



Fractionated CO₂ laser treatment for pearly penile papules: evaluation of clinical results and sexual health quality of life improvements

Fabián Pérez Rivera¹

Received: 22 May 2020 / Accepted: 13 July 2020
© Springer-Verlag GmbH Germany, part of Springer Nature 2020

Abstract

Background Pearly penile papules (PPP) are acral angiofibromas. They are asymptomatic, benign, non-infectious lesions located on male genitalia. Although asymptomatic and non-infectious, PPP can be a source of significant psychological distress to the patient and his sexual partner with a significant alteration in the patient's sexual concern.

Methods All PPP male patients who received fractionated CO₂ laser treatment between April 2017 and December 2019 were included in this study. All patients completed a self-administered survey between 3 and 12 months after treatment that evaluated changes in their sexual health quality of life (SHQL). This survey asked the respondents about previous medical consultations and proposed solutions, circumcision status, stories about embarrassing situations related to PPP, how PPP affected their sexual health, and how the fractionated CO₂ laser treatment impacted their sexual health.

Results A total of 20 male patients aged 18–54 years old (average: 29 years old) that had been diagnosed with PPP were treated using a fractionated CO₂ laser. A complete clearance of PPP was achieved in all cases with minimal complications and discomfort. Overall, 70% of the enrolled patients indicated they had suffered, at least once in their life, an embarrassing sexual situation due to their PPP and 60% of them rated the way that PPP altered their SHQL as very important to extremely important. Eighty percent of patients had previously consulted with another physician. In 75% of the cases, the answer from the physicians was that PPP are benign and non-treatable lesions. Ninety percent of the patients evaluated the level of improvement in their SHQL as successful: 45% as extremely successful, 45% as very successful, and only 10% reported poor results.

Conclusions Fractionated CO₂ laser treatment has demonstrated to be a safe and effective PPP treatment. PPP significantly alters young male SHQL and deserves medical treatment. The majorities of physicians minimize the psychological effects and impact of PPP in this population and are not aware of available PPP treatments.

Level of evidence: Level IV, therapeutic study.

Keywords Pearly penile improvement · Sexual health quality of life · Fractionated CO₂ laser treatment

Introduction

Pearly penile papules (PPP) are acral angiofibromas. They are asymptomatic, benign, non-infectious lesions located on male genitalia [1] (Fig. 1). These lesions were first described by Litre and Morgani in 1700 and termed PPP by Johnson and

Baxter in 1964 [2]. PPP appear predominantly as numerous small lesions 0.5–2 mm in diameter. They are dome-shaped, pearly white or pink-white papules located around the corona of the glans penis. They frequently occur in two or three rows around the corona of the glans penis and the frenulum [3]. The incidence appears to be highest during the second and third decades of life, and then decreases with age. It is estimated that PPP affects around 15–48% of men between the ages of 20 and 30 [3–8]. The risk of developing PPP is higher in Negroid patients and patients who have not been circumcised [3]. There is a lower expected incidence of PPP in circumcised patients and those over 50 years of age due to increased exposure to normal friction and abrasive forces over time [2].

✉ Fabián Pérez Rivera
fabian@perezrivera.com.ar

¹ Cirugía & Laser Dr. Pérez Rivera, Buenos Aires, Argentina



Fig. 1 Glans penis corona with a typical PPP presentation

Therapies for PPP include cryosurgery, electrodesiccation, curettage, shave excision, Er:YAG laser, pulsed dye laser, non-ablative fractionated 1550 nm laser, non-fractionated CO₂ laser ablation, and fractionated CO₂ laser ablation treatments [9–14]. The first mention of successful PPP treatment using a CO₂ laser was in 1989 by Magrid and Garden [8]. Since then, numerous authors have published CO₂ laser PPP treatments, especially using a fractionated CO₂ laser [3, 5, 7, 8, 11, 14, 15].

The aim of this study is to demonstrate how fractionated CO₂ laser PPP treatment improves PPP and how this condition affects sexual health quality of life SHQL in young males.

