640).

It is important to note that the lack of FDA approval does not mean lack of efficacy. What it means is that manufacturers of those products have not sought rigorous testing of their products to ensure safety and efficacy.

Medical products that are FDA approved are generally approved for a specific use. Any other use of that product is considered "off label." Unless specified otherwise, this practice is legal, and often medically very helpful. For example, gabapentin (Neurontin) is FDA approved for the treatment of seizures. It is not approved for the use of pain, but it can be very effective in the treatment of neuropathic pain, an off-label use. While off-label use of a medical product is legal, failure to inform the patient of that use is un-ethical.

Word of Mouth:

In managing pain, we are supporting the mutual-participation model of pain management in which the patient and the provider share their observations and experiences with each other, and together come up with a treatment plan. Both learn from each other. It is imperative, then, that the player find a provider he can trust and talk with. This does not mean that one cannot get valuable information from another player, friend, wife's second cousin, or even late-night infomercial. You should take that information at face value and run it by someone you trust, and hopefully that is your provider.

Pain Management Best Practice Reviews:

1. U.S. Department of Health and Human Services (2019, May). Pain Management Best Practices Inter-Agency Task Force Report: Updates, Gaps, Inconsistencies, and Recommendations. Retrieved from U. S. Department of Health and Human Services website: <https://www.hhs.gov/ash/advisory-committees/pain/reports/index.html>.

2. International Olympic Committee consensus statement on pain management in elite athletes, British Journal of Sports Medicine, 51(7), Feb, 2018.
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Physical, Restorative Modalities

Skilled Manual Therapy

Manual therapy is the skilled application of passive movement to a joint either within ('mobilization') or beyond its active range of movement ('manipulation'). This includes oscillatory techniques, high velocity low amplitude thrust techniques, sustained stretching and muscle energy techniques. Manual therapy can be applied to joints, muscles or nerves and the aims of treatment include pain reduction, increasing range and quality of joint movement, improving nerve mobility, increasing muscle length and restoring normal function. There are three paradigms for its therapeutic effects; physiological, biomechanical or physical, and psychological. Manual Therapy can be broken into three categories: MT1 (high-velocity low-amplitude manipulation), MT2 (mobilization and/or soft-tissue-techniques), MT3 (combination of MT1 & MT2) and MT4 (mobilization with movement). Manual therapy is often performed by a range of medical professions including certified athletic trainers, physical therapists, chiropractors, massage therapists and osteopathic doctors.

Instrument Assisted Soft Tissue Mobilization

As research has progressed over the last decade, so too has the utilization of Instrument Assisted Soft Tissue Mobilization (IASTM) within physical therapy. IASTM is one of the most commonly used modalities across the rehabilitation field for scar tissue manipulation and pain management. IASTM is a safe and effective technique that can be utilized for pain modulation as well as soft tissue manipulation. Utilizing an instrument, the clinician will apply the recommended pressure to the area and will begin scraping across the surface of the client. The frequencies and pressure will depend on the goals of the clinician as part of a skilled rehabilitation program.

Myofascial Cupping

Myofascial Dry Cupping has roots dating back to 3000BC with several proposed mechanisms as to how it manipulates the internal environment to produce improvements in reported pain, function and movement patterns. The cup is applied to the skin and with a manual vacuum, air is removed from inside the cup creating the suction to the skin. This vacuum seal then promotes blood flow to the area. Application can vary as some clinicians will leave the cup on the affected area for a short amount of time, to manually moving the cup across the surface of your skin, creating manipulation of the connective tissue. Many therapeutic interventions are compressive in nature, but cupping is one of the only true decompressive interventions. Cupping, utilized for many conditions, is most commonly used for tight/sore musculature alongside a skilled rehabilitation program.

Blood Flow Restriction

Blood Flow Restriction or “BFR” is when external pressure is placed on a proximal limb to promote blood pooling in capillary beds distal to the tourniquet. Studies have shown that muscle hypertrophic adaptations can be induced with much lower intensities than traditional resistance training. This is certainly a modality to consider when training or rehabilitating when heavier loads is contraindicated, e.g. coming back from orthopedic surgery or lower extremity injury. The biggest risk factors of BFR are associated with improper tourniquet use. Utilization of BFR should be done in the supervision of qualified personal alongside a skilled rehabilitation program, as improper use, too much pressure, improper placement, time, etc., can result in severe damage to the tissue.

Intermittent Pneumatic Compression Therapy

Intermittent Pneumatic Compression Therapy is most commonly used in the sports world as a recovery technique. This therapy requires an external unit alongside sleeves that would cover the affected limb(s). Once the sleeves are in place, they are connected to the unit that will sequentially provide compression starting distally and proximally through the sleeve by pumping air into each pocket or segment along the sleeve. As the air pressure increases to its max, the system will move up the chain creating a “milking” effect of the limb. The treatment time can last between 15 and 30 minutes and has been proven to remove the amount of blood lactate after high intensity training as well as reduced select skeletal muscle oxidative stress after heavy resistance training. Intermittent pneumatic compression is also commonly used in treatment in people having edema, or swelling, in the affected limb. Be ensured to follow the safety protocols as variations from this could potentially cause damage if not followed.

Vibration Therapy

There has been a steady increase in popularity and overall usage of vibration therapy in the rehabilitation space since the release of tools such as: Hypervolts, Theraguns, Deep Muscle Stimulators, vibrating foam rollers and balls, and whole-body vibration units like Power Plate. Local vibration therapy devices are relatively new to the general population but are commonly found in the rehabilitation space. There is clear evidence that vibration therapy stimulates the central nervous system to assist with decreasing pain and improving the perception of improved range of motion. Full body vibration therapy has been proven to have a hormonal response but both full body and local vibration therapies still need further research to fully understand the mechanisms behind the results. They are ultimately safe for use, alongside a well-rounded rehabilitation program.

Unweighted Treadmills

Unweighted Treadmills, or commonly referred to as a Lower-Body Positive Pressure Treadmills, is an orthopedic rehabilitation tool that reduces the risks of further injury by decreasing the forces the body must attenuate during impact activities like walking and/or running. There are two types of unweighted treadmills, aquatic or underwater treadmills and an air-pressurized treadmill. Both support the individual's body weight (BW), reducing overall load on the lower extremities, so that walking movements can be safely repeated, and the quality of movement is improved. The biggest benefit and use for an unweighted treadmill are the ability to remove the amount of body weight from weight bearing activities. This allows athletes recovering from post-surgical or lower body injuries to start rehabilitation from non-weight bearing to weight bearing activities. The use of an unweighted treadmill allows the clinician to progress the rehabilitation program utilizing a portion of the athlete's body weight and can be adjusted accordingly.

Electrical Stimulation

Electrical Stimulation (E-Stim) has been used for decades in the rehabilitation space. There are many different forms of electrical stimulation utilized for different reasons and goals. A few examples are E-Stim units include TENS, Russian stimulation, IFC, H-wave, and Iontophoresis. The two common uses for E-Stim is for pain modulation or for muscle re-education, depending on the frequency used. There are forms of E-Stim units that are portable and able to be used at-home after proper education from your medical professional. Generally, these units are safe to use but do require yearly maintenance and evaluation to ensure safety.

Hyperbaric Chambers

Hyperbaric chamber therapy is a well-established modality for treatment for numerous medical conditions. Typically, there are two modes of delivery, either in a single person cylindrical tube in which you lay in or in a small room that can hold 3 - 4 clients. Once you are in place, the tube or room is securely pressurized, increasing the atmospheric pressure, allowing your lungs to capture more oxygen. Once the oxygen is in your system it is carried through your body via blood, this increase in oxygen volume allows for your body to release certain growth factors and stem cells to help fight infections and promote healing. There have been two recent studies that show this treatment decreases inflammation and pain. This treatment is generally safe and should be administered by experienced professionals.

Whole Body Cryotherapy

Whole Body Cryotherapy (WBC) is a treatment modality that has recently become more mainstream over the last decade. The treatment typically begins one of two ways, in which you stand solo in a cylinder chamber with your head exposed or in a small room that could hold up to 4 adults and your body is exposed to extreme low (-100°C to -

300°C) temperatures. Treatment time last between 2 and 4 minutes and has been proven through recent research to reduce pain in injured individuals as well as reduce inflammation and markers that indicated cell damage. There are still many variables to evaluate and research is constantly being updated on this modality, but the most recent review of literature showed an 80% reduction in pain.

Extracorporeal Shock Wave

Extracorporeal Shock Wave (ESWT) is an invasive therapy that utilizes high energy pulses or “shock waves” to the targeted area of the body. These pulses can vary in intensity based on several unique factors of the patient’s presentation. The pulses create a “popping”, “clicking”, and/or “tapping” sensation on the surface of the skin, but the energy of the pulse can travel deep into the body. It has been shown to help treat a variety of chronic disorders from kidney stones to many chronic orthopedic tendinopathies depending on the type of shockwave. ESWT has been shown to be a safe and effective modality to improve pain levels and soft tissue healing, and should be considered for certain musculoskeletal pathologies alongside skilled rehabilitation program.

Low Level Laser Therapy (Class I, II, III)

Low Level Laser Therapy (LLLT) is a modality using low level laser or light emitting diodes across the surface of the skin. This near infrared light is used to reduce inflammation and pain, both acute and chronic in nature, as well as promote soft tissue healing and wound care. One study shows short and mid-term pain relief (22 weeks post treatment) but there is still a need for further research to truly understand the full range of therapeutic dosages (wavelength, time, and intensity) that can be delivered utilizing LLLT. Notably, there were only some mild side effects, no different than the placebo group. Consistently found in studies is its ability to contribute to pain management alongside a skilled rehabilitation program.

