Effects of Intermittent Dynamic Compression (Game ready) on Treatment of Musculo-Skeletal Injuries: About 12 Basketball Professionals

Diouf JD*, Gueye AB², Kinkpe CVA², Niane MM², Daffe M², Diao S³, and Sy MH¹

¹Orthopaedics and traumatology clinic, Grand-Yoff General Hospital, Dakar, Senegal
²Orthopaedics and traumatology clinic, Order of Malte Center, Dakar, Senegal

Abstract

Introduction: For the last decades, limbs external pneumatic compression technics associated with cryotherapy have become more and more popular among the sportive universe in order to achieve muscular recovery faster. The Game Ready device commercialized in Europe and the United States has often been used in sportives musculoskeletal lesions treatment. Nowadays its contributivity in post-surgical care mostly after arthroplasty and arthroscopy is no more to be demonstrated.

Patients and Methods: It is a preliminary prospective study focused on the 7th August, to 8th September 2017 lapse of time. The cohort being composed of 12 professional basketball players with an average age of 29.58 (24-37 years old). We had two Game Ready devices in possession mainly dedicated to the lower limb. The therapeutic protocol did vary according to the type of lesion. The pain and the swelling were the two main evaluative criteria.

Results: The knee was the most affected (11 players) followed by the ankle and foot (3 players). Among the lesions treated, the ankle sprain, the patellar chondropathy, and the patellar tendinitis were by far the more frequent. All patients have been treated with the Game Ready following a specific protocol associated with other therapeutic methods. The average visual analog scale score after cryotherapy was of 3/10 and the satisfaction index of the players was generally good. NSAID taking was reduced (83.3 %). Most of the players (eight) maintained their physical activity without losing on performance. Complete sportive activity cessation had only been registered for one player.

Conclusion: This study leads us to new reflexion fields regarding the Game Ready utility which can now be extended to post-surgical care. It also leads to a noticeable decrease in anti-inflamatory taking. Nonetheless, these outcomes must be read as preliminary. Other studies on a wider sample shall let us clearly appreciate its benefice on muscular healing.

Keywords: Cryotherapy; External pneumatic compression; Game Ready; Sports; Pain; Swelling

Introduction

Pain control in professional sport is the major aim to optimize players performance. We have always used cryotherapy in the sports and medical field. Indeed, the use of ice and snow as a therapeutic medium was already reported by Hippocrates (460–377 B.C). While the way of doing cryotherapy has evolved but especially the evolution of physiological knowledge allows us to better understand the effects and define the fields and methods of application.

The use of bags of crushed ice or cold gel packs attached to various anatomical sites with elastic bands is a common observation in locker rooms at sports facilities around the world. This cryotherapy with some degree of concomitant static compression is commonly applied immediately after the acute musculoskeletal injury or as a prophylaxis for degenerative orthopedic conditions [1].

For the last decades, limbs external pneumatic compression technics associated with cryotherapy have become more and more popular among the sportive universe in order to achieve faster sportives recovery and to reduce analgesic consumption [2,3]. This cryotherapy can be associated with a permanent static compression (CSP) or intermittent dynamic (CDI). In Senegal, it is the permanent static cryotherapy that is most often used in our teams.

In Europe and the United States, an external pneumatic compression device associated to cryotherapy is commercialized under the name of Game Ready [4]. The use of this device has increased lately among both professional and amateur sportive communities and also in arthroplasty and arthroscopic post-surgical care [5,6]. In Senegal, the most used technique for the teams is the permanent static cryotherapy. The main objective of this study is establishing with results analysis, advantages of the Game Ready device on our athletes.

Material and Methods

Materials

Our job has been realized out of the hospital, on a closed meeting of 12 professional basketball players all male. The average age is 29.58 (24-37 years old). It is a preliminary prospective study focused on the 07th August–08th September 2017 lapse of time during the closed meeting of 12 professional basketball players. The free and enlightened consent of the players were obtained before any application. We did include in this study all the players presenting musculoskeletal and tendinous lesions interesting these anatomical regions: thigh, knee, leg, ankle and foot; and eligible for the Game Ready. Players with other diseases not eligible for our device were expelled of the study.

Methods

We had got two external pneumatic compression systems (Game-Ready) mainly applicable to the ankle and foot, the leg, the knee and the thigh (Figure 1&2). The size of the device is 413 mm length x 197 mm width x 235 mm height. Its weight is 3.3 kg in the empty state and about 8.2 kg filled with ice and water. The level of pressure applied locally using the splint varies from 5 mmHg to
Figure 1: Game Ready Protocol [7].

