Case Report

Advancing Physiatric Care: A Comprehensive Case Study on Laser Therapy and Hydrotherapy Integration Post-Femoral Head and Neck Resection

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Advancing Physiatric Care: A Comprehensive Case Study on Laser Therapy and Hydrotherapy Integration Post-Femoral Head and Neck Resection

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Simple Summary: Hip dysplasia is a common hereditary condition in dogs and cats characterized by inadequate hip joint development. This condition can be managed conservatively or surgically. It has been observed that after surgical treatment, physiotherapy is crucial for these patients. Physiotherapy helps in faster recovery and reduces additional complications in gait biomechanics. The rehabilitation plan may vary depending on the case, but the main goals are pain and inflammation control and muscle mass gain. Laser therapy and the use of an aquatic treadmill are effective methods used in achieving these goals.

Abstract: Hip dysplasia is a prevalent hereditary condition affecting dogs and cats, characterized by inadequate development of the hip joint. This condition leads to pain due to capsular distension, microfractures, and joint incongruity in young animals, ultimately progressing to osteoarthritis in adult and elderly animals. The pursuit of pain relief and improved quality of life for individuals with osteoarthritis has been a focal point in several studies. In this context, veterinary physiotherapy has gained prominence in small animal practice, serving as both palliative care and a supportive modality in the clinical or post-surgical management of degenerative joint diseases. Laser therapy and hydrotherapy, recognized for their analgesic effects and capacity to promote muscle mass gain, have garnered attention for their potential efficacy in treating joint diseases. This study aims to evaluate the therapeutic effects of super pulsed laser therapy and controlled low-impact exercises (water treadmill) on a patient recovering from surgery involving bilateral femoral head and forehead resection. We observed positive outcomes, including pain resolution, improved muscle mass, and enhanced range of motion, contributing to the patient's overall recovery.

Keywords: orthopedic rehabilitation physical therapy; orthopedic surgery; osteoarthritis; musculoskeletal system; photobiomodulation; balance and stability; orthopedic pain

1. Introduction

Coxofemoral dysplasia (CFD) is a prevalent orthopedic disease characterized by joint incongruity and subsequent osteoarthritis and pain, influenced by complex interactions of multiple genes and environmental factors impacting disease susceptibility [1,3,8,37]. Although the coxofemoral joint is normal at birth, the imbalance between skeletal and muscular system growth rates during development imposes excessive loads on the femoral head, altering acetabular conformation and leading to irregular joint surface remodeling [6,36,38].

CFD can progress to painful secondary osteoarthritis and affect the dog's behavior, manifesting as chronic lameness, muscle atrophy, and exercise reluctance [2,23,50]. While medical and surgical management can alleviate pain, they do not address underlying skeletal muscle conditions, which necessitates physiotherapy for effective treatment.

Clinical signs of CFD include pain, lameness, stiff gait, and muscle atrophy, with diagnosis relying on comprehensive medical history, clinical evaluation, and imaging [6,10,23]. Manifestations may remain latent for extended periods, becoming apparent with the onset of degenerative joint disease.

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The pathophysiology involves muscle contractures, joint inflammation, and increased intra-articular pressure, contributing to pain and joint dysfunction [3,6,26,28]. Contractures of the adductor muscles, notably the pectineus, can cause microfractures during growth remodeling, exacerbating the condition.

In patients with osteoarthritis, increased intra-articular pressure and subchondral bone ischemia are prominent contributors to pain [3,6,26]. Understanding the multifaceted etiology and clinical manifestations of CFD is essential for targeted therapeutic interventions (Figure 1).

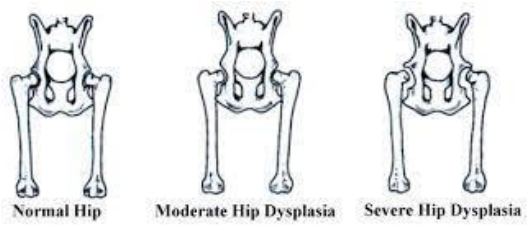

Figure 1. Hyp displasia.

The selection of an appropriate treatment strategy for coxofemoral dysplasia (CFD) hinges upon various factors, including the patient's age, the severity of dysplasia, and the presence of any concurrent pathologies. The primary objectives are to alleviate pain, enhance limb function, and optimize the patient's overall quality of life.

As illustrated in Table 1 below, conventional surgical interventions are inadequate in resolving the complex anatomical alterations associated with CFD. Instead, comprehensive symptom management is achievable through physiotherapy (rehabilitation) complemented by nutraceutical integration. Unlike surgical approaches, physiotherapy addresses the underlying muscular, tendinous, and ligamentous changes associated with CFD [19,29,32,41] (Table 1).

Table 1. comparative treatment.