Thermal Laser Therapy (Class IV)

Technology has introduced High Power Laser Therapy that emanates triple wavelength radiations at the same time, working 8/10 cm deep, improving efficacy. These devices are referred to as “class IV” reaching 7.500 mW power following previous “class III” or low-level laser that had a limited power up to 500 mW. Class IV Lasers had good anecdotal reports of effectiveness although limited scientific evidence, mostly in trauma related to sports. Treatment should follow strict protocols as additional trauma to the treatment area can occur if not followed. Administration of thermal lasers should always be with a trusted provider as part of a skilled rehabilitation program.

Sensory Deprivation Tank

Sensory Deprivation Tanks or Flotation-REST (restricted environmental stimulation techniques) tanks are tanks filled with about 1 foot of water that has a high concentration of salt. This high concentration makes it very buoyant in which the patient can float easily in the tank. These tanks are found in soundproof and light proof rooms to restrict all external sensations once fully relaxed. Treatment starts lying on your back floating in a quiet dark room, allowing the body and mind to simply reset from all the external stress on the body. Studies have shown treatment in these tanks can reduce pain, stress, anxiety/depression, improve sleep, and increase your outlook on life. At this time no negative side effects have been found for this modality. Some tanks are in what is called a "Pod", in which athletes who are too large will be unable to fit in or if the athlete is overwhelmed with being in smaller/confined space may not respond well to this treatment.

Hivamat

Hivamat deep oscillation therapy is an approved modality by the FDA for use with muscle relaxation, increasing circulation and pain relief. This modality has two methods of delivery, either by wand or the clinician/therapist's hands. An electrode is placed on clean, dry skin on both the clinician and the athlete and the clinician wears gloves with the use of baby powder to massage the treatment area. The frequency of the vibration can be changed depending on how intense the patient can handle. Typically, a treatment session lasts about 15 minutes and whether the wand or clinician's hands are being used, they must be moving for the vibration to be delivered. Research shows that the vibration along with manual massage can help with decreased pain and increased lymphatic drainage which helps to reduce swelling. This modality is used both for acute and chronic injuries and most commonly for swelling control. This device is ultimately safe for use, alongside a well-rounded rehabilitation program.

ARP Wave

The ARP Wave (Accelerated Recovery Performance) is a system that uses bio-electrical current, simultaneously with active range of motion/exercises to speed up the body's natural healing ability. The modality is said to have positive cellular effects of direct current electrical fields on bone and tissue healing. The ARP waveform used produces minimal inhibitory muscle contractions which allows for active range of motion in therapy and during exercise which allows for eccentric contractions to occur. Unfortunately, there are limited case studies and resources supporting the ARP Wave benefits. It is advised to consult with your medical professional before treatment.

Hypoxia Mask

Hypoxic Training Mask is a newer product on the market that claims to enhance athletic performance. It's a mask that covers the nose and mouth with different sized openings and flux valves. The openings and flux valves can be adjusted to increase the resistance of respiration, making it more difficult to breathe while wearing the mask. The goal of these masks is to mimic high elevation training. It is suggested that the device can increase endurance and VO₂max, as well as improve lung function. Although, recent studies are showing that maximum power output is limited while breathing comfort and breathing effort is increased. There is significant research on the effects of hypoxia training, but limited research for the ability of the mask to create similar results. There are many risks associated with the use of these types of mask and is not recommended until further research and training is provided.

Complementary Alternative Therapies

Introduction

The National Institute of Health defines CAM as “a group of diverse medical and health care practices and products that are not presently considered to be part of conventional medicine.”ⁱⁱ The following therapies are considered to be part of CAM:

- Chiropractic and Osteopathic Manipulation
- Massage
- Acupuncture
- Mind-Body Behavioral Interventions
- Meditation
- Yoga, Tai Chi, Qi gong and other meditative movement therapies
- Natural products (vitamins, herbal products, other supplements)
- Homeopathy
- Naturopathy
- Traditional Chinese Medicine
- Hypnotherapy
- Dry Needling
- Acupressure

All of these techniques are used in the management of pain and can be used as stand-alone treatments or in combination with traditional or complementary therapies as part of a multimodal, comprehensive treatment plan. Many of these therapies have licensure requirements for practitioners the nature of which varies state by state, and many have a substantial literature/evidence base. It is always best to research the qualifications of any therapist before receiving these therapies and to gain an understanding of the particular treatment.

In this section, we will only discuss acupuncture and massage. Chiropractic and Osteopathic manipulation are discussed under “Skilled Manual Therapy” in the section on Physical Restorative Modalities. For a more thorough review of these modalities please review:

- “Complementary, Alternative, or Integrative Health: What’s in a Name?” NIH National Center for Complementary and Integrative Medicine, <https://nccih.nih.gov/health/integrative-health>.
- “Noninvasive Nonpharmacological Treatment for Chronic Pain: A Systematic Review,” AHRQ, Comparative Effectiveness Review # 209, <https://effectivehealthcare.ahrq.gov/sites/default/files/pdf/nonpharma-chronic-pain-cer-209.pdf>.
- “Complementary Health Approaches: Advising Clients About Evidence and Risks,” SAMHSA Advisory, Fall, 2015, Vol 14, No 2, <https://store.samhsa.gov/system/files/sma15-4921.pdf>.

Acupuncture

Acupuncture is one of the oldest medical therapies with documented uses dating back more than 5000 years. Although the systematic study and use of acupuncture is generally attributed to China, there are records of acupuncture in multiple cultures. Despite this long history, there is very little understanding of what acupuncture does and limited evidence for efficacy for any particular condition. The Acupuncture Evidence Project, published in 2017, lists 117 conditions for which there is some level of evidence for efficacy. However, for most conditions, the evidence is weak. However, the consensus is despite the limited evidence, some patients respond well to acupuncture, there is no reliable way to predict who might benefit, the risk and cost is relatively low, and the potential benefit is high, so it is reasonable therapy to try. Pain and anxiety are generally considered the most common reasons a patient would seek acupuncture.

Models of Acupuncture

There are two basic schools of thought in acupuncture, which are not mutually exclusive. In the **traditional, eastern model**, disease is thought to occur because of an interruption of the flow of life energy, or qi. In what is probably the first example of a multi-modal, comprehensive treatment, all traditional Chinese medicine used herbs, meditation, exercise, and acupuncture prescribed in a manner to restore normal flow of qi. The theory is that qi flows throughout the body in channels referred to as meridians.

In traditional Chinese acupuncture, fine gauge, solid needles are placed at acupoints along these lines with points chosen in specific combinations for specific conditions. The needles may be manipulated with heat, electricity, or manual stimulation to achieve the desired effect. There are also several micro-meridian systems which can be used on their own or to augment body meridian acupuncture. These include scalp, ear (auricular-see battlefield acupuncture below), or hand acupuncture. While there is no evidence these meridians exist, they provide a predictable model on where to place the needles to achieve a specific effect based on collective experience over more than 2000 years.

In the **Western model**, it is recognized that all acupoints correspond to the position of nerves of varying sizes. Needle placement is determined based on the nerve supply of the body structure being manipulated. The larger the nerve stimulated, the greater the effect is thought to occur. The needles are then stimulated with electrical current of a specific frequency. It has been shown that the release of various neurochemicals can be stimulated by different frequencies. How this translates into a clinical effect is not known.

In the **hybrid model** the acupuncturist would use a combination of the two models.

Of particular interest to the NFL player is **battlefield acupuncture (BFA)**. A form of auricular acupuncture, BFA, developed in 2001, is used by the Department of Defense and the Veteran's Administration for the treatment of pain and other conditions. Its primary value is that it is easily learned and easily applied in the battlefield as well as clinic. The potential application to the playing field is apparent.

For more information on BFA, See
<https://www.acupuncturetoday.com/mpacms/at/article.php?id=31917>

How to get acupuncture

In the United States, acupuncture is FDA approved. Treatment should only be performed by either licensed acupuncturists and/or physicians with a minimum of 300 hours of training. Response to acupuncture is rarely instantaneous. It usually requires several sessions over a few weeks to get the maximum benefit. When you make the decision to try acupuncture, you should commit to a trial period of 5 – 10 sessions. Please note that most insurances do not cover acupuncture. It also important to remember that acupuncture is only one part of a balanced treatment plan which should include medication (if necessary), meditation, and restorative exercise. The exercise should emphasize core strengthening, flexibility, aerobic conditioning, and balance.

Risks

When one receives acupuncture from a licensed/trained acupuncturist using FDA approved, single use, sterile needles, the risks are thought to be minimal. Most side effects are minimal and short term such as local soreness, dizziness, bleeding, and bruising. Serious complications such as infection, perforated organ (lung, intestine), and nerve injury are rare. Please note that acupuncture can be sedating, so you should not plan any vigorous activity or long driving immediately after a treatment.

For More information on finding an acupuncturist, the treatment process, or other issues relating to acupuncture see:

<https://www.medicalacupuncture.org/For-Patients/Articles-By-Physicians-About-Acupuncture/NCCAM-Acupuncture-Information>

<https://www.mayoclinic.org/tests-procedures/acupuncture/about/pac-20392763>

<https://nccih.nih.gov/health/acupuncture/introduction>

<https://effectivehealthcare.ahrq.gov/topics/nonpharma-treatment-pain/research-protocol>

Massage

Massage therapy is a form of manual therapy performed by licensed massage therapist (LMT), Physical Therapist, or Athletic Trainers. Different techniques and intensities of

massage therapy are used to decrease chronic pain, decrease muscle tension, increase blood flow, reduce stress, and improve overall emotional well-being.