Figure 2: Game Ready Device.
75 mmHg and depends on the therapeutic indication. It operates on standard power outlets (100-240 V ~, 50-60 Hz, 1.0 A) [7]. The following items are included in the Game Ready system:

- A controller;
- AC adapter;
- A power cord

Connector pipe and splints (consisting of a heat exchanger and an outer sheath). A splint must be connected to the system before starting the treatment

It has several programs:

- Manual Mode: The system defaults to this mode, and adjusts the time and pressure settings.
- Program Mode: This mode allows you to choose from six programs that provide treatment for a preset time, then put the system on hold (no therapy) for a preset time, continuously and at a specific pressure setting [4,7].

The splint consists of an internal heat exchanger and an outer sheath. The Game Ready controller will be placed on a stable surface (such as the floor or a table) during use. Using it in a high ambient environment may affect the ability of the system to provide adequate cooling or limit the life of the ice. The Game Ready was applied to the players every night after a competition match or a training session following a standardized protocol and the clinical state of each player, during the whole gathering.

It was associated to another type of cryotherapy «cold pack» applicable just after a game or a training session an consisted in an ice pack fixed on the painful area with an elastic band (Figure 3).

![Figure 3: Game Ready Splint.](image)

The players also had kinesiotherapy sessions with classic exercises (joint mobility, muscular strengthening, manual drainage); electrotherapy and elastic contention (K-Tape) and pressotherapy type Normatec [8]. These physical methods were allied to a medication based on the clinical response. At the time of exploiting the medical files, we did focus on the morphometric data (weight, height, body mass index/BMI); on the musculoskeletal lesions of the players; on their medical past history and on therapeutic aspects. The therapeutic protocol depended on the type of lesion. Subjective criteria relied on the presence or not of pain rated by the visual analog scale (VAS), tumefaction and sports resumption.

For the interpretation of the statistical results, we used the Wilcoxon test. We used P value (p) whose threshold of significance was 0.05.

**Results**

The initial pain intensity according to the VAS before using Game Ready was on an average of 6/10. The Wilcoxon test noted a statistically significant p-value (less than 0.002).

**Sites of Lesions**

The knee was the most affected area (11 cases) followed by the ankle and foot (3 cases). The repartition of the lesions in our collection is reported on figure 4.

**Therapeutic Indications**

Micro traumatic orthopedic diseases were the most represented (n=10) followed by acute sportive traumatic affections (n=4) (Figure 5).

**Associated Treatments**

Half of our players had kinesiotherapy cares. Only 1 player (8%) had analgesics and 2 players (16.67%) anti-inflammatory. Regarding the contention, 2 players (16.67%) used semi-rigid removable contention and 5 players (41.66%) used another contention system (K-Tape) (Figure 6).

**Complications**

No specifically related complication to the cryotherapy and the pressotherapy had been noticed in this preliminary study.

**Evaluation**

The satisfaction index had been judged very well for 7 players (58%).

- **Pain**

  The pain was the main motive for applying cryotherapy and touched all players. The average VAS score was of 3/10 after cryotherapy.

- **Sportive activity**

  The complete cessation of sports was noted for one player presenting a cicatricial Achilles tendon. Three players had a partial rest with an average of 3 days. Eight players kept on their physical activity without losing on performance.

  The flexion-extension arc and the muscular strength were maintained for 91.67% of the players. The first parameter was only limited for one player who had a post-surgical Achilles tendon shortening.

**Discussion**

The results we have been lead to after our study give us new keys to reflexion on the new sportive recuperation method which is the Game Ready treatment. These results yet have to be considered conscious of the study boundaries which are the lack of biologic parameters allowing a precise evaluation of muscular recuperation and the preliminary level of sportive activity and performance most eclectic of the different athletes. In our series, recent sportive traumatic affections and chronic micro-traumatic affections were the most frequent.

**Therapeutic indications**

- Recent traumatic affections

  Wilkerson GB, et al. [9], in their randomized series of 34
Figure 4: Repartition of the sites of lesion.

Figure 5: Repartition of the Game Ready eligible lesions.
patients showed the benefit of compression when associated with cryotherapy for ankle traumasisms. Airaksinen O. [10] did also get to demonstrate the efficiency of cryotherapy associated with removable contention in the physiotherapy of 22 patients traumatized at the ankle. In our series, these ankle lesions are frequently seen with a cumulative rate of 24.96%. Their treatment with Game Ready gave good results mostly regarding pain remission.

