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Diode 980nm Used Interstitial Laser Treatment for Gynecomastia

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Abstract: Background: Gynecomastia involves non-cancerous enlargement of the male breast due to glandular tissue proliferation, affecting 40 to 55% of healthy men. Recent technological advances, particularly compact and dependable diode lasers operating at wavelengths like 810, 915, 940, and 980 nm, have demonstrated promising outcomes as reliable, safe, and effective alternatives to conventional liposuction. Our aim was to assess the therapeutic efficacy of the 980 nm diode interstitial laser in treating gynecomastia.

Methods: This study is a prospective, cross-sectional case series involving 36 patients undergoing laser-assisted liposuction for gynecomastia treatment. The Rohrich system was used to assess the severity of gynecomastia, with the senior author determining the required amount of breast gland to be removed for each patient. Following surgery, patients are assessed in the clinic on the fifth day to evaluate bruising or ecchymosis, and a chest binder is applied. Their next follow-up appointment is scheduled one month later. Patients' photographs are taken on the fifth day post-surgery, and again at one month and six months post-surgery. Postoperative swelling, pain, skin laxity, amount of aspirated blood, and any complications are closely monitored during this period.

Results: Right after surgery, all patients experienced swelling and minor bruising, which generally subsided within 10-14 days following the procedure. Overall, the surgical outcomes were deemed satisfactory in every case. Among the 36 patients, 28 (77.7%) were satisfied with their cosmetic results, while eight (22.3%) expressed dissatisfaction. One patient needed additional liposuction and glandular treatment due to under-correction, and another required corrective measures for skin irregularities. Significant skin tightening was noted in several instances. There were no reports of hematoma, seroma, infections, or other early postoperative complications.

Conclusions: Diode 980nm interstitial laser could effectively treat gynecomastia without postoperative complications.

Keywords: Gynecomastia, Interstitial laser, Diode, laser lipolysis

Introduction: Gynecomastia, a non-cancerous enlargement of the male breast caused by the growth of glandular tissue, is a common condition affecting 40-55% of healthy men [1]. Gynecomastia results from an imbalance between progesterone and estrogen and needs to be differentiated from male breast cancer [2].

Gynecomastia can be classified as fatty, glandular, or mixed. Simon et al. [3] the most widely used clinical classification for gynecomastia was established in 1973. However, new classifications have since been developed to standardize treatment protocols and describe the condition more accurately [4].

Rohrich et al. [6] The classification developed includes: grade I with minimal hypertrophy (less than 250 grams of breast tissue) and no ptosis; grade II with moderate hypertrophy (250 to 500 grams of breast tissue) and no ptosis; grade III with severe hypertrophy (more than 500 grams of breast tissue) and grade I ptosis; and grade IV with severe hypertrophy and grade II or III ptosis. Medical treatment can be effective in the early stages of tissue proliferation. However, over time, the tissue becomes fibrotic and unresponsive to medical therapy [5].

The main goals of surgical procedures should focus on addressing four key aspects: (1) excess skin, (2) excessive breast tissue, (3) abnormal positioning or enlargement of the areola, and (4) histological evaluation in cases where cancer is suspected [7].

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There are various treatment options available, such as straightforward liposuction, basic surgical excision, liposuction combined with surgical excision, and skin removal along with surgical excision [9].

For gynecomastia primarily consisting of fatty tissue, traditional liposuction is the preferred surgical approach [10]. Male breast tissue contains a higher proportion of fibrous tissue, which restricts and hinders the effectiveness of traditional liposuction alone. However, recent reports suggest using a cartilage shaver to remove fibrous tissue effectively.[11]. Power-assisted liposuction and ultrasound-assisted liposuction are used non-thermally to mechanically break down tissue, allowing for easier aspiration with minimal physical effort. The removal of excess skin post-liposuction is crucial for surgical success and achieving aesthetically pleasing natural contours [12].