Material and methods

All PPP male patients who received fractionated CO₂ laser treatment between April 2017 and December 2019 were included in this study. All patients were treated using a

fractionated CO₂ laser (iPixel CO₂, Alma Lasers) with a surgical handpiece. The parameters used were a 10-watt, repeat wave laser with a 100 ms on-time and 100 ms off-time for the non-focalized beam. Twenty to 30 min before the treatment, an anesthetic cream (lidocaine 7%, tetracaine 7%) was applied over the PPP. Cold air refrigeration at 4 °C (Cryo 6, Zimmer) was utilized during the treatment. The treatment consisted of one or two sessions with 3 or 4 weeks between each session. When the fractionated CO₂ laser was trained on the PPP, the laser focus was positioned 5 cm from the penis surface to generate a non-focused laser beam that enabled photoablation and photocoagulation effects instead of a cut effect. The end point of the treatment was when scabs appeared over any PPP (Fig. 2). All patients were instructed to apply Vaseline to the scabs after treatment. They were instructed to return to regular life immediately, but they needed to avoid sports, sexual activity, and masturbation for 7–10 days. The patients were warned about the possibility of residual PPP, in which case a second treatment was performed 3–4 weeks after the first session.

All patients completed a self-administered survey between 3 and 12 months after treatment that evaluated changes in their SHQL. The survey was a self-created, non-validated questionnaire about the patient's PPP experience. This survey asked the respondents about previous medical consultations and proposed solutions, circumcision status, stories about embarrassing situations related to PPP, how PPP affected their sexual health, and how the fractionated CO₂ laser treatment impacted their sexual health. Respondents were also asked about treatment-related pain and complications. As this was a retrospective survey, formal consent from a local ethics committee was not sought.

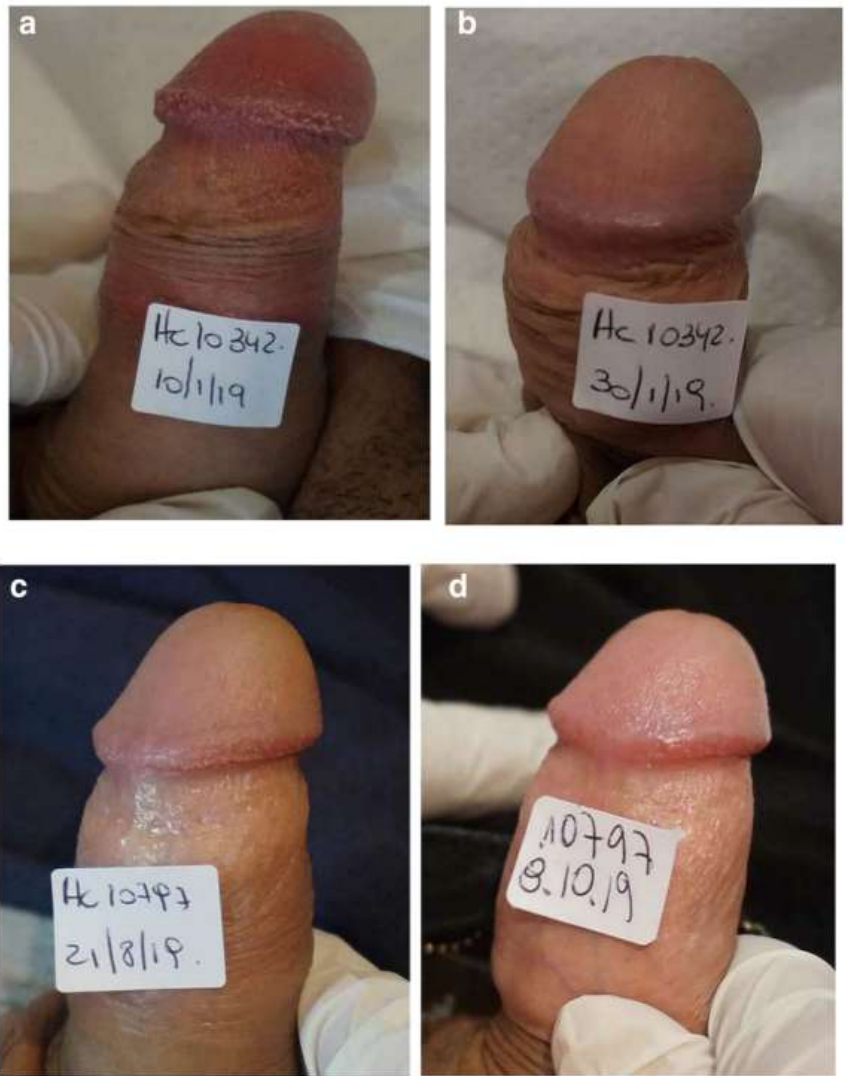
A continuous grading scale from 1 to 10 was used to measure the following questions:

