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Treatment of Vulvovaginal Candidiasis with A Strategy Based on Phototherapy (M.A.C.® Scar Acceleration Method)

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Abstract

Candidiasis, also known as candidiasis vulvovaginitis, is an infection caused by different types of Candida fungi, the most frequent being Candida albicans. The present study reports an effective strategy, which opens new avenues for the treatment of this public health problem. The MAC® Methodology, conventional laser light-emitting (LLLT)/LED) methods are based on the biphasic response demonstrated many times in LLLT research and as with other forms of drugs, a "drug" (irradiation parameters) and a "dose" (irradiation times) and the "Arndt-Schulz Law" is often cited as a suitable model to describe the dose-dependent effects of LLLT. This method uses photopharmaceuticals, cell markers and the use of correct parameters for each case to induce the acceleration of tissue repair. The present study shows a case of a 32-year-old patient diagnosed with recurrent candidiasis 4 years ago. Eighteen sessions were performed (every other day) using a photoactivated component (Methylene blue 1% + Clotrimazole 1%) and LED phototherapy (red, blue and violet) with emission times of 60 - 260 seconds for each applicator, according to the dose recommendations of the scar acceleration method (MAC®). At the sixth treatment session there was a noticeable decrease in the itching sensation reported by the patient. In session 11 she reported feeling a great improvement, indicating that she no longer felt itching in any area after 18 sessions. The present case demonstrates new methodologies to treat common problems in the population that have a positive impact on the quality of life. This methodology has a promising future because it is non-invasive and requires a great biological transformation for inflammatory, fungal and viral

control.

Keywords

Treatment of vulvovaginal Candidiasis, Candidiasis, Candida, M.A.C., MAC®

1. Introduction

Candidiasis, also known as candidiasis vulvovaginitis, is an infection caused by different types of Candida fungus, the most frequent being Candida albicans. It is a fungus commonly present in the intestinal and vaginal flora of women that causes infection when it reproduces at an accelerated rate. The most common symptoms are genital itching/burning, vulvar redness, pain, discomfort when urinating or during intercourse and alterations in vaginal discharge (whitish appearance), (Fukazawa, *et al.*, 2019) [1].

From the point of view of Physiotherapy, there are various electrophysical agents that have shown positive effects on healing and the eradication of fungi. Phototherapy systems using wavelengths close to violet/blue can have positive responses in this area (Pinto, *et al.*, 2017) [2]. The present study reports an effective strategy, which opens new avenues for the treatment of this public health problem. Conventional methods of laser light emission (LLLT)/LED) are based on biphasic response demonstrated many times in LLLT research and as with other forms of drugs, LLLT has its active ingredients or "drug" (irradiation parameters) and a "dose" (the irradiation time) and the "Arndt-Schulz Law" is often cited as a suitable model to describe the dose-dependent effects of LLLT (Chung, *et al.*, 2012) [3]; (Huang, *et al.*, 2011) [4].

The scar acceleration method (MAC®): The method is based on clinical sovereignty with accurate diagnostic instruments for tissue assessment of open wounds and tissue injuries in need of repair (tegumentary tissue, striated skeletal muscle, bone and cartilage). The MAC® method uses photodynamic therapy with the use of photopharmaceuticals, cellular markers and the use of correct parameters for each case inducing the acceleration of tissue repair. Photodynamic therapy (PDT) is a photochemical that uses light to activate specific chemicals that, in the activated state, confer cytotoxicity (Pinto, *et al.*, 2020) [5]. It involves three main components: a photosensitizer, a light source, and tissue oxygen. When the components are combined, they become toxic to the target cells (Hernandez, 1996) [6]; (Pinto, *et al.*, 2023) [7]. The correct light emission parameters need to be appropriate to excite the photosensitizer and produce reactive oxygen species "ROS" and accelerate ATP production (Hurme, *et al.*, 1991) [8] (Pinto, 2011) [9]. For this, MAC® uses doping in two treatment modalities Monodoses and Doses. Therefore, it is necessary to evaluate the type of tissue, taking into consideration its density, redox states, severity and depth of the tissue injury, and type of microorganism that may be colonizing the tissue.