Treatment x symptoms	Resection of the head and femoral strain	Denervation	Prosthesis	Rehabilitation
Pain in extension, adduction and flexion of the joint	-	+	+	+
Intermittent claudication paresis of hind limbs	-/+	+	+	+
Intra-articular pressure	+	-	+	+
Pectineus and iliopsoas contracture	-	-	-	+
Hypotrophy of the gluteus, quadriceps and biceps femoris	-	-/+	-	+
Pain in the sacral loin and lumbar thoracic spine.	-	-	-	+
Muscle and joint capsule pain.	-	+/-	-/+	+
Inflammation and retraction of the joint capsule.	+	-	+	+

The physiotherapy regimen employed encompassed a multifaceted approach incorporating several specialized techniques tailored to the needs of the patient. These techniques included:

Manual Treatment: Application of massage and stretching protocols to promote joint mobility and tissue flexibility.

Balance and Proprioceptive Exercises: Activities designed to enhance proprioception and stability, crucial for improving limb function and gait.

Therapeutic Exercises: Prescribed exercises targeting specific muscle groups to promote strength and endurance.

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Aquatic Treadmill Therapy: Utilization of an aquatic treadmill to facilitate low-impact exercise, fostering muscle conditioning and joint mobilization.

Super-Pulsed Class I Laser Therapy: Utilization of the ACTIVet PRO® device from Multi Radiance Medical (Solon, OH, USA) for laser therapy sessions. This therapy is known for its analgesic and anti-inflammatory effects, aiding in pain management and tissue healing. (Table 2)

The integration of these modalities within the physiotherapy protocol contributed synergistically to the patient's rehabilitation and recovery process (Table 2).

Table 2. This table shows the characteristics of the Laser Active Pro.

Feature	Specification
Laser radiation	905 nm
Broadband infrared radiation	860 nm
Visible red light radiation	660 nm
Laser radiation peak pulse power	50W
Laser pulse duration	110±20 ns
Broadband infrared radiation average power	250
Red light average power	100 mW
Radiation aperture	4±0.4 cm^2
Magnetic induction	35±10 mT

2. Materials and Methods

2.1. Patient Details

A 7-year-old male Canine Setter was the subject of this study (Figures 2–5).

Figure 2. Pre surgery x ray.

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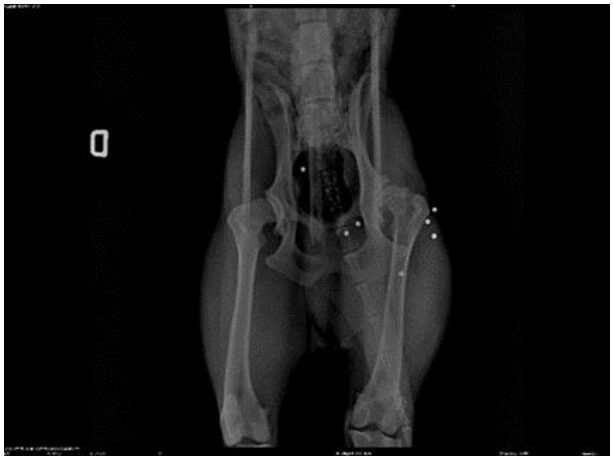

Figure 3. Pre surgery x ray.

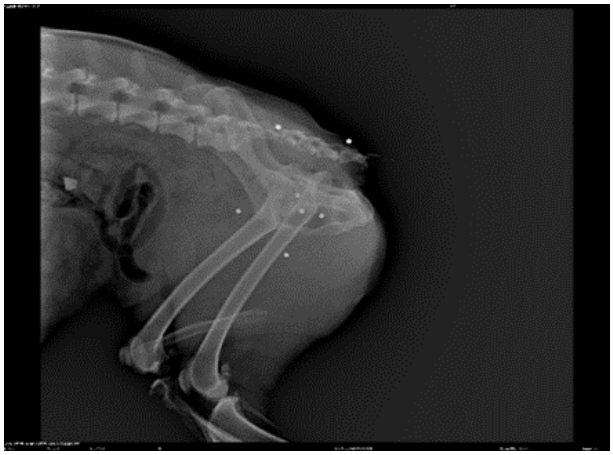

Figure 4. X-ray after the first surgery.

Figure 5. X-ray after the second surgery.

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Figure 6. Post-physiotherapy X-ray.

Figure 7. Use of images authorized by the guardian.

2.2. History

The canine was discovered abandoned near the municipal kennel and subsequently rescued. Following medical examination and X-rays, the dog was diagnosed with severe coxofemoral dysplasia, necessitating femoral head ostectomy due to joint dislocation. The initial surgery took place in March 2022, followed by a subsequent procedure in August 2022.