- a) How has your SHQL been affected by PPP?

Fig. 2 PPP fractionated CO₂ laser treatment. Anesthetic cream is applied 20–30 min before treatment and 4 °C cold air is used during the session. The laser handpiece is placed 5-cm distance from penis surface to allow a non-focused laser beam



Fig. 3 **a, b** 23 years old. PPP male patient B and A 20 days after treatment. **c, d** 29 years old. PPP male patient B and A 48 days after treatment



- 1 to 3: mild/4 to 6: moderate/7 to 9: severe/10: extreme. c) How painful was the treatment?
 1 to 3: mild/4 to 6: moderate/7 to 9: severe/10: intolerable.
 b) Describe your SHQL improvement after PPP treatment.
 1 to 3: poor/4 to 6: moderate/7 to 9: high/10: extreme.

Table 1 Story of previous appointments

Previous Medical Appointment	
Medical Specialty	Number / Percentage
No Previous Appointment	5 (25%)
Clinical Dr.	1 (5%)
Dermatologist	1 (5%)
Urologist	6 (30%)
Urologist + Dermatologist	4 (20%)
Urologist + Clinical Dr.	3 (15%)
	} Urologist: 65%

Results

A total of 20 male patients aged 18–54 years old (average: 29 years old) that had been diagnosed with PPP were treated using a fractionated CO₂ laser. A complete clearance of PPP was achieved in all cases with minimal complications and discomfort. Fourteen cases required two sessions and the remaining six cases only required one session (Fig. 3).

All patients completed the survey and were included in this study. Ninety percent of the patients were not circumcised. Seventy-five percent of the patients had previous physician consultations pertaining to PPP (urologist, dermatologist, and/or a generalist). Thirteen patients had specifically consulted urologists (Table 1).

When inquired about PPP solutions offered by physicians, 75% of the respondents expressed that they were told that PPP are a benign lesion that do not require treatment. In only two cases (10%), the consulting physicians recognized the condition and offered a treatment as a solution. When asked about how PPP affected their SHQL, 60% of patients answered that they were severely or extremely affected, while only 10% answered that they were mildly affected (Fig. 4).

A large number of respondents (70%) reported at least one embarrassing sexual situation resulting from PPP at least once in their lifetime. For the majority of patients, 18 cases (90%) reported an extreme (45%) or high (45%) improvement in SHQL after treatment, while only two patients (10%) rated their SHQL improvement as poor (Fig. 5).

Treatment-related pain was rated as tolerable, mild, or moderate by 80% of patients (Fig. 6). Seventy

percent of patients did not report any post-treatment side-effects. The remaining patients (6 cases) mentioned minor bleeding, minor discomfort, or transitory hypopigmented lesions. Only one case reported pain during recovery.

Discussion

PPP are asymptomatic, benign, non-infectious lesions that cause significant psychological and cosmetics concerns. PPP often prompt patients to seek therapeutic removal of these lesions. Despite the benign nature of these lesions, many patients feel anxious or humiliated by PPP. Sonnex and Dockerty (1999) analyzed data from 200 male patients evaluated at the Department of Genitourinary Medicine, Addenbrooke's Hospital Cambridge, UK, and documented a PPP prevalence of 48%. One-third of these patients demonstrated a concern regarding PPP, and one-quarter had experienced embarrassment because of these lesions [4].