Laser lipolysis involves applying lasers directly to fat tissue, providing advantages such as quick recovery, high patient tolerance, and notable tissue retraction following the procedure [13].

Ndlaser is employed for laser lipolysis followed by transmammary resection of the remaining mammary gland for treating mixed gynecomastia. This technique has yielded highly satisfactory results with a low rate of complications. [14]. Technological advancements, like diode lasers available in compact, reliable forms at multiple wavelengths such as 810, 915, 940, and 980 nm, show promising results in studies as a

safe, effective, and consistent alternative to traditional liposuction methods [15]. Hence, we aimed to evaluate Diode 980nm interstitial laser effect in the treatment for gynecomastia.

Patients and methods

This study is a prospective, cross-sectional case series involving 36 participants who underwent laser-assisted liposuction for gynecomastia treatment. It was conducted at national institute of laser enhanced sciences Cairo University, Egypt, spanning from September 2022 to March 2024. The clinical study protocol received approval from the Ethics Committee, and all participants provided informed consent for both the study and the surgical procedures.

Preoperative

Patients underwent a thorough assessment, including a detailed medical history, comprehensive physical examination, and routine laboratory tests such as fasting blood sugar, complete blood count (CBC), liver enzymes, creatinine, prothrombin time, and hormonal profiling, to rule out secondary causes of gynecomastia. Participants under 18 years old or over 50 years old, as well as those with a BMI over 40 kg/m^2, were excluded from the study.

The Rohrich system was employed to grade gynecomastia severity, with the senior author determining the necessary amount of breast glandular tissue to be removed for each patient.

Procedure

Patients were positioned upright to assess the proportion of breast tissue in relation to underlying fat. Inflammation folds, breast boundaries, and planned stab-site incisions were marked on each breast. Concentric topographic marks were centered on the most prominent part of each breast. Using a ruler with millimeter markings, squares measuring 10x10 cm were drawn on the patient's skin in a different colored pen for each marked area.

The procedure took place in surgical operating rooms under general anesthesia. Patients received a single dose of broad-spectrum intravenous antibiotics, followed by oral doses twice daily for five days. The first stage of the operation involved injecting a tumescent solution of epinephrine diluted in saline (1:1,000,000). This solution induced vasoconstriction and was administered through a multi-perforated micro-cannula connected to a peristaltic pump. Hydrodissection around the breast disc helped create a plane for laser cannula positioning.

The tumescent solution was infiltrated from the pre-pectoral space to the skin, starting at the anterior axillary line and moving downward through the soft tissue affected by gynecomastia. Approximately 500 to 1500 ml of tumescent solution was required, depending on breast size and the extent of fatty tissue present, to achieve adequate tumescence.

Following up:

After making a single 3-mm stab incision in the anterior axillary line to ensure maximum mobility for the surgeon, a laser cannula is inserted. It is crucial to maintain a tangential angle with the chest wall during this process to avoid penetration or burning of the epidermis. The tip of the cannula is positioned within the breast tissue, and laser treatment is conducted at 15W power in continuous mode (CW) to elevate the temperature of the breast tissue disc. Subsequently, the laser cannula is used to treat the surrounding fatty tissue in deeper and sub-dermal planes around the breast disc.

To ensure uniform distribution of laser energy and optimal tissue temperature elevation in the adipose layer, 5000 joules are delivered for each 10x10 cm square on the skin. This preparation facilitates easier movement of the liposuction cannula through fibrous breast tissue during subsequent procedures. The cannula is moved back and forth within the fat layer parallel to the surface, and after completing 10-15 motions, it is repositioned to the adjacent square area. The total exposure duration and accumulated energy per breast are carefully monitored and recorded During the procedure, careful monitoring of skin temperature ensures that reaching 40ºC indicates effective penetration into the subdermal plane, targeting treatment up to the collagenous layer. After completing the laser treatment on one side, suction begins while maintaining elevated tissue temperature before cooling down. Using a 3-mm cannula, liquefied fat is aspirated following lipolysis. One hand compresses and holds the breast tissue while the other moves the cannula back and forth to create channels in the fibrous tissue. Throughout suction, the surgeon's non-dominant hand monitors contour changes to assess the amount of glandular tissue removal and flap thickness. After suction, they reassess the thickness and consistency of the skin fold around the areola. This procedure effectively removes excess tissue while preserving muscle edge anatomy, resulting in a more sculpted chest contour for the patient.

