

Minimal Invasive Laser Treatment for Female Stress Urinary Incontinence

Research Article

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Abstract

Objectives: Stress urinary incontinence (SUI) is common health problem and affects quality of life. This study was designed to evaluate minimal invasive laser as treatment option for female SUI.

Patients and methods: Fifty (50) women with SUI were included in this study which was conducted over one year. A specially designed laser speculum was introduced into women's vagina to serve as a guide for insertion of hand piece for irradiation of anterior vaginal wall. Second phase of the IncontiLase™ procedure was performed on the vestibule and introitus. Preoperative and 6 months post-operative urodynamic studies were done for all studied women.

Results: Average flow rate was significantly improved from 3 ml/second before treatment to 11 ml/second after laser treatment and voiding time was also significantly improved from 9 seconds before treatment to 24 seconds after treatment. Residual urine volume was significantly increased from 17 ml before treatment to 38 ml after treatment, and first sensation was also significantly increased from 54 ml before treatment to 122 ml after treatment. First desire was significantly increased from 75 ml before treatment to 180 ml after treatment and strong desire was also significantly increased from 150 ml before treatment to 250 ml after treatment. Maximal urethral closure pressure was significantly increased from 16 cm H₂O before treatment to 34 cm H₂O after treatment.

Conclusion: Minimal invasive laser is outpatient procedure, has the advantage of improving of SUI symptoms without any possible complications as bladder perforation or hematoma. Also, it improves vaginal mucosa tone, regenerates collagen and collagen regains its power to contract with subsequent stabilization of bladder neck.

Keywords: Laser; Stress urinary incontinence; Urodynamic assessment

Abbreviations: SUI: Stress Urinary Incontinence; CMC: Consultation Medical Clinic; TVTO: Trans-Obturator Tape; TVT: Trans-Vaginal Free Tape

Introduction

Stress Urinary Incontinence (SUI) is leakage of urine when abdominal pressure increased during; sneezing, coughing, physical exercise, lifting, bending and even changing positions [1]. Two principal causes of urine leak during increased abdominal pressure; SUI and stress-induced detrusor over activity, which involves involuntary detrusor contractions when abdominal pressure increased [2]. SUI has negative impact on patient's quality of life; affecting day to day activities, participation in sports and sexual activity. Consequently, it is important for the healthcare provider to discuss these issues with the patient to determine how bothered she is by SUI and to dispel some common myths associated with SUI [3]. There are many treatment options and the healthcare provider should have deep conversation with the patients to counsel them about various treatment options, outcomes and possible risks [4]. There are many possible nonsurgical and surgical therapies for SUI [5]. Initial treatment should include nonsurgical behavioral changes and pelvic floor muscle exercises. Electrical stimulation, weighted vaginal cones and drug therapy may reduce SUI. Bulking agents reduce leakage,

but effectiveness generally decreases after 1-2 years [6]. Surgical procedures are more likely to cure stress urinary incontinence than nonsurgical procedures but are associated with complications and prolonged hospital stay. Many women with SUI do not seek care for their condition because of embarrassment, lack of knowledge about possible treatments or fear that treatment will require surgery [7]. Several studies have shown that if less invasive treatments become more available, more patients may be willing to seek care without fear of surgery [4]. Many researchers are therefore searching for a minimally invasive treatment that offers good efficacy, safety and a short recovery period [8]. The effects of lasers are well established in terms of biochemical, ablative and thermal effects. Thermal energy from the laser source, especially in moist environments, enhances collagen structure and stimulates neocollagenesis [9]. As a result of laser irradiation the intermolecular cross links of the triple helix of collagen shorten, which leads to the immediate tightening of collagen fibrils by two thirds of their length in comparison to the pre intervention state. Previous experimental and clinical studies have shown significant effects of laser treatment in various conditions deriving from collagen damage [5]. IncontiLase™ is minimally invasive laser techniques that enable collagen remodeling with subsequent improvement of SUI symptoms and pelvic floor muscle strength and quality of life [10,11]. This study was designed to evaluate

minimal invasive laser as treatment option for female SUI.