Ninety percent of our patients were not circumcised, which is in accordance with the literature. In a large study of 3515 English-speaking adults in the USA recruited through an online panel, Flynn et al. (2016) highlighted the importance of sexual health and satisfaction with one's sex life for many participants. The worse a patient feels about his SHQL, the worse his sex life will be [16]. Likewise, it can be concluded that the better a patient feels about his SHQL, the better his sex life will be. In 90% of the cases examined in our study,

Fig. 4 Pre-treatment SHQL rates affected by PPP

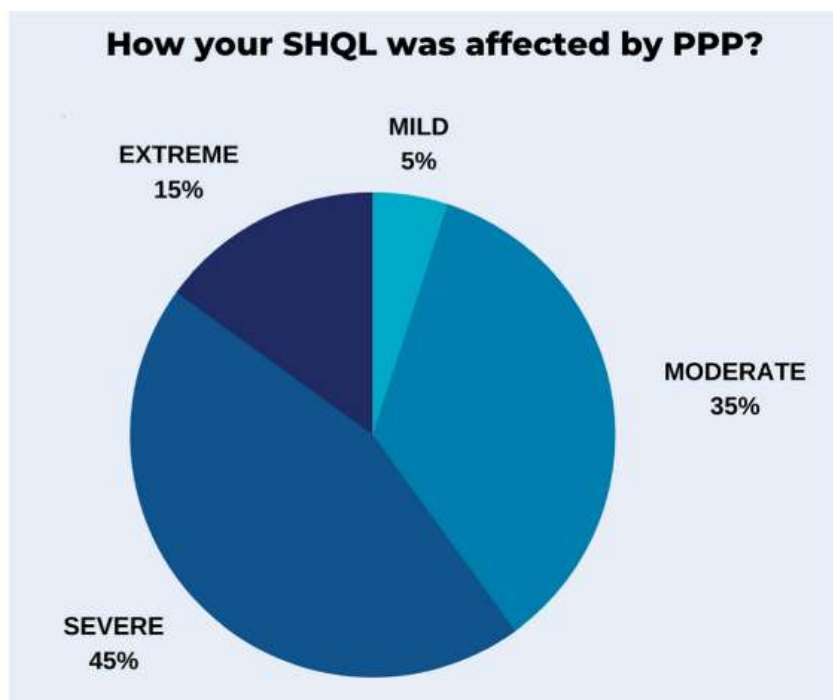
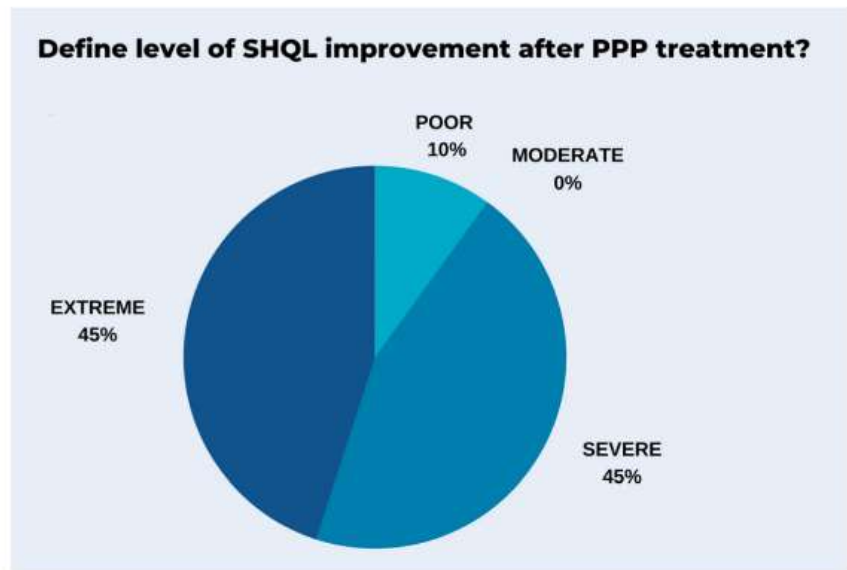