They meticulously monitor the color and volume of aspirate, classifying it as clear, yellow with minimal blood content, or bloody, to assess surgical outcomes. This bloodless approach is especially beneficial for treating fibrotic male glands prone to bleeding. The study utilized the VELAS™ diode laser device from GIGA Laser, Wuhan, China, operating at a single wavelength of 980 nm with adjustable power settings from 1 to 25 W, capable of emitting laser in continuous wave (CW) or pulsed modes. Additionally, a 600 μm fiberoptic delivers the laser to tissues.

After removing residual fatty tissue, the remaining mammary gland is easily identifiable. A cross-shaped incision is made on the nipple using a microsurgery scalpel with a specially designed handle. Therefore, four well-irrigated triangular flaps are created. These flaps need to be turned outward with traction points to avoid injury during the dissection of the mammary gland. The translucent and pearly glandular tissue, easily identified through the incision, is removed using instruments like the Gillies hook or Halsted forceps. Dissection of the gland begins by applying traction to the hook along the plane connecting it to the subcutaneous tissue. After freeing the glandular tissue, it is divided into smaller sections and extracted through a small incision. Careful maneuvers are crucial to avoid injury to the

areola skin and ensure no devitalized tissue remains in the newly created cavity. To prevent skin retraction and potential adhesion to deeper planes, it is important to maintain sufficient tissue in both the subareolar and prepectoral planes.

After surgery, a chest binder is applied, and patients are examined in the clinic on the fifth day to assess bruising or ecchymosis. Follow-up consultations are scheduled for one month and six months post-surgery, with photographs taken at these intervals.

Postoperative swelling, pain, skin redundancy, aspirate blood content, and any complications are carefully monitored. Patients are instructed to wear the compression garment continuously for the first seven days and then for a total of six weeks, except during bathing.

The fluid used during surgery was a saline solution containing 1 ml of a 1 in 1000 adrenaline solution. Each patient received a self-assessment questionnaire with linear analogue scales ranging from 1 to 10 for four categories. They were asked to rate their surgical outcomes using this questionnairesheet.[16].

Results:

In this study, prior to undergoing liposuction surgery, patients with gynecomastia received interstitial diode 980nm laser treatment to address preoperatively identified adipose breast enlargement with a glandular component. The study involved 36 patients treated over a 24-month period, ranging in age from 19 to 48 years (mean: 31.4±7.8 years, median: 33 years). All patients had bilateral gynecomastia with no significant size difference between both sides. Before liposuction, interstitial laser treatment was administered to 72 breasts. During suction-assisted liposuction, the mean infiltration volume per breast was 250 ml (range: 150-400 ml), and the mean aspiration volume per breast was 280 ml (range: 175-480 ml). The average duration of liposuction per breast was 13 minutes, with a range of 10 to 18 minutes. **Table 1**

Table 1: General and uterine assessment before treatment in the studied patients

		n=36
Age (years)	**Mean**	31.4 ± 7.8
	Range	19 - 48
Site of gynecomastia	**Bilateral**	36 (100%)
No of treated breast		72
infiltration volume per breast (ml)	**Mean**	250
	Range	150 - 400
Aspiration volume per breast	**Mean**	280
	Range	175-480
Time per breast for liposuction (min)	**Mean**	13
	Range	10-18

Data presented as mean and range, number (percentage).