- Micro-traumatic affections

In our series, we mostly noted patellar and Achilles tendon tendinitis with a cumulative rate of 33.3%. Knobloch K, et al. [11] in their series of 60 patients established the superiority of compression associated cryotherapy over cryotherapy alone for Achilles tendon tendinitis treatment. In a matter of fact, they did notice an improvement in the intratendinous microcirculation after 3 to 10 minutes of cryotherapy application; which is beneficial for the healing [12]. Zhang J, et al. [13] did prove cryotherapy effects on treating Achilles tendon traumatic ruptures and chronic tendinopathy. Nevertheless, their study did not specify the mode and frequency of that cryotherapy.

We did notice no improvement in the healing process on the two MRI realized on a four weeks interlude. Otherwise, we did get to observe a partial resorption of the swelling around the lesion. Regarding the patellar tendinitis, we hardly came to an acute appreciation of the Game Ready benefice since there were other associated therapeutic methods; most notably the electrotherapy.

**Associated Treatments**

- Cryotherapy and immobilization

16.67% of the athletes of our series had removable semi-rigid contention and 46.67% used another contention system (Kinesiology Tape).

Elastic bandage associated with cryotherapy in ankle traumatized rehabilitation is still efficient according to Airaksinen O, et al. [14] work. In a matter of fact, it permitted 4 weeks to gain on the re-education time. At the contrary, Wilkerson GB, et al. [9] did not shed light on significant differences about the time lapse until sports activities resuming when compression is associated with cryotherapy.

- Cryotherapy and Medication

In our series, we did notice a significant reduction of analgesics taking among our athletes compared to previous competitions. Actually, 8.33% of the athletes were on analgesic and 16.67% on an anti-inflammatory. Watkins AA, et al. [3] shows in his service the noticeable decrease in medicines administrated; in particular morphine derivatives in post-surgical care. Still, speaking of pain and swelling care, Merrick MA, et al. [15] did not show a huge difference between the different groups (Ice and drug vs drug alone). Scarsella JB, et al. [2] also stated that there was not a huge difference between groups regarding analgesics consumption. This analysis of
Merrick and Scarcella JB, et al. can get their explanation in a more important presence of the pain after surgery. Their patients had indeed a VAS score higher than ours [2,3].

- Cryotherapy and Electrotherapy

Cryotherapy was associated with the Game Ready treatment for 83.3% of athletes. Michlovitz SL, et al. [16] did not show a significant difference regarding the pain and swelling remission when associating low and high-frequency electrotherapy. That result of Michlovitz SL, et al. comfort us in the idea that the Game Ready alone would be effective in treating low-grade patellar tendinitis. Yet it would be uneasy to affirm it considering our tiny sample.

Clinical Results

The pain was the main motive for cryotherapy and was found with all the players. The average VAS score was of 3/10 in our series after applying the Game Ready. All studies state the analgesic effect of the cryotherapy even when applied without compression. Lessard LA, et al. [17] shows a significant pain reduction after knee arthroscopy. Through a causality relation, he demonstrates the noticeable decrease of the analgesic taking after surgery. At the same time, comparing 2 groups (ice and compression vs. ice alone), Cohn BT, et al [18] also shows a huge reduction of medications taking. At the opposite, Laba [19], Edwards DJ, et al. [20] and Sloan JP, et al. [21] series did not show a significant difference (focusing on the pain and swelling remission) when associating cryotherapy to compression. In our series, that important reduction of the pain and swelling played an important role in the performance of the athletes. Sixty-seven percent of our players kept on their physical activities on a normal basis. The flexion-extension arc (knee and ankle) were conserved for 91.67% of the players, as of the muscular activities. So, the improvement of painful phenomenon or spasms delaying active rehabilitation.

Conclusion

Cryotherapy is a particularly interesting tool for the treatment of painful phenomenon or spasms delaying active rehabilitation and mobilizations or preventing an early resumption of functional activities. We always had recourse to cryotherapy in traumatology. Nowadays our use of it has evolved and creates a growing interest. Present investigations concerning the sportive recovery method using the Game Ready proved their efficiency on pain control. Our results should be interpreted as preliminary. Other studies on a larger sample shall allow us to clearly establish its benefits, even in arthroplasty and arthroscopy. This device also permitted us reduces noticeably the prescription of anti-inflammatory. Unfortunately, its cost makes it difficult to be available in all our national clubs but it remains a standard internationally.

References