There are several different techniques that could be used during your experience depending on the desired outcome you want and or need. The most common types are:

1. Deep Tissue
2. Sports
3. Swedish
4. Friction
5. Shiatsu massage.

Massage techniques can be used both as a therapeutic intervention, as well as for relaxation and stress reduction. Therapeutic interventions, such as Deep Tissue, Sports, and Friction massages are meant to improve constant aches and pains, improve pain levels for chronic injuries, and promote healing in damaged tissues. These are the most common types of massage utilized with athletes and can provide relief with pain, soreness, and muscle/fascial tension if implemented correctly. Swedish and Shiatsu massages are shown to potentially improve blood pressure levels, heart rate, relieve tension, and improve overall mental health and feelings of depression. These techniques are often less intense, which helps stimulate the circulatory, lymphatic, and hormonal systems to promote stress relief and relaxation, and improve emotional health.

Dry Needling

Dry needling is an intervention performed by a skilled practitioner (physical therapist, physician, or licensed acupuncturist) that uses a thin filiform needle to penetrate the skin and stimulate underlying myofascial trigger points, muscles, and connective tissue locally & the nerves in the spinal and brain systemically to release natural pain controlling chemicals. Dry needling has several implications for clinical use and has been found to be very effective for decreasing pain and improving function. Treatment should be administered by a clinician who has gone through the additional continuing education course work. Some states do not allow physical therapists to perform this modality.

Acupressure

Acupressure is a Traditional Chinese Medicine (TCM) technique derived from acupuncture. It involves applying physical pressure with a finger or device on different acu-points on the body instead of having a practitioner place needles in those acu-points. Studies show that acupressure has positive effects on pain and sleep disturbance for people who have chronic pain, insomnia, and some chronic diseases¹⁻⁴.

Some people prefer acupressure because it has very little risk associated with its use. There are practitioners who can provide acupressure, or it can be self-administered. The pressure applied to the acu-points is usually provided in a circular motion and is done for a few minutes until a dull ache is experienced. There is evidence that supports both practitioner- and self-administered acupressure. For self-administered acupressure, the main evidence-based types are:

- Auricular Acupressure - This is where a small seed or seeds are taped to the outer ear and pressure needs to be applied to the seeds at least once per day. Studies on auricular acupressure show it has at least short term effects on pain⁵.
- Relaxing Acupressure – This type of acupressure involves stimulating points on the body, which are most commonly used in TCM for insomnia. Points are stimulated once per day about 3 minutes each. Relaxing acupressure improved sleep and reduced fatigue in a large cohort of cancer survivors⁶, and improved pain and physical function in older adults with knee osteoarthritis⁷
- Stimulating Acupressure – The acu-points used in stimulating acupressure are associated with reducing fatigue. This acupressure reduced pain and fatigue in people with chronic back pain⁸.

How to get acupressure

If seeking a practitioner, it is best to start with certified acupuncturists (more information can be found in the [Acupuncture section](#) about how to find a provider). Acupuncturists use their knowledge of the points used in acupuncture to provide acupressure for specific problems. Often acupressure is advertised as one of the techniques they can perform. It usually takes a few weeks to feel effects from acupressure.

When looking for self-administered acupressure, there are apps and websites that are designed to help guide how to do this. The MeTime apps were developed by the University of Michigan to help people administer the relaxing and stimulating acupressure. They are available for the iphone and android. There are other apps for self-administered acupressure available, although not all are backed by research studies. See acupressure section on the [NFLPA wellness website](#). To work, it is thought that acupressure requires consistent daily practice for 4-6 weeks for effects to be felt.

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Medication

Basic Concepts

We, as a people, have been putting substances in or on various parts of our bodies since the dawn of mankind with the hope of ameliorating symptoms of various types. We have great faith in the power of substances, be it a pharmaceutical, supplement, or herbal product. This behavior is hardly limited to the United States (US). The use of opioids, cannabinoids, and salicylates for pain dates back more than 3000 years. However, the regulation of pharmaceuticals in the United States did not begin until the late 1800's.

Currently, there are many medications used for pain, both FDA approved and not. These can be classified by route of administration into oral, topical and injectable. They can be further categorized into **analgesics and adjuncts**. Analgesics are medications that have a direct effect on inhibiting pain. Examples include Tylenol, Ibuprofen and Tramadol. Adjuncts are medications that may have some analgesic ability alone but are more effective when used with an analgesic medication. Examples include Flexeril, Prozac and gabapentin.

Supplements and herbal products are not classified and may be sold "over the counter (OTC)." There is a general perception that these products are safe, but that may not be true. Even vitamins, in excess are potentially harmful. For example, St John's Wort, a supplement used to treat depression, when used alone or in combination with certain other anti-depressants can be fatal. Other supplements may be tainted with dangerous additives. Arsenic and lead have been found in various dietary supplements.ⁱⁱⁱ

Assessment of Benefits and Risks

All substances carry a risk. The discussion of all risks is well beyond the scope of this guide. Players are advised to consult with their health care provider, pharmacist, or on-line source such as the Mayo Clinic (<https://www.mayoclinic.org/drugs-supplements>). When substances are combined either with each other or with supplements, these risks can be additive or compounded with other risks making the danger very real. It is critical that you have an open and honest relationship with your doctor. You should inform that individual of all the medications and supplements you are taking. Therefore, it is incumbent on you to research what you are taking no matter who is recommending it, and you should never put anything in your body without knowing:

- What it is and where it came from?
- What it is used for (i.e. benefits)?
- What its risks are by itself and when taken with other substances?
- What are the alternative options?

Oral

Acetaminophen (Tylenol, Paracetamol)

Acetaminophen is an oral, OTC analgesic. It is recommended as a first line, primary analgesic for mild to moderate pain. It is frequently used as an adjunct

with opioids for moderate to severe pain. In some individuals, it can be effective as a primary analgesic for moderate to severe pain. It can also be used safely and synergistically with Non-Steroidal Anti-Inflammatory Drugs (NSAID's) with the combination providing greater analgesia than either alone.

Acetaminophen's primary benefit is its relatively safe profile. Its primary side effect is liver toxicity, which is rare. Acetaminophen toxicity is the leading cause of liver failure in the United States, which can be fatal. While this side effect is dose dependent, there is no predictability to this side effect, and the toxic dose can be quite variable depending on the health of the individual. The current FDA recommendation is a maximum of 3000 - 3250 mg/day. Acetaminophen should be avoided in individuals with liver disease. Many patients are not aware that acetaminophen is often present in combination with opioids in medications such as Percocet and Vicodin. The amount present in these medications would need to be included in calculating the daily consumption.

Non-Steroidal Anti-Inflammatory Drugs (NSAID's)

NSAIDS's are among the most commonly administered medications for pain and inflammation. They include non-prescription and prescription medications:

Non-prescription/Over the Counter (OTC)

[Aspirin](#), Ibuprofen ([Midol](#), [Advil](#), [Motrin](#)), Naproxen, ([Aleve](#), [Naprosyn](#)). It is important to remember that although OTC NSAID's may be sold in lower doses than the prescription variants; in sufficient doses, they have the same side effects.

Prescription

Ibuprofen ([Motrin](#)), Flurbiprofen ([Ansaid](#)), Ketoprofen ([Orudis](#)), Naproxen ([Naprosyn](#)), Piroxicam ([Feldene](#)), Diclofenac ([Volaren](#)), Sulindac ([Clinoril](#)), Indomethacin ([Indocin](#)), Tolectin ([Tolmetin](#)), Ketorolac ([Toradol](#)), Nabumetone ([Relafen](#)), Celecoxib, ([Celebrex](#)), Etodolac ([Lodine](#))

The evidence

NSAID's are considered to be a drug of choice for **short term** management of acute nociceptive and/or inflammatory pain. The evidence for their use in chronic and/or neuropathic pain is limited. Long term use for chronic and acute-pain-chronically is limited due to risk (see below).

For more information on evidence, see:

<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC1855338/>

NSAIDS

What do NSAID's do? NSAID's inhibit the production of prostaglandins (PG). These are substances that have a variety of effects in humans. PG's help produce both a sensation of pain and an inflammatory response to injury. These are separate functions, but to the extent inflammation creates pain, they overlap. By blocking the production of PG's, NSAID's treat both pain (analgesia) and

inflammation, the relative effect on each varying between NSAID's. For example, ibuprofen treats both well while ketorolac and naproxen are more specific for analgesia.

Side effects and risks: The side effects occur because PG's do a lot of other important things in the body. They help produce the mucous that protects the stomach lining, control kidney blood flow, control blood clotting, and number of other important things. NSAID's block all these functions as well and that can create problems. NSAID's have the potential to create dangerous side effects including gastro-intestinal hemorrhage (which can be potentially fatal), other bleeding problems, cardiovascular effects such as stroke and heart attack, impaired renal function including renal failure, and liver damage. NSAID induced gastro-intestinal bleeding leads to 100,000 hospital admissions yearly and a death rate of somewhere between 3200 and 16,500 deaths annually. Because of these side effects, in 2007, **the FDA recommended all NSAID's be used in the lowest dose for the shortest time possible.** While these risks are relatively rare for short term use (7 – 14 days), the likelihood increases with long term use. Therefore, it is important that any use of these medications beyond a few days be supervised by a health care professional.

For more information on NSAID risk, see:

<https://www.fda.gov/media/73092/download>

https://www.ajmc.com/journals/supplement/2013/a467_nov13_nsaid/a467_nov13_fine_s267

COX 1 vs Cox 2 NSAIDS's: Cyclo-oxygenase (COX) is the enzyme that produces PG's. It comes in two types, Type I and Type II. Most NSAID's affect both. COX2 selective NSAID's (celecoxib, etodolac) have been proven to be less toxic to the GI system. While relative stomach protection is a benefit of COX2 NSAID's, they do carry a higher cardiovascular risk, and they seem to offer no protection against kidney effects.