Among the 36 cases studied, gynecomastia was attributed to idiopathic causes in 12 cases (35%) and persistent pubertal hormonal changes in 19 cases (56%). In terms of severity, 26 cases (17.5%) were classified as grade III, 38 cases (25.5%) as grade IIb, 69 cases (46%) as grade IIa, and 17 cases (11%) as grade I.All grade III cases underwent combined gland excision with liposuction. Patients who underwent laser treatment showed improved skin redundancy, and postoperative edema was more common compared to those undergoing traditional liposuction. **Figure 1**

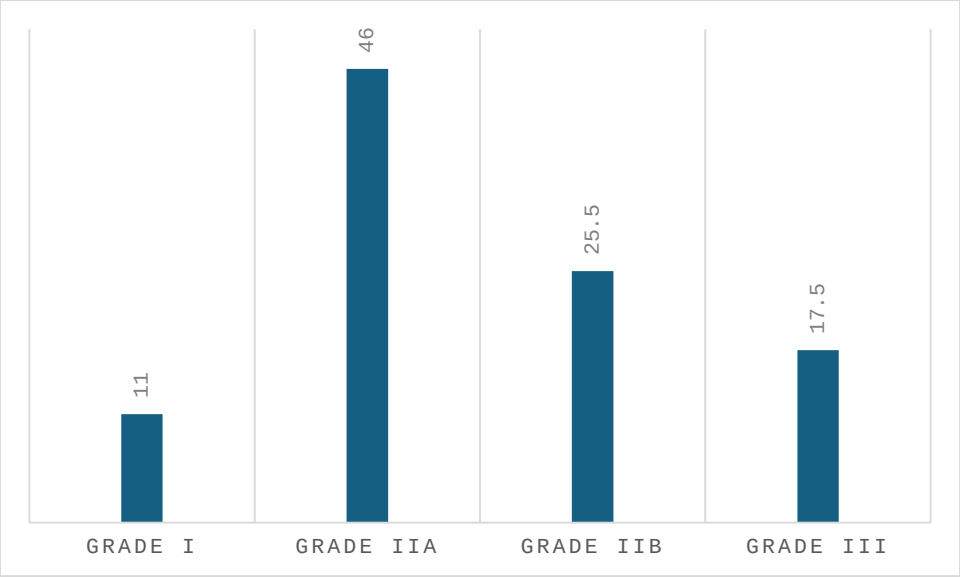

Figure 1: Grading of gynecomastia in the studied cases

The average follow-up duration was 12.5 months (range: 8-15 months). Each breast received an average infiltration of 469 ml of tumescent fluid (range: 284 to 716 ml). The total aspirated volume during both ultrasonic and conventional liposuction phases averaged 504 ml (range: 250 to 800 ml).In bilateral breast liposuction, the average amount of lipoaspirate was 385 mL (range: 75 – 800 mL). The duration of laser-assisted liposuction (150 - 180 minutes) was nearly double that of traditional methods .During the immediate postoperative period, patients experienced minimal edema and bruising, which typically resolved within 10 to 14 days. **Table 2**

Table 2: Results of the treatment of gynecomastia with liposuction

		n=36
Follow up (months)	**Mean**	12.5
	Range	8 - 15
The tumescent fluid volume infiltrated per breast	**Mean**	469
	Range	284 - 716
Total volume aspirated in both ultrasonic and conventional liposuction phases(ml)	**Mean**	504
	Range	250 - 800
Amount of lipoaspirate in the liposuction of bilateral breast (mL)	**Mean**	385
	Range	75 – 800

Data is presented as mean and range.

In all cases, the surgical outcomes were favorable. Out of the 36 patients, 28 (77.7%) expressed satisfaction with their cosmetic results, while eight patients (22.3%) were dissatisfied. One patient required additional liposuction combined with glandular treatment due to under-correction, and another patient experienced skin irregularities that required corrective measures. No seromas, hematomas, or injuries to either surgeons or chest structures were reported. Significant skin tightening was observed in several cases. The use of interstitial laser treatment before liposuction alone successfully addressed gynecomastia to the satisfaction of the surgeons. Importantly, there were no cases of hematoma, seroma, infection, or other early postoperative complications .**Table 3**

Table 3: Satisfaction among the studied cases

		n=36
Satisfaction	**Satisfied**	28 (% 77.7)
	Not satisfied	8(22.3%)

Data is presented as number (percentage).