Fig. 5 SHQL improvement scale after PPP treatment



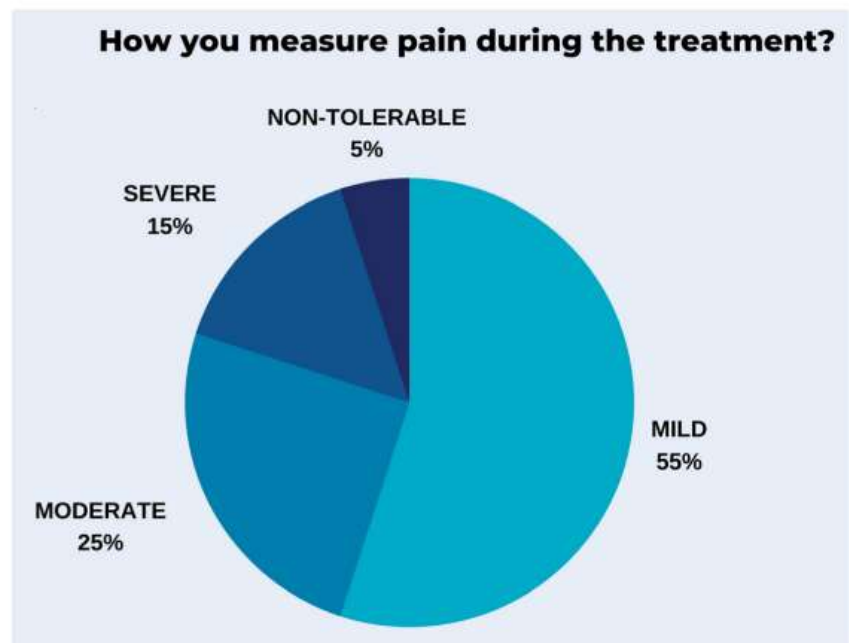
patients reported that their sexual lives had greatly or extremely improved after PPP laser treatment.

Adolescents with PPP are often concerned that they have acquired a sexually transmitted infection or fear that the papules are a physical consequence of masturbation [5]. These concerns coupled with the high level of sexual activity expected of the patients enrolled in the study (average age: 29 years) likely contributed to the high level of concern patients expressed in this study regarding their SQHL and the number of embarrassing sexual situations due to PPP (rated as great or extreme in 60% of the cases). Seventy percent of patients reported an embarrassing sexual situation due PPP at least once in their lives prior to treatment.

Although laser therapy for lower genital tract lesions in women is well-established in the medical literature [17, 18], this survey reveals that this treatment option for PPP is not popular among physicians encountering this condition in the clinic. It is surprising that the majority of medical doctors still believe PPP does not require treatment. In fact, 75% of the respondents in this study had previous physician consults for PPP and were frequently told that PPP is a benign lesion without any treatment options.

While various types of lasers have been used for PPP therapies [9–13], the fractionated CO₂ laser is preferred when treating these types of cutaneous tumors due to its ability to ablate textural defects. Thermal injury is limited to the epidermis and dermis, where the target chromophore (water) resides.

Fig. 6 Treatment pain scale



Thus, when the fractionated CO₂ laser beam is non-focused 5 cm from the penis surface, PPP ablation can be achieved with precise hemostasis and bleeding control without scarring or permanent injury.

The average numbers of sessions and follow-ups (3–12 months) reported in this study are in accordance with those established in previous reports [5, 7, 8, 11]. We used repeat-pulsed fractionated CO₂ laser exposure (100 ms on-time, 100 ms off-time) instead of a short-pulsed exposure to achieve better ablation and photocoagulation. McKinlay (1999) [11] discovered that treatment of lesions with vessel diameters greater than 100 μm (biopsies of PPP typically show vessel diameters as large as 200 μm) results in a tendency for bleeding with short laser exposures.

Following Lane et al.'s (2002) recommendations [7], we propose that a non-focused fractionated CO₂ laser beam positioned from 5 cm from penis surface is an effective treatment for PPP. With this method, one can obtain ablation with precise hemostasis and bleeding control. This was evident in our study, with only two cases of bleeding during the procedure and no cases of scarring or permanent injury. Treatment pain was scored as mild or tolerable in 80% of cases. The only anesthetic treatment involved applying an anesthetic cream before treatment and cold air during the treatment as previously reported [4–11].