Recommendations on Using NSAID's:

1. NSAID's are appropriate medications for acute pain of mild to moderate severity.
2. Use both OTC and prescribed NSAID's for the shortest time and in the lowest dose possible.
3. Do not use OTC NSAID's for more than 7 days without consulting with a doctor
4. Combining an NSAID with acetaminophen has been shown to have a stronger effect than either alone. When possible, use acetaminophen instead of an

NSAID. If this does not provide sufficient analgesia, use both in combination to minimize the dose of the NSAID.

5. Never take two different NSAID's at the same time.
6. Avoid taking an NSAID with an oral corticosteroid (see oral corticosteroids).
7. If you need to be on NSAID's for a longer time, consult with your doctor about gastro-intestinal protective strategies.
8. Do not use NSAID's without oversight by a doctor if you or your immediate family have a history of stomach or intestinal ulcers, cardiac disease, kidney disease, liver disease, hyper or hypercoagulable blood, or allergic reaction to NSAID's. You should also not take Celecoxib if you have a history of allergy to sulfa drugs.

Glucocorticoids (Cortisone related medications (Oral))

What are they? These medications are known collectively as "cortisone." However, the drug cortisone itself is rarely used. More appropriately they are referred to as glucocorticoids. Oral glucocorticoids include prednisone, methylprednisolone (Medrol, Depo-Medrol, Solu-Medrol), and dexamethasone.

What do they do? Glucocorticoids are steroid hormones produced by the adrenal gland. They are **not** performance enhancing steroids. While they have many roles in the body, two are important for our consideration. First, they modulate the body's immune response. Second, they are involved in blood sugar metabolism. Their primary role is to increase blood sugar by breaking it down from fat, muscle, and other body stores in order to help fuel our "metabolic fire," or give us energy.

When used as a medication, either oral or injectable, the effect is to decrease the inflammatory response to injury or other inflammatory process. When injected, they also decrease the sensitivity of the pain nerves (c-fibers). Both roles are important when treating pain and inflammation. The side effects are related to the effect on glucose metabolism. When taken for long periods of time or in very high doses, these medications have destructive effects on skin, bone, muscle, and soft tissue. By increasing metabolism, in the short term, they can create hunger, weight gain, and anxiety, and they may also impair sleep. They can cause fluid retention. These medications when taken for short periods, can aggravate diabetes or hypertension, but will not cause them. When taken for months to years, they can cause these problems.

How are they used? These medications are used for acute nociceptive and/or inflammatory pain. They can be used as a first- or second-line medication. They are not analgesic by themselves. Frequently it takes several days for them to have an effect, so they are often paired with an analgesic medication such as acetaminophen or an opioid initially. The peak dose is administered for one day

to two weeks after which the dose is gradually tapered down over the course of several days. The reason for the taper is our body does not produce glucocorticoids when we take these medications. We need these substances to live. Sudden absence is a medical emergency. The taper allows the body to begin making its own cortisone. You should never stop taking a prescribed regimen before completing it without consulting your doctor. When taken for 1 – 2 weeks or less, such a medical emergency is quite rare, but your doctor should be involved in the process.

Because of the adverse effects on your body, glucocorticoids are rarely used for more than three weeks at a time. This limits their role in acute-pain-chronically. When determining the cumulative dose, you have been exposed to, you must include any injectable or topical cortisone you may have used.

For more information on cortisone see:

<https://www.mayoclinic.org/drugs-supplements/corticosteroid-oral-route-parenteral-route/precautions/drg-20070491>

Opioids

Opioids are **analgesic** medications. They are used to treat moderate to severe pain (see below). They are natural, semi-synthetic and synthetic derivatives of opium which vary widely in their potency. There are short acting and long acting forms. Examples of short acting medications include: tramadol ([Ultram](#), [Ultracet](#)), [codeine](#), hydrocodone ([Vicodin](#), [Norco](#), [Lortab](#)), oxycodone ([Tylox](#), [Percocet](#)), hydromorphone ([Dilaudid](#)), [morphine](#), and fentanyl ([Duragesic topical patch](#)). Long acting forms include [oxycontin](#) (oxycodone), [MS Contin](#) (morphine), [Exalgo](#) (Dilaudid), [tramadol ER](#), and [Zohydro ER](#) (Vicodin). **Long acting opioids are not recommended for acute or post-operative pain.**

While opioids are generally considered the most effective pain medications, their use is limited by side effects including decline in cognitive function, respiratory depression, constipation, **tolerance, dependency, and addiction**, and death. It is important to note that the risk of addiction is less than 1% when used low dose for acute pain, and rises to 5 – 10% when used in higher doses for more than 7 days.^{iv} The risk of death rises when used in high dose and/or in combination with other drugs (**benzodiazepines**, gabapentin).

There is evidence to support the use of opioids for acute pain. However, except for severe pain, opioids should never be used as a first line drug (See WHO analgesic ladder described above) and should only be used for short periods when pain is not responsive to other therapies. Opioids are not a stand-alone treatment and should never be used to prevent pain. They should be part of a multimodal care plan (see below).

There is no clear evidence for or against the use of opioids for chronic pain either nociceptive or pathological. The use for acute pain-chronically is also not clear and needs to be determined on a case by case basis.

Because opioids cloud judgement and reaction time, opioids should never be used to treat pain in a player who is actively playing. The prescription of opioids is tightly controlled by Federal (Controlled substances act) and State law. While the laws vary State by State, players need to know the following:

- Opioids may only be prescribed by a physician and dispensed by a pharmacy each licensed to do so by the Drug Enforcement Agency (DEA).
- Before initiating the prescription, the injured player must be examined by the provider **and a written record must be generated with a justification for the prescription.**
- The provider is obligated to obtain a written, signed informed consent before prescribing the medication.
- The medication must be stored in a labelled bottle which identifies the drug, the patient, the address of the patient, and the date of prescription. When stored in any other manner, the possessor is subject to arrest.
- The medication may only be taken for the reason prescribed.
- It is illegal to share the medication with another individual.
- It is illegal to sell the drug to another individual.
- It is recommended that upon completion of the prescription, any unused pills be disposed or usually through local take-back drug programs at local police stations.

For more information about opioids, see:

- Dowell, D, Haegerich, TM, Chou, R, "CDC Guideline for Prescribing Opioids for Chronic Pain-United States, 2016," MMWR Recomm Rep 2016;6 (No. RR-1): 1-49. DOI: <https://www.cdc.gov/mmwr/volumes/65/rr/rr6501e1.htm> icon.
- Dowell, D, Haegerich, TM, Chou, R, "No Shortcuts to Safer Opioid Prescribing," N Engl J Med 2019; 380:2285-2287, [June 13, 2019](https://www.nejm.org/doi/full/10.1056/NEJMp1904190), DOI: 10.1056/NEJMp1904190, <https://www.nejm.org/doi/full/10.1056/NEJMp1904190>.
- "Guidelines for the Chronic Use of Opioid Analgesics," Adopted as policy by the Federation of State Medical Boards April 2017, http://www.fsmb.org/siteassets/advocacy/policies/opioid_guidelines_as_adopted_april-2017_final.pdf.
 - "Opioids for Acute Pain, What You Need to Know," <https://www.cdc.gov/drugoverdose/pdf/patients/Opioids-for-Acute-Pain-a.pdf>

Tricyclic/Tetracyclic Antidepressants (TCA's)

TCA's ([Elavil](#), [clomipramine](#), [desipramine](#), [doxepin](#), [imipramine](#), [nortriptyline](#)) are typically used for the treatment of depression and anxiety, however there is evidence for their use in the management of pain. TCA's inhibit the reuptake of serotonin and norepinephrine and increase dopamine neurotransmission in the frontal cortex.

The onset of action for TCA's, once adequately dosed, is 2-4 weeks, making these less of an option of the management of acute pain. They should, however, be considered for the management of chronic pain, particularly in someone who is also suffering with insomnia, depression, or anxiety as it can be a single pill strategy for the management of multiple medical issues. Long term use is generally considered safe and non-habit forming.

Side effects of TCA's broadly include weight gain, blurred vision, drowsiness, dry mouth, dizziness and impaired coordination. They may be lethal in overdose and when combined with alcohol.

Serotonin-Norepinephrine Reuptake Inhibitors (SNRI's)

SNRI's ([Pristiq](#), [Effexor](#), [Cymbalta](#), [tramadol](#)) are typically used for the treatment of depression, anxiety and neuropathic pain, however there is evidence for their use in the management of pain. SNRI's inhibit the reuptake of serotonin and norepinephrine and, weakly, dopamine.

The onset of action for SNRI's, once adequately dosed, is 1-4 weeks, with peak efficacy being achieved after 6-8 weeks. This makes these less of an option of the management of acute pain, and better suited for the management of chronic pain, particularly in someone who is also suffering with depression or anxiety. Long term use is generally considered safe and non-habit forming.

Side effects of SNRI's include increased blood pressure, urinary retention and sexual dysfunction. These medications can also cause insomnia and increased sweating, particularly when taken in the evening.

Antiepileptic (AED's)

AED's ([gabapentin](#), [Depakote](#), [Lyrica](#), [carbamazepine](#), [oxcarbazepine](#)) drugs are used for a wide variety of medical disorders including seizures, restless leg syndrome, depression, bipolar disorder, anger/impulse control issues, migraines and neuropathic pain. These medications have varying actions including increasing brain concentrations of GABA, inhibiting the release of glutamate and binding calcium channels. These mechanisms serve to reduce neurotransmitter release which produces anti-nociceptive effects.