During the follow-up period, most patients experienced minor complications post-procedure that did not require surgery. These included one case of seroma and moderate bruising, but there were no hematomas, infections, or other early postoperative issues. Postoperative assessments revealed no residual lumps or irregularities in any patients, and none needed skin reduction procedures. However, one patient (2.78%), the oldest at 57 years, had a small residual skin fold that wasn't bothersome. Complications like gradually resolving numbness and residual lumps in two patients (5.55%) were addressed effectively with post-operative massages over three months, improving palpable irregularities from liposuction areas. There were no instances of skin burns or necrosis observed. Localized areas of hardening due to localized fibrosis were found in 3 cases (8.3%), likely caused by small burns in the fibro-fatty tissue. Two cases (5.55%) also experienced breast asymmetry after surgery, typically resolving within a month as edema subsided. **Table 4**

Table 4: Complication in the studied cases

	N=36
Haematomas	0 (0%)
Infection	0 (0%)
Hypoesthesia	2 (5.55%)
Skin burn	0 (0%)
Breast asymmetry	2 (5.55%)
Seromas	1 (2.78%)
Moderate bruising	3 (8.3%)
Residual lumps and irregularities	3 (8.3%)
Skin necrosis	0 (0%)
Local area of induration	3 (8.3%)

Data is presented as number (percentage).

Cases:

Figure 1: Case 1 before the operation and after the operation

Figure 2: Case 1 before and after the operation

Discussion:

Laser lipolysis, a recently developed technique, aims to enhance recovery speed, decrease operator fatigue, and achieve simultaneous skin tightening. Incorporating the Nd laser has improved the traditional lipoplasty method.[13].

Badin et al. [17] It has been noted that laser technology is effective for lipolysis in the upper abdomen and around the belly button. The Nd laser, initially chosen for its deep 1064-nm wavelength penetration, has been supplemented by diode lasers emitting at 810, 940, and 980 nm wavelengths. These diode lasers, operating within the same spectrum, offer advantages typical of diode technology, such as higher efficiency (usually around 30%) and greater power outputs (25 W or more).

The interaction between laser and tissue occurs when laser energy is absorbed by specific chromophores, generating enough heat to induce the desired thermal damage. This heat affects both adipose cells and the extracellular matrix, causing both reversible and irreversible cellular damage [18].

Reynaud et al. [19] discovered that using low-energy settings with both 980 nm and 1064 nm wavelengths resulted in reversible damage, as evidenced by the swelling of adipocytes, with their diameter increasing by up to 100 micrometers. The laser-induced heat changed the sodium and potassium balance across the cellular membrane, facilitating the movement of extracellular fluid into the cell interior. This observation is in agreement with that of Badin et al. [17] who used the laser of Nd:YAG.They noted that following lipolysis, the average diameter of adipocytes measured 95.69 micrometers, compared to 73.48 micrometers in their normal state and 85.54 micrometers after conventional liposuction. Multiple studies have affirmed that the Ndlaser from Deka (Manchester, NH), distributed in the U.S. by Cynosure (Westford, MA), does not function mechanically.[17, 19].