Another important factor is the qualitative measurement of the basal temperature of the skin, where tissues with higher temperature and/or irradiance require less dosimetry and tissues with lower irradiance require higher dosimetry. Monodoses are subdoses. It is used time fold over time, fractioning the time in each wavelength. This doubling of time can increase or decrease depending on the time of the comorbidities (chronic or acute), the characteristics of the injury, the objective of the treatment, and the clinical evaluation. Dosimetry is increased or decreased depending on each case. Doses are fixed time folds at each wavelength. The dose is medialized. It is most often used in organisms where metabolism is high upon clinical evaluation.

2. Objective

Inhibit the accelerated growth of the fungus and improve the patient's symptomatology.

3. Methods

The present case shows a 32-year-old female patient, diagnosed with "Candidiasis" four and a half years ago, presenting itching, pain and burning in the vulvar, vestibular and anal areas. During this period, she underwent several treatments, including the use of vaginal ovuli, topical creams and fluconazole, however, always after three months she reported a recurrence of symptoms and an increase in symptoms 15 days before her menstrual period. At the evaluation, itching was recorded 8/10 (vestibule and vulvar fork), 6/10 (anal) in addition to lack of tissue elasticity and lubrication, associated with Candida proliferation. Eighteen sessions were performed (every other day) using a photoactivated component (Methylene blue 1% + Clotrimazole 1%) and LED phototherapy (red, blue and violet) with emission times of 60 - 260 seconds for each applicator, according to the dose recommendations of the scar acceleration method (MAC®).

3.1. Laser Physics X MAC® Analysis

Spatio-temporal control over the intensity of a laser/LED pulse has the potential to enable or revolutionize a wide range of laser-based applications. Currently, laser applications suffer from little flexibility by conventional optics that provides little or no control over the trajectory of the peak intensity (Simpson, *et al.*, 2020) [10]. Conventional optics relies only on spatial formation, for example by refraction or diffraction, which severely restricts its flexibility (Simpson, *et al.*, 2020) [10]. Most of the time, the laser beam assumes a Gaussian shape (from a normal distribution). This makes it more difficult to determine the exact irradiance (W/cm^2) at any point in the beam. There is peak irradiance, and the irradiance decreases with distance from the center of the beam. As the power is increased, the irradiance at the tail of the Gaussian profile increases and the distance of the critical limit from the beam center becomes larger. At any value of z, the intensity of the Gaussian beam is a function of the radial distance. The Gaus-

sian function has its largest value on the z-axis, with = 0, and slowly decreases with increasing. The width W(z) of a Gaussian distribution increases with axial distance z (Welsh, *et al.*, 1989) [11]. More recent spatiotemporal pulse modeling schemes, called "self-flying focus" techniques, can produce symmetric cylindrical intensity peaks that propagate at any velocity over distances much greater than a Rayleigh band. When temporal pulse modeling is combined with the self-flying focus model, the collapse point can move at an arbitrary constant velocity through the collapse region. produces an arbitrary trajectory intensity peak that can be sustained for distances comparable to the focal length. The technique combines temporal pulse modeling and the inherent nonlinearity of a medium to customize the time and place at which each temporal slice within the pulse reaches its focus. With the doubling of time over time the parabolic profile of the wave amplitude begins to change tending to maintain and control the velocity of the laser/LED peak irradiance, controlling the divergence of the beam over a long distance, increasing and concentrating power and the therapeutic window without declining, **Figure 1**. (Pinto, *et al.*, 2021) [12].

$$\frac{P(t)}{P_C} = \left[\left(\frac{w_i}{w_f}\right)\left(\frac{1}{z_c(t)/f} - 1\right)\right]^2 + 1$$

The above equation expresses the laser power in the ratio of $P(t)/P(c)$, where w_f is a linear focal point. The t represents time with the pulse. And this is different when the time slice collapses. That is, by performing the integration of $z_c(t)$ and rearranging the terms, we raise the equation to another dimension,