The onset of action for AED's, once adequately dosed, is 6-8 weeks, making these suitable for the management of chronic pain, particularly in someone who is also suffering with migraines, anxiety, or anger issues. Long term use is generally considered safe and non-habit forming.

Side effects of AED's broadly include weight gain, drowsiness and impaired motor coordination. They are lethal in overdose and when combined with alcohol can cause significant damage to the liver.

Topical

Capsaicin

Capsaicin is a derivative of chili peppers that is used to treat pain. It binds to nociceptive neurons and after an initial period of stimulation (generally perceived as heat), it causes them to degenerate. It also depletes Substance P which reduces pain impulse transmission to the central nervous system.

The onset of action for Capsaicin is immediate, making this a good option for the treatment of acute muscular and neuropathic pain. Additionally, it can have long lasting effects, less risks for drug interactions, and lower risk for systemic side effects.

Side effects include increased sensitivity, burning and redness at the site of application, and in rare cases, it can cause severe burns and neurotoxicity.

Camphor

Camphor is a derivative of the Camphor Laurel, a large evergreen tree. It is used to treat topical pain caused by bug bites, cold sores and mild burns. It produces a cooling, counterirritant effect by stimulating TRPM8 receptors.

The onset of action for Camphor is immediate, and it has antibacterial, antifungal and anti-inflammatory properties making this a good option for the treatment of acute topical pain.

Side effects include local irritation, and less commonly, severe burns and allergic reactions. If taken orally it can be lethal.

Opioids

Opioids are **analgesic** medications. They are used to treat moderate to severe pain. They are natural, semi-synthetic and synthetic derivatives of opium which vary widely in their potency. There are short acting and long acting forms. Examples of short acting include Fentanyl Duragesic Topical Patch. Long acting forms include topical morphine, See Opioids in the Oral section above for more information.

Injectable (Intravenous/Intramuscular)

Ketorolac (Toradol)

Toradol is a unique **NSAID** that when administered parenterally (IV, IM, intra-nasal) has an analgesic potency similar to morphine. It is also available in an oral form with substantially less analgesic potency. The advantage of Toradol is that it does not cause respiratory depression or cognitive side effects as opioids may, and it has a low addiction, abuse, or mis-use risk. When administered repetitively, though, the drug has a potential to cause bleeding complications, particularly gastro-intestinal. The risk is sufficient that the drug carries a black box warning. The following are recommendations for Toradol (both oral and parenteral) use:

- It should only be used under the supervision and order of a physician or other **qualified health care professional**.
- It should only be used for severe, acute pain
- It should never be used to prevent pain (prophylactically).
- Its use should be of short duration, less than 5 days, at the lowest effective dose.
- It should never be used with other NSAID's, oral corticosteroids, or other blood thinners
- It should be never used in a player with a history of GI bleeding or kidney disease.

For more information about Toradol, see:

Mativa, et al, "Recommendations of the National Football League Physician Society Task Force on the Use of Toradol® Ketorolac in the National Football League," Sports Health. 2012 Sep; 4(5): 377–383, <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3435943/>

"Ketorolac tromethamine - Drug Summary," Physicians Desk Reference, 2019, <https://www.pdr.net/drug-summary/Ketorolac-Tromethamine-Tablets-ketorolac-tromethamine-1793.3935>

Interventional Therapies

Overview

While any medical therapy is considered an intervention, in the practice of pain management, the term “interventional” is reserved for invasive, percutaneous (through the skin), non-surgical therapies. For our purposes, these include:

- Trigger Point Injection
- Peripheral Corticosteroid Injections (joint, tendon, ligament)
- Spinal Corticosteroid Injection (epidural, facet joint)
- Radio-frequency neuro-ablation
- Regenerative Therapies, (Prolotherapy, Platelet Rich Plasma, Stem Cell)

These therapies, because of their invasive nature, have a less favorable cost-risk/benefit ratio than other therapies mentioned in this guide. Because of this, They should:

- Rarely be considered a first line treatment
- Always be part of a larger, multi-modal treatment program which, at the least, includes active physical and restorative modalities designed to restore function and improve performance. Medications, complementary alternative therapies, and/or behavioral and psychotherapies may be included.
- Be performed by a provider with advanced training in the modality involved. Spinal injection and neuro-ablation are preferably performed by a provider with additional training in pain management.

Trigger Point Injection

What is a trigger point injection?

Trigger point injection is often referred to as “wet needling.” It is performed in the same manner as dry needling as discussed above with the exception that a fine gauge, hollow needle capable of delivering medication is used. Substances typically used include saline or a local anesthetic (usually lidocaine). Multiple studies have shown there is no difference in outcome between dry and wet needling. One study suggested that a local twitch response must be created for the procedure to be successful whether done dry or wet. That study has not been confirmed. After injection, muscle soreness lasts for several days and is normal. Many specialists believe that injection of a local anesthetic into the area minimizes this, although there is no evidence to support this. Because cortisone offers no added benefit and is potentially harmful to local tissue, it should **never** be used in a trigger point injection.

How is it done?

The patient is placed in a relaxed position. The muscle to be injected is palpated to find a taut band. The needle is then introduced into muscle and advanced back and forth until the muscle twitches. As the muscle twitches, the patient often elicits a jump sign,

meaning acknowledgement (verbal, jumping) that it hurts. Once the twitch is elicited, the needle is removed. The muscle then should be passively stretched, and a hot or cold pack applied. The patient should be instructed on how to stretch the muscle at home. The patient should also be instructed that the pain will likely increase for a few days before it gets better, and that more than one session is necessary to get maximum relief.

Typically, several muscles are involved in a predictable pattern. All should be treated both with injection at each session and with home stretching.

While there is evidence that both wet and dry needling work for some people, what is not known is how the needling actually works and how frequently it should be done. It is rare that one injection session is enough. This author sees the patient every 1 – 2 weeks for a minimum of five sessions or until the symptom is improved. Once the muscle pain is better and function improved, the patient can begin restorative exercise.

If the pain is not improving, the most common reason is a persistent structural injury that is reflexively driving the myofascial pain. Until this underlying structure is treated, the trigger points will persist. Conversely, trigger points develop in response to structural injury as a neurological mechanism. Sometimes they persist after that structure has been successfully treated and create a residual dysfunction. At this point, they are more amenable to wet or dry needling.

Only a physician well trained in myofascial pain should be performing these injections.

For more information on trigger point injection, see:

<https://www.aafp.org/afp/2002/0215/p653.html>

<http://www.crd.york.ac.uk/crdweb/ShowRecord.asp?LinkFrom=OAI&ID=12001001757>

<https://www.ncbi.nlm.nih.gov/pubmed/29037652>

<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3182370/>

Also, see: **Travell & Simons' Myofascial Pain and Dysfunction: The Trigger Point Manual** (2-Volume Set) which is available in most physical therapists' or physiatrists' office. Each muscle is covered in great detail.

Peripheral Corticosteroid Injections

Corticosteroids are naturally occurring hormones in the human body that are involved in various physiological processes, including metabolism, stress response, immune response, regulation of inflammation, etc. Synthetic corticosteroids (e.g. cortisone) are manufactured drugs with corticosteroid-like effects which are commonly used to treat medical conditions. In musculoskeletal medicine, corticosteroids are primarily used to relieve pain, reduce inflammation, and improve function. Additionally, targeted corticosteroid injections may be used for diagnostic purposes to help confirm the primary source of symptoms. These injections may be administered intraarticular (into joints),

periarticular (around joints), or into soft tissue structures (bursae, tendons, ligaments, muscle).

Intraarticular corticosteroid injections (i.e. joint injections) have been shown to be effective at temporarily reducing joint pain and swelling in various joints throughout the body. The most common indication for joint injections is treatment of osteoarthritis,^{1,2} but others include but are not limited to chondromalacia, meniscus tear, labral tear, and inflammatory joint conditions (e.g. gout). The onset of action is rapid (typically within 24 hours) and effects usually last 2-4 months. It is relatively safe to repeat intraarticular steroid injections every 3 months as needed. Injection frequency should be guided by the underlying disease process, response to past injections, the availability of other treatment options, patient preferences, and clinical judgement.¹ However, there has been some data to suggest there is dose- and time-dependent chondrotoxicity associated with steroids and local anesthetics.^{3,4}

Corticosteroid injections into periarticular and soft tissue structures such as bursae, tendon, ligaments, and muscles can also be helpful in certain instances. These injections are often a beneficial adjunctive treatment along with physical therapy for treatment of bursitis, impingement syndromes, and myofascial trigger points.^{1,5,6,7} In fact, steroid injections have been shown to be definitive treatment in de Quervain tenosynovitis and trochanteric bursitis.^{1,7,8,9} However, use in treatment of tendinopathy and tendon or ligament injury should be cautioned. Although steroid injections have been shown to be effective in decreasing inflammation and pain associated with tendon and ligament injury for up to six to eight weeks, corticosteroids have been shown to have deleterious effects on tendon and ligament tissue. These negative effects may result in increased risk of further injury and/or rupture, and are exacerbated by multiple injections and intrasubstance administration.^{10,11,12} In treatment of tendinopathy, some studies have suggested that although there is improvement in pain in the short term, pain often worsens in the intermediate and long term when steroid injections are administered.¹¹

Diabetic athletes should take particular caution when using corticosteroids due to the effect on blood glucose levels. Single intraarticular corticosteroid injections have little effect on glycemic control.¹³ However, periarticular and soft tissue injections can cause significant elevation of blood glucose that may persist up to 3 weeks.^{14,15} Hence, diabetic athletes should have blood sugar levels monitored closely in the weeks following any corticosteroid injection.