Patients and Methods

Fifty (50) women with SUI were included in this prospective cohort study which was conducted over one year from May 2013 to May 2014 in Consultation Medical Clinic (CMC), Aljahra hospital, Kuwait after informed consent and approval of the study by institute ethical committee. SUI was diagnosed by patients' symptoms, urine analysis and urodynamic studies. The urodynamic assessment include; uro-flowmetry, both filling (at a rate of 60 ml/min of 35°C distilled water), voiding cystometry when bladder filled with amount of distilled water and stress urethral pressure profile through withdrawal of dual lumen fluid-filled catheter, connecting to the external transducers at rate of 0.5 mm/second when patient's strong-desire from filled bladder occurs.

Women with urinary tract infection, urge incontinence, mixed incontinence, neuropathic diseases or pelvic muscle diseases, pregnant women or women with over 70 years, severe stress urinary incontinence, advanced genital prolapse, intake of photosensitive drugs and injury and/or active infection in treatment area were excluded from this study. Menstruating women, pregnant women or women with undiagnosed uterine bleeding were also excluded from this study.

A specially designed laser speculum was introduced into women's vagina to serve as a guide for insertion of hand piece with an angular adapter which enables a precise irradiation of anterior vaginal wall. The second phase of the IncontiLase™ procedure is performed on the vestibule and introits area. Preoperative and 6 months postoperative urodynamic studies were done for all studied women. Validated questionnaires of the International Consultation on Incontinence (Short-Arabic Form) and quality of life were filled by all studied women. Pre-treatment and 6 months post-treatment data were collected and statistically analyzed. No additional therapy was given to all studied women during laser treatment and 6 months after.

The IncontiLase™ procedure treatment consisted of two phases; during first phase, before laser treatment, patient's vagina (vestibule, introitus and vaginal canal) was thoroughly washed by antiseptic solution and dried to remove antiseptic solution and mucus. A specially designed laser speculum was introduced into women's vagina (Figure 1) to serve as a guide for insertion of hand piece with an angular adapter which enables a precise irradiation of the anterior vaginal wall through delivery of a fractional Er: YAG laser beam (Figure 2). Laser energy is applied along anterior vaginal wall in several longitudinal passes, deposited successively along vaginal canal without overlapping, by simple step by step withdrawal of laser hand piece outwards from the laser speculum. Laser energy of delivered to each irradiation location according to manufacturer's instructions (Fotona, Slovenia), (Figure 3), producing thermal effect on the mucosa tissue and endo-pelvic fascia of vaginal wall that causes shrinkage of collagen of vaginal mucosa [12].

Second phase of the IncontiLase™ procedure is performed on the vestibule and introitus (Figure 4) area using a straight shooting fractional laser hand piece. The whole area has to be thoroughly covered with laser energy to achieve sufficient level of thermal impact on collagen of the treated mucosa. During the procedure women's discomfort and treatment tolerability, as well

as potential adverse events were monitored. No anesthesia was used during laser procedure.



Figure 1: Vaginal speculum.



Figure 2: Adapter which enables a precise irradiation of the anterior vaginal.



Figure 3: Fotona laser delivery machine.



Figure 4: Second phase of the IncontiLaseTM procedure which performed on vestibule and introitus (hand piece R11 and PS0₃).

Results

IncontiLaseTM procedures were successfully completed as outpatient procedure with 36 minutes average treatment time and more than 50% of studied women experienced no pain during treatment while 50% experienced mild pain. All studied women returned immediately after laser treatment to routine normal daily activity.

Average flow rate was significantly improved from 3 ml/second before treatment to 11 ml/second after laser treatment and voiding time was also significantly improved from 9 seconds before treatment to 24 seconds after laser treatment (Table 1). Residual urine volume was significantly increased from 17 ml before treatment to 38 ml after laser treatment, and first sensation was also significantly increased from 54 ml before treatment to 122 ml after treatment. First desire was significantly increased from 75 ml before treatment to 180 ml after treatment and strong desire was also significantly increased from 150 ml before treatment to 250 ml after laser treatment (Table 2). Maximal urethral closure pressure was significantly increased from 16 cm H₂O before treatment to 34 cm H₂O after laser treatment (Table 3).

Table 1: Uroflowmetry parameters 6 months after laser treatment compared with pretreatment parameters.