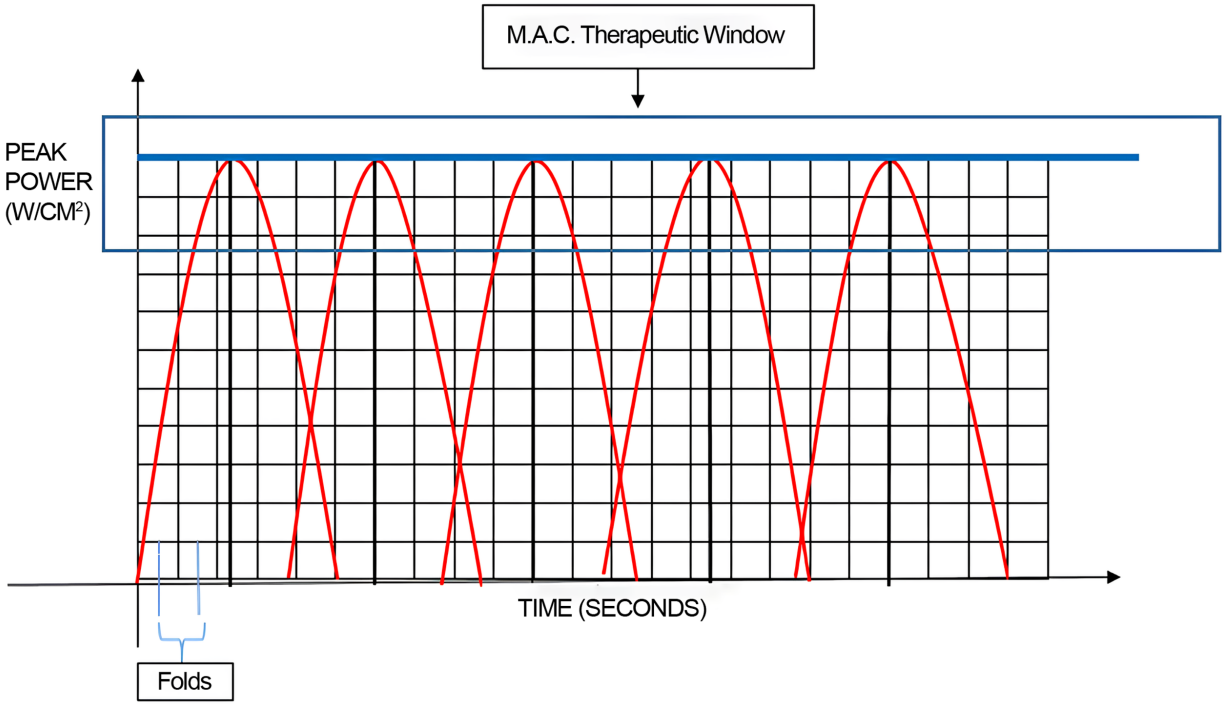


Figure 1. Graphic scheme of the folds in space-time keeping control of the peak laser/LED power velocity keeping a constant therapeutic window.

and this provides a reduction in the speed of the peak power. The MAC® method resembles the technique for spatiotemporal control; the "self-flying focus".

4. Results

Graph 1 displays the evolution of the treatment, using the MAC® method, assessed through the Visual Analog Scale (VAS) for Itching, across three distinct areas: vulva, vestibule, and anal zone.

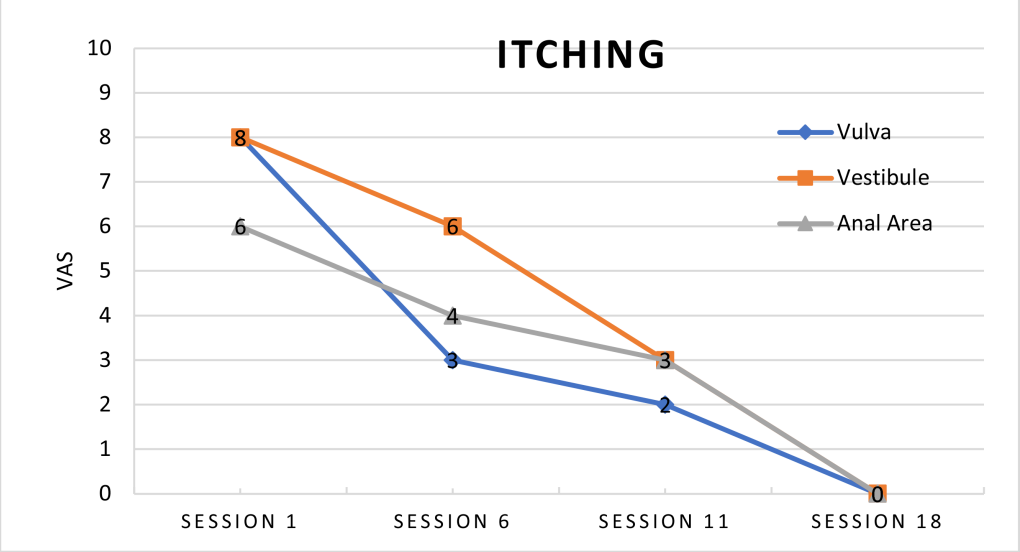
We can observe that in "Session 1", itch levels are high in all three areas, indicating significant pain or discomfort at the beginning of treatment. As the treatment sessions progress (Session 6, Session 11 and Session 18), there is a noticeable decrease in itching for each area, suggesting improvement in symptoms or a reduction in the patient's perception of symptoms.