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Radiofrequency Neuro-Ablation (RFA)

It would seem to make sense that if there was no pain signal, there would be no pain. It is intuitive, then, that destroying the nerve signaling the pain would remove the pain signal. That is the basis for neural-ablation. Unfortunately, our intuitions often don't work well in practice, and that is the limit of NA. When a nerve is damaged, it, in effect creates a short circuit that results in a number of changes both in the peripheral and central nervous systems. Any pain relief obtained, quickly returns (weeks to months) and can be worse than it was prior to the procedure (de-afferentative pain). While the procedure can be repeated, it becomes less effective usually by the second or third

attempt. Because of this, most neuro-ablative procedures are only performed for severe, refractory pain in individuals with a life expectancy of less than six months.

NA can be performed with surgically (cutting the nerve), chemically (phenol, absolute alcohol), or thermally (heating with radio-frequency or cooling with cryoprobe).

Proponents of radio-frequency ablation (RFA) acknowledge that any pain relief is temporary (6 – 12 months), and that the procedure will be less effective when repeated, but claim that it does not cause de-afferentive pain states.

The most common reason the procedure is done is to treat spinal facet joint pain by applying RFA to the medial branch. RFA is also increasingly being used to treat other problems such as chronic knee pain. Despite the popularity of the procedure in the US, the evidence for its effectiveness for chronic spinal facet, sacro-iliac or knee pain is limited.

While it is unlikely that this procedure would be recommended for an active NFL player, the popularity of the procedure makes this a possibility to be aware of.

The following are some general recommendations for someone considering medial branch RFA for back pain.

- Be aware this is not a “long term fix.” The pain will return.
- Be aware there is a possibility the pain could be worse immediately afterwards, sometimes permanently.
- Be aware that when the pain invariably returns, it could be worse than it was before the procedure.
- MB RFA should never be a first- or second-line treatment. It should always be preceded by a trial of pharmaceutical, physical restorative, and/or complementary alternative therapies.
- MB RFA should not be performed before a trial of epidural injection.
- Before MB RFA is done, it should always be preceded by two confirmatory local anesthetic medial branch blocks with at least 80% improvement in pain.
- Because it is unlikely more than one facet joint is involved, these blocks should target only one joint at a time.
- MB RFA should only be done as part of a comprehensive pain management program.

Prolotherapy

Prolotherapy, also referred to as proliferative therapy or sclerotherapy, is categorized as a regenerative and/or a complementary alternative therapy. The basis for regenerative therapies is the stimulation of the healing process. In platelet rich plasma injection (PRP, see below), this is accomplished by injecting platelets into a site of injury. The platelets release growth factors which simulate healing. In prolotherapy, an irritant is injected into joint, tendon, or ligament to simulate tissue injury, creating an inflammatory reaction. In either therapy, the process can be accentuated by direct trauma of the tissue by actively

needling the area (fenestration). It is hypothesized but not proven that the inflammatory reaction that results, can heal and strengthen the injured tissue.

There are many irritants used, but the most commonly used is concentrated dextrose. There is no clear recommendation of how frequently the injections should be administered, but the procedure repeated weekly to monthly for several months.

There have been several literature reviews of safety and efficacy of prolotherapy, usually as a broader look at therapies for low back pain, musculo-skeletal pain, and osteoarthritis of the knee. The results are quite variable, and the general consensus is there is insufficient evidence to support or refute the use of prolotherapy for any specific condition. Furthermore, there is insufficient safety and efficacy data, and, as a result, the procedure, itself, is not FDA approved. Proponents of the procedure justify it as an off-label use of dextrose, but it not clear that is consistent with principles for off-label use established by the Center for Biologics Evaluation and Research. The procedure is not covered by Medicare or most other insurances.

Proponents and non-proponents alike do not recommend prolotherapy as a first-line treatment. It should only be done after medication and/or physical restorative therapies have failed. The procedure should only be performed by a physician (MD or DO) with special training in the procedure.

For further information, please see:

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<https://www.mayoclinic.org/prolotherapy/expert-answers/faq-20058347>

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Regenerative Therapies

Introduction

Regenerative medicine is a rapidly growing field within orthopedics and musculoskeletal medicine. It is the process by which medicinal cells or cell products are used to treat painful musculoskeletal conditions in order to improve pain and function. These conditions include tendon, ligament and muscle injuries, as well as osteoarthritis.

It is important to note that the therapies discussed in this section are not FDA-approved but are FDA-cleared. This simply means that the FDA considers these interventions to be safe, but their efficacy has not been proven from the FDA's standpoint. Further research is needed in order to obtain FDA-approval.

Although there are other injectables and techniques considered to be regenerative medicine, this section will focus on the most commonly used therapies with the strongest evidence. These therapies are divided into two categories – non-stem cell products (platelet rich plasma and amnion derived products) and stem cell containing products (bone marrow aspirate concentrate and adipose derived stem cells).

Non-Stem Cell Containing Products

Platelet Rich Plasma (PRP)

Platelet-rich plasma (PRP) is a concentrated solution of platelets obtained by spinning a patient's whole blood to obtain plasma with a higher concentration of platelets than what is typically present in blood. Platelets are naturally occurring cells in our blood that contain various cytokines and growth factors (TGF-B, VEGF, PDGF, EGF, FGF-2, IGF), which are bioactive proteins involved in cell signaling and wound healing. When secreted by platelets, these proteins regulate inflammation and stimulate tissue healing in the body. This process occurs naturally following an injury but can also be activated in painful or injured tissues by direct injection of PRP into the area (i.e. PRP injection).

In short, a PRP injection is accomplished by drawing blood from a vein, processing the blood in a centrifuge system, then injecting the concentrated platelet product into the site of pain or injury on the same day. People who respond well typically begin noting improvement 4-6 weeks post-injection.

There are over 100 published research studies on the use of PRP for treatment of knee osteoarthritis.¹ Most of these studies have reported improvement in pain and function, but not all. It appears PRP is more effective in mild to moderate osteoarthritis compared to more advanced stages. When effective, the duration of benefit is usually 6-12 months. Notably, PRP is deemed to be very safe but there is no evidence that the cartilage is repairing through regrowth. It remains unclear how PRP works.

PRP has also been shown to be beneficial in the treatment of tendon disorders. Most evidence supports its use in common extensor tendinopathy (tennis elbow) and patellar tendinopathy (jumper's knee), although there is some evidence showing benefit of PRP injections for Achilles, rotator cuff, gluteal, and proximal hamstring tendinopathies. Younger and active individuals seem to benefit from this procedure, although this needs to be further studied.¹⁶ Additionally, current literature suggests that leukocyte-rich PRP (LR-PRP) is more beneficial than leukocyte-poor PRP (LP-PRP), although both show positive results. Outcomes appear to be optimized by use of ultrasound guidance and minimizing the amount of local anesthetic at the site of injection. Addition of needle tenotomy (fenestration) may also be helpful.⁹

Furthermore, there is some evidence that PRP injections are helpful, in addition to physical therapy, in treating hamstring injuries. Although PRP injections do not appear to significantly reduce return to play timelines after hamstring strains, they have been shown to diminish scar formation and improve the quality of healed tissue on ultrasound and MRI imaging.^{19,22}

Amnion Derived Products

Amnion derived products are allogeneic, which means they are not taken from the patient's own cells. They are derived from placental tissue which supports the growth of a fetus during pregnancy.² This human chorion/amnion tissue is dehydrated and primarily composed of proteoglycans and extracellular matrix proteins such as collagen, keratin, and albumin. Some claim that amnion products contain growth factors and other bioactive components, similar to PRP, but this is controversial.^{20,21} Furthermore, there is a common misperception that these products contain stem cells, but several studies have shown that there are no live, viable stem cells in the commercially available amnion derived products.^{20,21}

Amnion derived products typically come in a vial containing the dehydrated powder. The product is then reconstituted (mixed) and injected into the location of interest. Thus, the primary advantage of this procedure is that there is no need to take blood from the patient.

Although amnion products have been used for numerous orthopedic conditions to decrease pain and inflammation, there is not much research available on these treatments. Most studies focus on applications in the foot and ankle, and less studies on chronic tendon conditions and osteoarthritis. Currently, there is insufficient evidence to recommend amnion derived products in treatment of musculoskeletal conditions. More studies are needed.

[To Access and Further Information and Resources about ADP – click here](#)

Stem Cell Containing Products

Bone Marrow Aspirate Concentrate (BMC or BMAC®)

Bone marrow aspirate is obtained by harvesting bone marrow from the bone marrow cavity through a puncture site most commonly in the lower back at the posterior pelvis. After aspirating the bone marrow, it is spun in a centrifuge to increase the concentration of mesenchymal stem cells and progenitor cells compared to whole bone marrow; this is referred to as bone marrow aspirate concentrate (BMC or BMAC®). This concentrate is then injected into the area of interest. BMC contains both stem cells and growth factors. Optimal concentrations to use in the procedure and the cellular make-up of BMC remain unknown.

