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# Application of Intraoperative Fluorescence Spectroscopy in Classical Abdominoplasty in Patients with Diabetes Mellitus

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## Abstract

The purpose of this scientific study is to evaluate the effectiveness of intraoperative luminescence spectroscopy in reducing the incidence of postoperative complications after abdominoplasty in patients with diabetes mellitus. In the main (experimental) group, the mobilization of the skin-fat flap was performed under the control of luminescence spectroscopy to assess tissue viability, while in the control group, the standard method was used. Intraoperative parameters were evaluated, and in the postoperative period, the area of purulent wounds, the volume of lymphorrhea, indicators of systemic inflammation (leukocytes, C-reactive protein, procalcitonin), and the frequency of complications were recorded. The area of the mobilized flap in the experimental group was significantly smaller (456.6 ± 12.8 $cm^2$ vs. 617.6 ± 13.8 $cm^2$). The incidence of purulent complications in the control group was 24.1% versus 19.0% in the experimental group. On day 7, the area of purulent wounds in the control group reached 98.6±7.8 $cm^2$, and by day 14 it increased to 187.5±6.8 $cm^2$, while in the experimental group it was 16.8 ± 1.9 $cm^2$ and did not progress. Indicators of systemic inflammation and procalcitonin levels were significantly lower in the main group. Using spectroscopy, the group also had decreased drainage discharge volume and drainage removal timing. Thus, the use of intraoperative luminescent spectroscopy for abdominoplasty in patients with diabetes mellitus allows an objective assessment of tissue viability, reduces the volume of excision, and significantly reduces the risk of postoperative purulent complications.

**Keywords:** Diabetes mellitus, Abdominoplasty, Luminescent spectroscopy, Postoperative seroma, Purulent wound

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## Introduction

Surgical correction of the anterior abdominal wall in recent years has acquired not only therapeutic and aesthetic relevance, but also increasing social significance. Nowadays, a "harmonious belly" has become an aesthetic norm (Mendes *et al*., 2024; Triana *et al*., 2024). Factors such as pregnancy, weight loss, taking certain medications, aging, physical inactivity, and previous surgeries force many people to resort to surgery to correct the contour of the abdomen (Karunaratne *et al*., 2023; Rao *et al*., 2024; Cheung *et al*., 2025).

Abdominoplasty, commonly referred to as a “tummy tuck”, is a surgical procedure aimed at removing excess skin and subcutaneous fat and eliminating diastasis of the rectus muscles to restore the proportional aesthetics of the anterior abdominal wall (Valença-Filipe *et al*., 2023; Cannistrà *et al*., 2024; Di Diego *et al*., 2025). Despite the improvement of surgical equipment and advanced training of surgeons, abdominoplasty remains one of the most technically challenging operations in plastic surgery. In recent years, surgeons have focused on achieving optimal aesthetic results while minimizing postoperative complications (Jessen *et al*., 2021; Horta *et al*., 2022; Sutcu *et al*., 2022; Stein *et al*., 2024). Local complications are usually associated with extensive mobilization of the skin-fat flap, which significantly increases the risk of necrosis and SSI (Khan & Fatima, 2021; Abbaszadeh *et al*., 2025; Tuominen & Koljonen, 2025).

In addition to their ischemic origin due to excessive tissue mobilization and high stress, these complications are also affected by major metabolic disorders such as impaired glucose and lipid metabolism (Bamba *et al*., 2016; Camargo *et al*., 2025). The incidence of complications during abdominal wall correction in patients with diabetes mellitus can reach 30.8% and is directly related to the severity of obesity and the level of glycemia (De Paep

*et al*., 2021; He *et al*., 2025). Modern methods of abdominoplasty are aimed at reducing surgical trauma and improving scarring results (Jessen *et al*., 2021; Montesanti *et al*., 2022; Sutcu *et al*., 2022; Di Diego *et al*., 2025).

However, the key limitation remains the lack of objective criteria for assessing the required amount of flap mobilization. In this context, luminescence spectroscopy is a promising tool for the intraoperative assessment of tissue viability. The foundation of this diagnostic technique is autoluminescence, which is radiation produced by metabolic processes during cell death (Deglmann *et al*., 2017; Raghuram *et al*., 2021; Mito *et al*., 2024).

The essence of the method is to detect and analyze radiation emitted by specific substances, called fluorophores, which are formed when cells are damaged (Mito *et al*., 2024). The most important universal fluorophores capable of generating luminescence include such molecules as NADH, NADPH, collagen, elastin, flavins, and carotene (Giovannacci *et al*., 2019; Fontes de Moraes *et al*., 2023). These compounds play a crucial role in key metabolic processes in the body, participating in the Krebs cycle, the pentose phosphate pathway, the mitochondrial respiratory chain, and lipid peroxidation (Croce & Bottiroli, 2017; Valença-Filipe *et al*., 2023). Changes in the concentration and electronic state of these molecules directly reflect the state of cells and tissues (Croce *et al*., 2018; Dumanian & Moradian, 2021).

In this study, laser-induced ultraviolet photoluminescence spectroscopy using a special instrument was used to record and analyze the glow. This device is a complex system that includes a laser radiation source — an excimer laser based on xenon chloride (XeCl), a highly sensitive luminescent signal detector, and a modern data processing and recording system (Croce *et al*., 2014). The main advantage of this method is its high accuracy and resolution, allowing measurements to be made on very small areas of tissue, only 1-5 mm.