One of the limitations of this study was the use of a non-validated questionnaire. Further studies to confirm these results will employ validated instruments for measuring SQHL in PPP patients.

Conclusions

Fractionated CO₂ laser treatment has been demonstrated to be a safe and effective PPP treatment. PPP significantly reduces young male SHQL and deserves medical treatment. The majorities of physicians minimize the impact of the psychological effects of PPP in this population and are not aware of available PPP treatments.

Compliance with ethical standards

Conflict of interest Fabián Pérez Rivera declares that he has no conflict of interest.

Ethical approval All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki Declaration and its later amendments or comparable ethical standards. For this kind of retrospective observational study no ethical approval is required.

Informed consent Informed consent was obtained from all individual participants included in the study.

Patient consent Patients signed informed consent regarding publishing their data and photographs.

References

- O' Neil CA, Hansen RC (1995) Pearly penile papules on the shaft. *Arch Dermatol* 131:491–492
- Maranda EL, Akintilo L, Hundley K, Nguyen AH, Moore KJ, Zullo J, Jimenez JJ (2017) Laser therapy for the treatment of pearly penile papules. *Lasers Med Sci* 32(1):243–248
- Deda A et al (2019) CO₂ laser treatment for pearly penile papules - personal experience. *J Cosmet Laser Ther* 21(3):152–157
- Sonnex C, Dockerty WG (1999) Pearly penile papules: a common cause of concern. *Int J STD AIDS* 10:726–727
- Krakowski AC, Feldstein S, Shumaker PR (2015) Successful treatment of pearly penile papules with carbon dioxide laser resurfacing after local anesthesia in an adolescent patient. *Pediatr Dermatol* 32(3):433–435
- Leung A, Barankin B (2014) Pearly penile papules. *J Pediatr* 165(2):409
- Lane JE, Peterson CM, Ratz JL (2015) Treatment of pearly penile papules with CO₂ laser. *Pediatr Dermatol* 32(3):433–435
- Magid M, Garden JM (1989) Pearly penile papules: treatment with carbon dioxide laser. *J Dermatol Surg Oncol* 15(5):552–554
- Baumgartner J (2012) Erbium: yttrium-aluminium-garnet (Er: YAG) laser treatment of penile pearly papules. *J Cosmet Laser Ther* 14(3):155–158
- Porter WM, Bunker CM (2000) Treatment of pearly penile papules with cryotherapy. *Br J Dermatol* 142(4):847–848
- McKinlay JR, Graham BS, Ross VE (1999) The clinical superiority of continuous exposure versus short-pulsed carbon dioxide laser exposures for the treatment of pearly penile papules. *Dermatol Surg* 25(2):124–126
- Ocampo-Candiani J, Cueva-Rodriguez JA (1996) Cryosurgical treatment of pearly penile papules. *J Am Acad Dermatol* 35:486–487
- Sapra P, Sapra S, Singh A (2013) Pearly penile papules effective therapy with pulsed dye laser. *JAMA Dermatol* 149(6):748–750
- Gan SD, Graber EM (2015) Treatment of pearly penile papules with fractionated CO₂ laser. *J Clin Aesthet Dermatol* 8(5):50–52
- Rokhsar CK, Ilyas H (2008) Fractional resurfacing for the treatment of pearly penile papules. *Dermatol Surg* 34(10):1420–1422
- Flynn K et al (2016) Sexual satisfaction and the importance of sexual health to quality of life throughout the life course of US adults. *J Sex Med* 13(11):1642–1650
- Qureshi AA, Tenenbaum MM, Myckatyn TM (2018) Nonsurgical vulvovaginal rejuvenation with radiofrequency and laser devices: a literature review and comprehensive update for aesthetic surgeons. *Aesthet Surg J* 38(3):302–311
- Jomah J, Bahi AW, Mousa KP, el-Saharty A, Neyazi SM (2019) Treatment of vaginal relaxation syndrome with an Erbium:YAG laser 360° scanning scope via automatic dual mode technique. *Eur J Plast Surg* 42:169–176

Publisher's note Springer Nature remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.