There are significantly fewer publications on BMC than PRP, the majority of which focus on treatment of knee osteoarthritis. Results have generally shown temporary improvement in pain and function, but there is no conclusive evidence that this procedure improves disease or regrows cartilage in humans.^{1,6} ?? Importantly, no significant adverse events have been reported for this therapy, thus it appears to be safe and potentially effective in certain patients for pain and functional improvement. Similar to PRP, it is not yet understood how BMC works and it seems to be most effective in less severe osteoarthritis.^{1,2}

There is some evidence to support BMC injections in conjunction with surgical rotator cuff repairs to augment the healing process postoperatively. Otherwise, there is currently insufficient evidence to support use of BMC in treatment of tendon disorders.¹²

[To Access and Further Information and Resources about BMC – click here](#)

Adipose Derived Stem Cells (ASCs or ADSCs)

Adipose stem cells (ASCs), also known as adipose derived stem cells (ADSCs), are of interest to clinicians because they can differentiate into different tissues, such as bone and cartilage, when placed in the appropriate environment in the body. Adipose tissue has been shown to contain mesenchymal stem cells at a higher concentration than even bone marrow aspirate.

ASCs are obtained through a liposuction procedure where the physician infuses tissues under the skin with a saline solution containing anesthetic with/or without epinephrine through a thin tube. The physician then removes both the liquid and tissue under suction, similar to a liposuction cosmetic procedure but at a much lower volume. This typically generates 100-200 mL of product consisting of a mixture of circulating blood cells, fibroblasts, endothelial progenitor cells, smooth muscle cells, white blood cells, hematopoietic stem cells, and adipocyte progenitors. Using a filtration technique, stem cells, progenitor cells and adipose

cells are micronized into smaller fragments. These isolated cells are then injected into the area of interest.

ASC research remains in its infancy as there are very few published studies. One small study on ASC use in treatment of moderate to advanced knee osteoarthritis showed improvement in pain and function which continued through one year.¹³ Another study suggested ASC outperformed PRP in treating Achilles tendinopathy.¹⁸ Otherwise, there is currently insufficient evidence to recommend ASC in treatment of osteoarthritis or other musculoskeletal conditions. More studies are needed.

Closing Comments

Overall, regenerative therapies show much promise in reducing inflammation, improving pain, and promoting tissue healing. Many believe PRP and stem cell therapies are the future of sports medicine, but there is a need for continued investigation and optimization of these therapies for acute and chronic musculoskeletal conditions. In time, these optimizations could provide the athlete with faster healing, stronger repairs, and the potential to reduce return to play timelines for a number of common injuries.

Due to the limited number of high-quality research studies currently published, regenerative medicine therapies are still considered investigational in the United States and, in turn, are not typically covered by insurance. This may, in some instances, lead to financial incentives on the part of the treating practitioner. Hence, it is very important that athletes and patients are aware of the current research surrounding these therapies. Being educated on this topic helps one make informed decisions on how to proceed with their care.

What you should know:

- There are few high-quality studies on regenerative medicine
- Regenerative medicine treatments are typically not covered by insurance
- Care providers may have financial incentives to offer these treatments
- Consult with a trusted provider when making decisions regarding use of regenerative medicine therapies
- Consider using a fellowship-trained sports medicine provider with Certificate of Added Qualification in Sports Medicine (CAQSM)
- Consider using a provider associated with a well-established institution
- Always consider obtaining a second opinion from another provider prior to proceeding with treatment

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Pain, Sleep, and Performance

Overview

Pain and sleep have a bidirectional relationship. Pain can impede a player's ability to sleep well, and poor sleep exacerbates pain. Sleep plays a role in every aspect of life. Poor sleep habits are linked to many health concerns: depression, anxiety, increased cortisol, lactic acid build up, memory, slower reaction time, and increased perception of pain. In fact, one resource noted that being up for 19 hours is equivalent to having a .08 blood alcohol level which substantially impaired performance and increased risk for injury.

In the evaluation and treatment of pain, it is critical to assess sleep and address any and all sleep disturbances. Optimizing sleep can not only lessen pain, but it can also promote healing.

Assessment

There are many components to sleep, so it is important to do a thorough and systematic evaluation. This, in turn, can inform the development of the treatment plan. While there are certain sleep disturbances which are easy to identify, there are many which can be subtle yet disruptive. It is incumbent on the provider to ask in-depth questions about a player's sleep hygiene:

1. What are your bedtime habits/rituals?
2. What sort of bed do you sleep on?
3. Where does light come into your room?
4. What sort of alarm do you use?
5. Do you feel rested when you wake up?
6. How long does it take you to fall asleep?
7. Once you fall asleep, do you stay asleep or wake up throughout the night?
8. How many hours of uninterrupted sleep do you generally get?

To aid in this process, there are tools which can help to gather the relevant data. Notably, there are apps which help to track sleep, and a provider may ask a player to fill out a sleep log. Should this initial assessment cause concern, a player may benefit from having a sleep study done. This is a test which measures various physiological markers while one is sleeping, and it can be done in the home or in a hospital. A sleep study is a noninvasive comprehensive real-time evaluation which provides inimitable data that is essential to making certain diagnoses about sleep.

The ongoing evaluation of sleep is an important component of pain management, because certain treatment options for pain will affect sleep. For instance, there are pain medications which cause drowsiness, and others which interfere with the manner in which one progresses through the various stages of sleep. Also, there are interventions like acupuncture which can target both pain and poor sleep simultaneously. To ensure that sleep is not compromised by the treatment plan for pain, a player and his provider must routinely address the topic of sleep.

Psychological Therapy

Cognitive Behavioral Therapy for Insomnia (CBT-I)

The term “sleep hygiene” refers to the habits and behaviors that surround sleep. Sleep hygiene encompasses much more than most realize, and it has a tremendous impact on the quality of a player’s sleep. As a result, it is often true that lifestyle changes and modifying bedtime rituals can significantly improve/resolve sleep issues. As with anything, it’s important to learn these skills properly and practice them. There is a particular therapy, Cognitive Behavioral Therapy for Insomnia (CBT-I), which was designed for that particular purpose, and there are clinicians who specialize in providing CBT-I. A player with sleep disturbances will benefit from CBT-I, and studies have shown that it can lead to long-term resolution of a variety of sleep symptoms.

Medications

It is important to note that the use of a medication to address sleep issues is usually only warranted if other non-pharmacologic measures have been implemented. There are several classes of medications that are used to address falling asleep more easily, and there are not any medications which have been shown to reliably help in sleeping through the night. Of those used to help with the initiation of sleep, none are safe for long-term use.

Over the Counter (OTC)

An over the counter medication, melatonin, is a synthetic version of a substance that the brain makes in the evening to promote sleep, and it has little risk of dependence or abuse. Over the counter sleep-aids like diphenhydramine (commonly known as Benadryl and Zzzquil) and doxylamine succinate (commonly known as Unisom) are intended for extremely short term-use (i.e. 1-3 days), have little utility, and can lead to dependence.

Sedative Hypnotics

Prescribed medications like estazolam (Prosom), Eszopiclone (Lunesta), Ramelteon (Rozerem), suvorexant (Belsomra), Temazepam (Restoril), Triazolam (Halcion), Zaleplon (Sonata), and Zolpidem (Ambien) are FDA approved to be used for sleep symptoms. But these are not the optimal intervention for long-standing sleep disorders and should only be used for a short duration (i.e. less than one month). Importantly, these agents carry a significant risk for addiction, and they interact with other chemicals, like alcohol and other medications. If a player and a provider decide to use one of these agents, there needs to be close medical monitoring to ensure that the medication is used safely and appropriately.

Antidepressants

Antidepressant medications such as TCA’s (previously discussed) are used in both the management of pain and can provide relief from sleep symptoms due to their side effects (i.e. drowsiness). These medications are discussed elsewhere in this guide, and they should be considered if clinically indicated.

Devices

Continuous Positive Airway Pressure (CPAP)

The CPAP machine is used in the treatment of Obstructive Sleep Apnea, and it must be prescribed by a provider. The machine has a mask which is worn over the face as a player sleeps, and a constant flow of air is delivered through the mask to keep airways open. The machine ensures that the player gets adequate oxygenation during sleep allowing the brain to rest comfortably overnight. This facilitates decreased pain, sharper cognition, and improved performance.

Psychotherapies

Psychotherapies for pain are generally aimed at improving the physical, social, emotional and occupational functioning rather than on resolving the pain itself. As such, engaging in these modalities can have benefits that extend well beyond pain alone. These interventions are considered to be low-risk and broadly applicable. There are four main types of psychotherapies for pain which have evidence for their effectiveness:

1. Cognitive Behavioral Therapy (CBT)
2. Mindfulness-Based Stress Reduction (MBSR)
3. Acceptance and Commitment Therapy (ACT)
4. Operant-Behavioral Therapy

Cognitive Behavioral Therapy (CBT)

CBT was developed in the 1960's by Dr. Aaron T. Beck after noticing that many of his patients had internal dialogues that were distorted and unhelpful. It is a time-limited (e.g. 12-16 weeks) therapy aimed at reshaping unhealthy patterns of thinking which in turn has a significant impact on both behavior and perception. CBT has been extensively studied and has been demonstrated to effectively treat anxiety, depression, addiction, chronic migraines, complex regional pain syndromes, arthritis, sleep disorders, spinal cord injury and chronic pain.

Treatment focuses on behavioral and cognitive responses to pain. CBT protocols involve psychoeducation about pain, behavior, and mood, strategies for relaxation, behavioral activation, effective communication, and cognitive restructuring for distorted and maladaptive thoughts about pain. CBT has been proven to have long term effects and has been shown to improve disability above and beyond the effects of routine medical care.

Mindfulness-Based Stress Reduction (MBSR)

MBSR was developed at the University of Massachusetts in the 1970's by Jon Kabat-Zinn. Mindfulness can be understood as a nonjudgmental acceptance of the present experience. It uses a combination of meditation, body awareness, yoga and exploration of patterns of behavior. It is time-limited, generally 8-10 weeks, and has been shown to be effective in anxiety, depression, substance use, chronic pain, headaches, lower back pain, arthritis and insomnia.