Kim and Gernemus[20] employed the Nd laser in a study involving 10 patients. They found that laser-assisted liposuction (LAL) resulted in improved hemostasis, faster wound healing, and reduced surgical trauma compared to traditional liposuction methods. MRI scans showed more pronounced reduction in targeted regions such as the submentum, suggesting a potential correlation between treatment intensity and outcomes [21]. In the submental area, Nd

lipolysis has been shown through histological findings and clinical outcomes to be safe and effective. Studies using the 980-nm diode laser have also demonstrated its safety and effectiveness, suggesting it as a viable alternative to traditional liposuction methods[22]. Ultrasonographic evaluation of submental area in patients in Valizadeh et al. [23]

The study demonstrated that both procedures resulted in a significant reduction in fat thickness compared to baseline. However, comparisons between the two groups at 2-week and 2-month follow-ups indicated that laser-assisted lipolysis (LAL) was more effective than conventional liposuction in reducing fat. Most patients in the LAL group reported minimal pain and a quick return to daily activities. Additionally, patients in the lipolysis group reported higher satisfaction levels regarding perceived fat reduction, improved skin appearance, and overall satisfaction compared to those in the liposuction group. These findings align with previous studies and suggest that patients generally prefer lipolysis techniques [19, 24, 25].

Reynaud et al. [19] 58% of patients were "very satisfied" and 22% were "satisfied" and returned to their normal activities within 24 hours, according to the report.. Weiss and Beasley [24] reported that 78% were “extremely satisfied” and 72% were “significant improvement in skin tightness” with 924-nm laser system. In Valizadeh et al. study [23], 16 (89%) of patients were “very or moderately satisfied” after LAL compared with 1 patient in the liposuction group.

In cosmetic patients, concerns about skin laxity in the submental area often outweigh those about fat accumulation. Techniques such as laser-assisted lipolysis (LAL), which can stimulate collagen production and tighten the skin, are therefore more appropriate for addressing this concern. Currently, there are no clinical trials comparing the outcomes of 980-nm diode laser lipolysis with conventional liposuction in the submental area using both subjective and ultrasonographic evaluations [23].

In contrast to the proven safety and effectiveness of the 1,064-nm Nd laser in treating gynecomastia, the 980-nm diode laser offers several advantages: (1) it enables direct coupling between electric power and light, (2) it exhibits excellent energy conversion compared to other laser types (approximately 40%), and (3) these lasers are affordable and compact [13].

In Trelles et al. [13]

In a clinical study involving 28 patients with gynecomastia, the described technique proved to be safe and consistently reproducible. During the postoperative period, all patients experienced no complications. After 6 months, 18 patients (64.3%) rated the results as "very good," 6 as "good" (21.4%), 3 as "fair" (10.7%), and 1 as "poor" (3.6%). Physicians evaluated the photographs as "very good" in 22 patients (78.6%), "good" in 5 (17.9%), and "fair" in 1 (3.6%).Despite the absence of a control group and the relatively small number of procedures, our findings appear robust when compared to larger studies involving excisional techniques, suction-assisted, ultrasound-assisted, and power-assisted liposuction described in the literature. Courtiss [26] reviewed 159 patients treated surgically for gynecomastia, with 101 (192 breasts) undergoing excisional techniques. He reported a high rate of complications including over-resection (18.7%), unsightly scarring (18.7%), hematoma (16.1%), seroma (9.4%), and under-resection (21.9%). Another series by Lista and Ahmad involved 99 patients (197 breasts) treated with power-assisted liposuction [27].In three patients, there was a residual solid mass of fibroglandular breast tissue deep to the areola/nipple complex, which needed a complementary excisional technique. Complications (seroma) occurred in two breasts (1%).Rohrich et al. [6] examined 61 patients who underwent liposuction, including both suction-assisted and power-assisted techniques. Additional treatment was unnecessary for 86.9% of patients (53 out of 61) treated with either method. However, eight patients (13.1%) required staged excision to address remaining breast tissue.

Limitations:

Our sample size was relatively small. In addition, we didn’t compare Diode 980nm interstitial laser with other types of laser or with surgical intervention for treating gynecomastia. We recommended further larger comparative studies to strengthen our findings.

Conclusions:

Diode 980nm interstitial laser could effectively treat gynecomastia without postoperative complications.

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Conflict of Interest: Nil

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