2.3. Assessment

In October 2022, the patient presented with pelvic extension pain, gluteal muscle atrophy, quadriceps and femoral biceps contractures, iliopsoas muscle contracture, lumbar thoracic spine pain, and joint capsule retraction. The dog exhibited difficulty in sitting and standing. Goniometry measurements indicated left coxofemoral joint flexion of 48º and extension of 158º, and right

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coxofemoral joint flexion of 47º and extension of 157º (normal flexion 50º, extension 162º). Thigh perimetry measurements were 28 cm (right) and 29 cm (left).

2.4. Methods

The treatment plan comprised 20 physiotherapy sessions utilizing the ACTIVet PRO® laser (Multi Radiance Medical, Solon, OH, USA) for pain and osteoarthritis management, aquatic treadmill for muscular reinforcement, balance and proprioception exercises, therapeutic exercises, and core strengthening. Additionally, Alevica® was administered for pain control, and Chondrostress® was prescribed to enhance cartilage hydration and synovial fluid viscosity in degenerative diseases such as coxofemoral dysplasia.

Rehabilitation sessions included tecar therapy, super-pulsed laser, and aquatic treadmill exercises administered twice weekly for two months, followed by once-weekly sessions for the final two weeks. Laser therapy aimed to expedite healing, control inflammation and pain, and alleviate muscle contractures. Specific laser treatments targeted thoracolumbar region pain, chronic pain at the surgery site, and pectineus muscle contracture.

Hydrotherapy sessions progressed through different water levels: hip joint level for the first two weeks, mid-femur level for subsequent sessions, and knee-deep water for the remaining sessions. Significant improvements were observed in muscle contracture and joint pressure after the fourth session.

Physiotherapy continued for two months to restore muscle mass, improve joint amplitude, and achieve total pain control. Condrostress® supplement C was continued indefinitely to manage degenerative joint disease.

3. Results

In the last evaluation, the patient exhibited no signs of pain and demonstrated ease in sitting and standing. The post-surgery treatment effectively restored the patient's function and quality of life. Radiographic assessment revealed no developmental signs of osteoarthritis and an increase in muscle mass. Thigh perimetry measurements showed improvement, with the right thigh measuring 30 cm and the left thigh measuring 31 cm.

4. Discussion

The evolution of rehabilitation has brought forth substantial scientific evidence supporting the effectiveness of non-surgical interventions for treating hip dysplasia, particularly in cases where there is no joint luxation. This case report underscores the necessity of rehabilitative measures even following corrective surgery, given that surgical techniques such as osteotomy, denervation, or prosthesis placement do not address soft tissue alterations (e.g., muscles, joint capsule). Consequently, it is essential to integrate pre- and post-surgery physiotherapy into all hip dysplasia treatment protocols to facilitate enhanced and accelerated patient recovery.

5. Conclusions

Recent studies demonstrate the efficacy of various physical therapeutic modalities in the conservative or post-surgical treatment of canine coxofemoral dysplasia (FCD) [28,32,48]. Physiatry exerts biological effects through physical mechanisms, eliciting biochemical responses in the body. Laser therapy is recommended for its analgesic effects [12,39,40], and low-impact exercises on a hydro treadmill [17,18,20,47] are beneficial for individuals with osteoarthritis.

Physical exercises on an aquatic treadmill contribute to weight control, a crucial factor in therapeutic management to avoid joint overload [21,24]. The physical properties of water decrease the relative weight of the animal due to buoyancy, and the increased density challenges muscles more than air [20,42]. These properties make hydro treadmill and swimming ideal exercises for animals with arthropathy, providing greater energy expenditure and less joint impact [11], and they are

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particularly important in the multimodal treatment of canine obesity in dogs with osteoarthritis [11,21,42,56].

Regular treadmill exercise enhances the release of beta-endorphins, improves self-esteem, and aids in pain relief in humans [11]. Further studies are necessary to elucidate the effects of aquatic physical exercises on dogs in relation to the release of endogenous substances and well-being. Nonetheless, the thermal effect of heated water is known to promote relaxation and improve joint mobility in dogs [57].

Laser therapy is effective in controlling joint pain and chronic disease in both humans [12,15,16] and dogs [38,39] Its analgesic effects occur through photo biomodulation of the inflammatory response, increasing cellular ATP synthesis and transforming prostaglandins and prostacyclin, thereby exerting anti-edematous and anti-inflammatory effects [16]. Laser therapy also increases the release of endorphins, providing relief from non-inflammatory pain [45].

To promote pain relief, improve joint movement amplitude, and increase muscle mass through physiatry modalities, it is essential to employ appropriate assessment methods for each parameter. In this case report, subjective assessments by the owner, goniometry, and perimetry of the coxofemoral joint and associated muscles were utilized [22,44–46].