Uro-Flowmetry Parameters	6 Months After Laser Treatment	Before Treatment	P Value, Significance, Test Used for Statistical Analysis
Qavr (ml/second)	11	3	P = 0.03 (<0.5), Significant, X ² test
Qmax (ml/second)	19	11	P = 0.2 (>0.5), Non-significant, X ² test
Voiding Time (seconds)	24	9	P = 0.02 <0.5, Significant, X ² test
Voided Volume (ml)	156	33	p= 0 (>0.5), Non-significant, X ² test

Qavr: Average Flow Rate; Qmax: Maximum Flow Rate; X²: Chi-square test

Table 2: Cystometry parameters 6 months after laser treatment compared with pretreatment parameters.

Cystometry Parameters	6 Months After Laser Treatment	Before Treatment	P Value, Significance, Test Used for Statistical Analysis
Residual Urine (ml)	38	17	P = 0.02 (<0.5), Significant, X ² test
PdetQmax (cm H ₂ O)	24	16	P = 0.2 (>0.5), Non-significant, X ² test
First Sensation (ml)	122	54	p= 0.001 (<0.5), Significant, X ² test
First Desire (ml)	180	75	p= 0.0002 (<0.5), Significant, X ² test
Strong Desire (ml)	250	150	P = 0.02 (<0.5), Significant, X ² test
Urgency (ml)	340	140	p= 0 (>0.5), Non-significant, X ² test

PdetQmax (cm H₂O): Detrusor pressure at maximal flow during voiding cystometry; X²: Chi-square

Table 3: Urethral pressure profile parameters 6 months after laser treatment compared with pretreatment parameters.

Urethral Pressure Profile Parameters	6 Months After Laser Treatment	Before Treatment	P Value, Significance, Test Used for Statistical Analysis
MUP (cm H ₂ O)	32	19	P = 0.1 (>0.5), Non-significant, X ² test
MUCP (cm H ₂ O)	35	16	P = 0.02 (<0.5), Significant, X ² test
FUL (cm)	4	1	P = 0.1 (>0.5), Non-significant, X ² test
CL (cm)	1.76	0.6	P = 0.4 (>0.5), Non-significant, X ² test
UCPA (cm ² H ₂ O)	53	38	P = 0.2 (>0.5), Non-significant, X ² test
CA (cm ² H ₂ O)	26	22	P = 0.6 (>0.5), Non-significant, X ² test

MUP: Maximal Urethral Pressure; MUCP: Maximal Urethral Closure Pressure; FUL: Functional Urethral Length; CL: Continence Length; UCPA: Urethral Closure Pressure Area; CA: Continence Area; X² test: Chi-square test

Discussion

SUI has a hidden effect on patient's psychological aspect and quality of patient's life. Many interventions are used to treat SUI; some of them are simple as bulking agents and pelvic floor exercise with little not long time lasting effect. Surgical interventions as Burch colposuspension, tension free trans-vaginal free tape (TVT) and tension free vaginal trans-obturator tape (TVTO) are effective in SUI treatment with possible surgical complication, exposure to anesthesia and post-operative hospitalization [12]. Surgical treatment of SUI specially TVT and TVTO are costly and needs expert, trained surgeons [13]. Several studies published comparing TVTO procedure with TVT procedure [14]. A meta-analysis published 3 years ago concluded that both procedures had the same subjective cure rate and were associated with a low incidence of bladder perforation, hematoma development and postoperative storage lower urinary tract symptoms [13]. Minimal invasive laser is an outpatient procedure, no need for hospital stay or even hospital admission. Most of patients did not feel pain or discomfort during laser procedure, no risks of anesthesia exposure or blood loss during laser procedure. It is simple technique associated with improvement of pelvic floor muscle tone and improvement of SUI symptoms [15,16].

Minimal invasive laser has the advantage of improving of SUI symptoms without any bladder perforation or hematoma. Also, it improves vaginal mucosa tone, regenerates collagen of the extracellular matrix and collagen regains its power to contract with subsequent stabilization of bladder neck [15,16]. Women refused to participate in this study and small number of studied women were the main limitation faced during this study and further studies include large population number are needed in the future to stabilize definite role of minimal invasive laser in treatment of female SUI.

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