In particular, the line representing the "Vulva" starts at a value of 9 and decreases to 2. The "Vestibule" line begins at 8 and ends at 1. The "Anal Zone" starts with a lower value of 6 and finishes at 0.

The overall trend indicates that the treatment is effective in reducing the symptoms or pain associated with candidiasis in the treated areas.

Figure 2 illustrates the before and after effects of treating candidiasis in the vulvar and vestibular regions, as well as in the anal area of the patient, using the MAC® method. In the "Before" photograph, both areas display an inflamed and irritated appearance, with tissue compromised by fungal infection, as evidenced by altered coloration and texture. These signs are indicative of Candida infections, which are known to provoke symptoms such as redness, swelling, and pain.

Following the treatment, the "After" image in both areas reveals a significant reduction in inflammation and irritation. The skin now appears to exhibit a



Graph 1. Intensity of the symptom (itching) in the patient studied: VAS: Visual Analog Scale, session 1: beginning of the protocol, session 6: six days in treatment, session 11: 11 days in treatment, session 18: At the end of treatment.

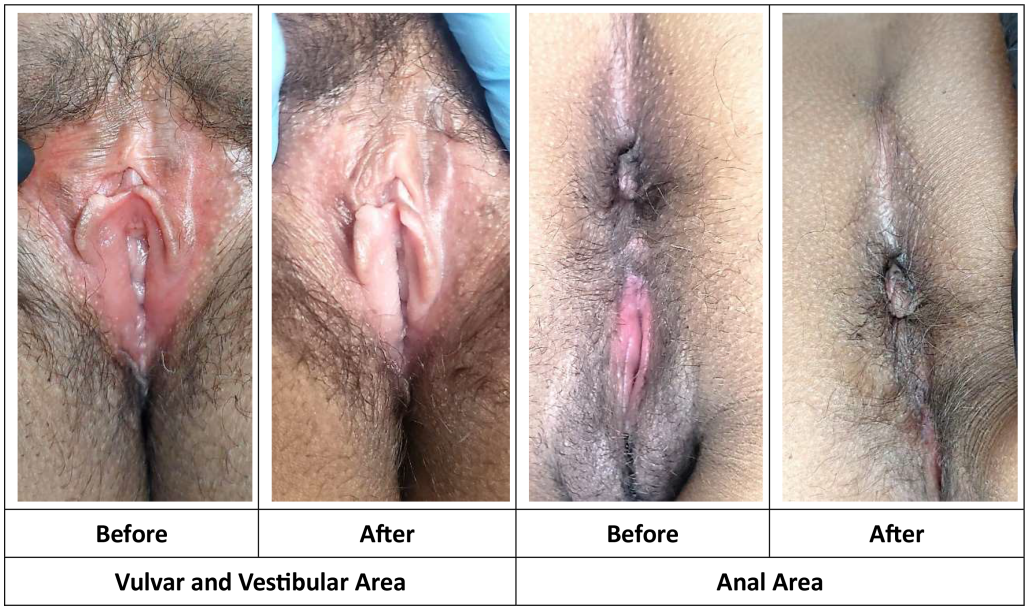


Figure 2. Vulvar and vestibular regions and anal area before and after treatment with MAC® scar acceleration method.

more normal texture and healthier coloration, presenting a more uniform and less irritated appearance, which signifies a decrease in the symptoms of candidiasis. This visual evidence indicates a positive response to the treatment, demonstrating a clear improvement in symptoms and the overall condition of the treated areas.

5. Conclusions

The present case demonstrates new methodologies to treat common problems in the population that have a positive impact on quality of life.

The treatment of candida in the vulvovaginal area is complex, however, this methodology is safe, painless and quick to implement.

Although we present a case, we have a larger casuistry with similar results. This methodology has a promising future because it is non-invasive and requires great biological transformation for inflammatory, fungal and viral control. In this methodology, the rapid control of the symptomatology ensures that we continue to research with a higher number followed by a follow-up of at least 6 months.

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Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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