In this specific case, the owner reported substantial improvement, indicating that the patient is no longer hesitant to walk, sit, or stand

And in the measurements [13]

1. Goniometry of the left coxofemoral joint pre-treatment: flexion 48º extension 158º (normal flexion 50º extension 162º) Post treatment flexion 50º extension 160º
2. Goniometry of the right coxofemoral joint pre-treatment: flexion 47º extension 157º (normal flexion 50º extension 162º) Post treatment flexion 50º extension 159º
3. Pre-treatment perimeter left thigh 28 cm left thigh 29 cm
4. Post treatment Right thigh perimetry 30 cm; left thigh 31 cm (Tables 3 and 4)

Based on our findings, we conclude that hydrotherapy and laser therapy offer effective means to address muscle contractures, joint extension, and support strength, ultimately enhancing the quality of life for our patients. Importantly, these therapies pose minimal risk or contraindication, as the use of super pulsed laser does not result in burns or abrasions on the patient's skin and does not require shaving. To further elucidate these benefits, continued studies and comparative analyses with cases of hip dysplasia, with or without surgical intervention, are warranted [27–29].

Table 3. This table shows the perimetry pre and post treatment.

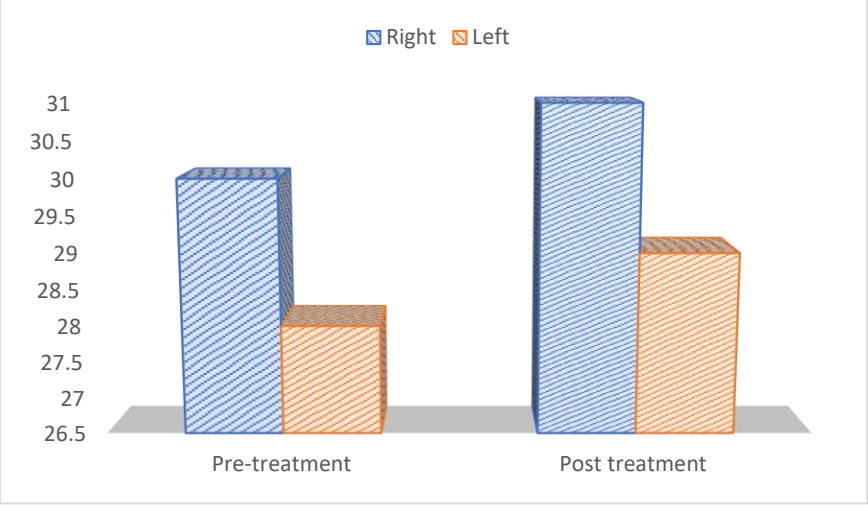

Table 4. This table shows the goniometry pre and post treatment.

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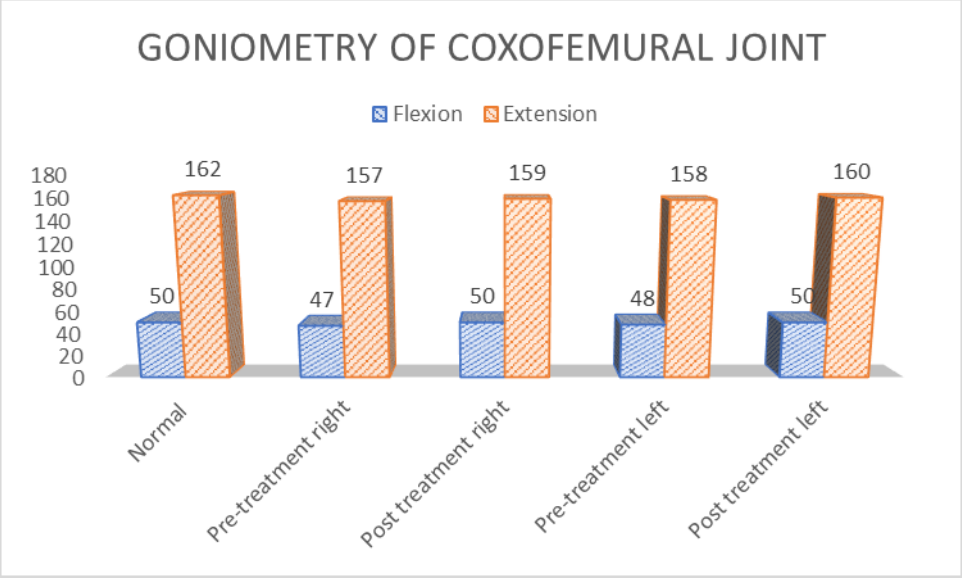

Informed Consent Statement: Informed consent was obtained from all subjects involved in the study.

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Conflicts of Interest: The authors declare no conflicts of interest.

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