Treatment focuses on the uncoupling of physical and psychological aspects of pain and teaches body and proprioceptive signals, awareness of physical sensations, and the development of mindful activities. MBSR has demonstrated efficacy in addressing the severity of medical and psychological symptoms, pain intensity, and coping with stress and pain. The gains have been shown to last up to 4 years after the intervention.

Acceptance and Commitment Therapy (ACT)

Steven Hayes developed ACT in 1982 to create a mixed approach integrating both

cognitive and behavioral therapies. It differs from CBT in that it helps the individual clarify their personal values and take action on them. ACT has been shown to be effective for the treatment of depression, anxiety, musculoskeletal pain and whiplash associated disorders.

Treatment focuses on the acceptance of pain and the ceasing of maladaptive attempts to eliminate and control pain through avoidance and other problematic behaviors. It further emphasizes psychological flexibility and promotes behavioral engagement in pursuit of personal goals. There is strong evidence that ACT interventions have medium to large effects on function, performance and work status.

Operant-Behavioral Therapy

Operant-Behavioral Therapy was proposed by Wilbert E. Fordyce in 1984. He proposed a behavioral model of pain adaptation in which maladaptive behavioral responses to pain develop through contingent relief from pain or pain-related fear. In short, negative reinforcement inadvertently contributes to the development and maintenance of pain chronicity, deconditioning, and depression. Operant-Behavioral Therapy has been shown to be effective for the treatment of complex regional pain syndromes, lower back pain, mixed chronic pain, and whiplash-associated disorders.

Treatment focuses on extinguishing unhealthy behaviors used to avoid pain and fostering adaptive behavioral responses to pain. Behavioral responses are reinforced through the extinction of associations between the threat of pain and physical behavior. Operant-Behavioral Therapy has shown to have positive effects on pain experience, mood, negative cognitive appraisals, and functioning.

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Medical Cannabis (Marijuana, CBD, THC, and associated products)

Any discussion of cannabis (aka, marijuana), hemp, THC, or CBD needs to begin with the **warning** that consuming any product with THC, including some forms of hemp derived CBD, may lead to a positive toxicology screen that is a violation of league rules and subject to disciplinary actions including suspensions and fines (National Football League Policy and Program on Substances of Abuse). Hemp can legally contain up to .3% THC. Most CBD products are derived from hemp that contains approximately 30 parts of CBD to 1 part of THC. That means that taking 120 mg of CBD also means you could be taking about 4 mg of THC. While this may not be enough to cause intoxication, it is possible that urinary THC metabolites may be high enough to produce a positive urine test. The only way to completely avoid this risk is to not take any product that contains THC.

At the same time, it is also important to acknowledge that some players are choosing to use cannabis and/or CBD for pain, inflammation, or other medical concerns and to acknowledge that a recent report by the National Academy of Sciences, Engineering and Medicine (see <http://nationalacademies.org/hmd/reports/2017/health-effects-of-cannabis-and-cannabinoids.aspx>) found “conclusive or substantial” evidence supporting an effect of cannabis or cannabinoids for the treatment of chronic pain in adults. The evidence for the effect was primarily based on a pharmaceutical plant derived oral preparation with an equal amount of CBD and THC. The medical use of products cannabis or hemp products also have health risks as well as potential benefits. It is important to provide individuals who are already using these products, or who plan to use these products, with information about the potential risks and benefits beyond the risks of violating league rules. The following paragraphs summarize what is currently known. This information should in no way be interpreted as a recommendation to try a cannabis or CBD product or how to use a product to achieve a medical effect. Rather, the information below is provided to help those who are using or who plan to use a cannabis product to reduce their risks of experiencing negative health effects.

Cannabinoids (*Cannabis* s. derived products – eg: [Marinol](#), [Syndros](#), [Cesamet](#), [Epidolex](#))

Cannabis is the term used to refer to a group of genetically related species of plants, commonly known by names like marijuana and hemp. Hemp is a term that is used to refer to a cannabis plant with less than .3% THC. Hemp was historically cultivated for fiber and other uses, but more recently has been cultivated for the production of cannabidiol (CBD). Cannabis plants with greater than .3% THC are cultivated more broadly for their medicinal and psychoactive properties. Cannabis derived products sold in dispensaries may contain a range of THC and CBD. Hemp derived CBD products that were recently legalized at a federal level must contain less than .3% THC.

Because of the federal prohibition on Cannabis for many decades, the research on the medical effects of cannabis products containing THC and/or CBD is limited. However,

there has been considerable research on the risks of cannabis derived products and there is some limited evidence on therapeutic effect, which can be used to make some recommendations on how to minimize the risks and maximize any benefits. While it would normally be advisable to wait for additional evidence before publishing these guidelines, residents in more than 30 states and Canada now have access to these products and the cannabis industry (both medical cannabis and hemp) is expected to reach \$60 billion in the near future, creating a situation where such guidelines are much needed even if the evidence base is not extensive or conclusive.

In January 2017, the National Academy of Sciences, Engineering, and Medicine (NASEM) released a comprehensive report on the health effects of cannabis, which can be used as a more comprehensive resource although it is important to note that there have been primary studies published since that time.

Potential risks of products containing psychoactive doses of THC include the following:

1. Acute impairment of cognition, particularly verbal learning. These effects of which may last of to 72 hours depending on the frequency and quantity of use (see Scott et al., 2018).
2. Acute impairment of ability to drive or operate machinery.
3. An association between THC use and the development of psychosis in adolescents and young adults.
4. Risk for the development of a Cannabis Use Disorder, which is greatest among young males (e.g., teens and early twenties) who are using for recreational reasons and are using inhalable forms. The risk decreases with age, decreases for oral formulations, and appears to be low among patients using medical products based on research on a 1:1 THC to CBD oral formulation (i.e., Sativex) in Europe and Canada.
5. Use by pregnant or nursing women may also convey risks to unborn (e.g., there is an association with low birth weight) or nursing children.
6. Recently, there has been an alarming increase in vaping related lung disease, which appears to be related to pre-packaged vaporizer oils that may also contain THC, CBD, or nicotine. At this point, these products should be avoided.

There have been no documented risks of negative effects of CBD at doses normally encountered. Potential risks of very high doses of CBD (e.g., > 1200 mg) may include the following:

1. Elevated liver function tests.
2. Drug interactions possibly related to the effects of CBD in drug metabolic pathways.

Consistent with the NASEM report (2017), there is evidence that cannabis derived products, particularly in the form of an equal blend of THC and CBD, may be useful for pain. However, the most effective ratio of CBD to THC, the most effective doses, and the most effective route of administration are not known. The majority of the evidence for pain comes from studies that tested a 1:1 formulation of CBD to THC. There have been

only a few studies supporting the effect of THC only. There have been no published studies that support the use of CBD only for pain. There is one recently published paper in the medical literature that provides guidelines on the use of cannabinoids (see [Maccallum & Russo, 2018](#)).

The primary source of risk in cannabis and CBD products is related to the amount of THC in the product. CBD does not have any published adverse effects except at really high doses. For individuals who plan to smoke or vaporize flower, there is the additional risk of lung irritation. Topicals include products like creams, salves, oils, and transdermal patches. There is very little research on the efficacy of topical products. In fact, there are no high-quality studies to support the effects of topicals, but it is possible that topical may have a localized anti-inflammatory effect. Given the lack of research, there are no guidelines on the use of topicals.

Alcohol

Alcohol consumption is associated with 88,000 deaths in the U.S. each year, making it one of the leading causes of death. Individuals with pain often report using alcohol to cope with pain and are more likely to develop a Alcohol Use Disorder than individuals without pain. Although alcohol may have an immediate effect in terms of dampening pain, the long-term effect tends to be a worsening of pain symptoms. For example, heavy adult drinkers are more likely to have heightened sensitivity to painful stimuli compared to non-drinkers. The negative effects of alcohol are likely due the fact that alcohol increases inflammation. In addition, heavy alcohol use is known to interfere with sleep, which in turn makes recovery difficult and also exacerbates pain.

Of particular importance to the professional athlete is alcohol's effects on performance and recovery. Regular alcohol use depresses immune function, impairs vitamin and nutrient absorption and storage, and delays muscle repair. Additionally, reaction time, precision, equilibrium, hand-eye coordination, accuracy, balance, judgement, stamina, strength and speed can be impaired for up to 72 hours (three days) after use.

A common question is "how much alcohol is too much?" According to the National Institute on Alcohol Abuse and Alcoholism (NIAAA), two drinks per day for men is considered to be a safe level of consumption. Consuming five or more drinks is considered to be binge drinking and likely leads to long-term inflammation, poor sleep, poor recovery, poor performance, and worsening of pain. For those reasons, it is strongly recommended that individuals avoid consuming more than two alcoholic beverages and strongly recommended that individuals do not use alcohol in an attempt to control pain.

Surgical Procedures

As a general statement, the following is adapted from the International Olympic Committee consensus statement on pain management in elite athletes:

“Elective surgery has no place in the treatment of pain itself but may address structural damage non-responsive to non-operative treatment, or to avoid further impairment of an athlete’s health. An operation for a chronic injury and pain condition must aim to correct a structural problem that influences pain and functional limitations and should occur as part of a multifaceted, bio-psycho-social management approach. Surgical intervention includes setting individual treatment and outcome goals for the athlete. The athlete must have a complete understanding of the risks and benefits and accurate expectations about postsurgical recovery and pain. When appropriate, surgery can be part of a multidisciplinary approach for pain reduction. Surgery should not be performed to treat chronic pain simply because all other interventions have failed but should rather be used when a structural problem associated with the pain has been identified.”
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