The intensity of the recorded glow directly correlates with the degree of ischemic cell damage: the more severe the ischemia, the brighter the glow. Several studies have shown a direct correlation between the concentration of cellular catabolism products and the peak of luminescence when pumped with UV laser radiation in the range of 380-410 nm (Restifo, 2021; Vaganov *et al*., 2024; De Roode *et al*., 2025).

However, the spectral characteristics of the detected signal can vary significantly depending on the wavelength of the radiation. This is due to the influence of various substances capable of 'quenching' luminescence and suppressing its intensity. Among such substances are primarily hemoglobin and its derivatives: oxyhemoglobin, deoxyhemoglobin, and myoglobin (Liu *et al*., 2020). Their presence in the tissue must be taken into account when analyzing the obtained data to more accurately assess microcirculation in the ischemic zone.

In spectral analysis, this phenomenon is reflected in a negative luminescence peak at frequencies of 420–450 nm. The spectral characteristics of the recorded signal are shown in **Figure 1**.

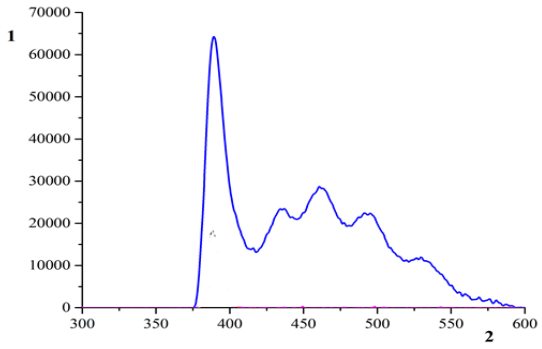



**Figure 1.** Spectral characteristics of the signal obtained using ultraviolet luminescent spectroscopy (1 – luminescence intensity, 2 – frequency at which the signal was obtained).

Ultimately, the presented method provides objective information about the degree of tissue damage at the cellular level, offering high precision, making it an irreplaceable tool for determining tissue viability (Croce *et al*., 2014; Kiyama *et al*., 2016; Nielsen *et al*., 2022; Vaganov *et al*., 2024; De Roode *et al*., 2025).

The accuracy of the method is ensured not only by the high sensitivity of the equipment but also by the deep understanding of the biochemical processes underlying the recorded signal. Our previous studies showed that the appearance of necrotic areas in histological samples was observed when luminescence intensity did not exceed $0.95 \pm 0.15 \times 10^5$ photons at a frequency of 410 nm (Vaganov *et al*., 2025). The boundary between viable and necrotic tissue was established using this value as a guide.

Objective of the study: To evaluate the effectiveness of classical abdominoplasty under the control of luminescent spectroscopy in patients with diabetes mellitus.

## Materials and Methods

This prospective, direct, non-randomized comparative study included 50 patients with diabetes mellitus who underwent classical abdominoplasty with rectus abdominis diastasis or simultaneous hernioplasty between 2020 and 2025.

All study participants were divided into two groups. The first group (n=21) consisted of patients who underwent classical abdominoplasty under intraoperative luminescence spectroscopy control. The second group (n=29) consisted of patients who underwent classical abdominoplasty using the traditional method without the control of spectroscopy.

The average age of the patients was 51.9± 4.6 years. There were 10 men (20%) and 40 women (80%). Both groups had comparable compensated comorbidities and were monitored for 3 months postoperatively **(Table 1)**.

**Table 1.** Concomitant pathology in the study groups

| Diagnosis | Number of patients in group (%) | Number of patients in group 2 (%) | p |
|---|---|---|---|
| **Hypertensive disease** | 18 (85.7) | 24 (82.8) | 0.334 |

| | | | |
|---|---|---|---|
| **Coronary heart disease** | 10 (47.6) | 14 (48.3) | 0.328 |
| **Postinfarct cardiosclerosis** | 3 (14.3) | 5 (17.2) | 0.124 |
| **Chronic heart failure** | 1 (4.8) | 2 (6.9) | 0.085 |
| **Stroke outcomes** | 1 (4.8) | 1 (3.4) | 0.234 |
| **Chronic kidney failure** | 1 (4.8) | 2 (6.9) | 0.085 |
| **Chronic obstructive pulmonary disease** | 2 (9.5) | 3 (10.3) | 0.549 |
| **Cerebravascular disease** | 3 (14.3) | 4 (13.8) | 0.525 |
| **Peptic ulcer disease of the stomach** | 2 (9.5) | 3 (10.3) | 0.549 |

The primary endpoint of the study was the completion of the experiment. The secondary endpoint was the suppuration of the postoperative wound.

*Inclusion Criteria for Participation in the Study*

- The possibility of performing classical abdominoplasty in combination with correction of diastasis of the rectus abdominis and postoperative ventral hernias;
- -the presence of type 2 diabetes mellitus in the compensation stage;
- Body mass index (BMI) from 30 to 40;
- Absence of infringement of the contents of the hernial sac or purulent-necrotic skin lesions in any area.
- The absence of decompensated general somatic pathology and irreversible metabolic disorders was required.

*Exclusion Criteria from the Main Group Included*

- The inability to close the aponeurosis defect in large and giant postoperative hernias;
- The presence of severe obesity with a BMI of more than 40;
- Purulent-necrotic processes of the skin and subcutaneous tissue of various localization;
- Decompensated metabolic disorders (significant lipid spectrum disorders, ketoacidosis).
- The presence of concomitant inguinal and femoral hernias was noted.

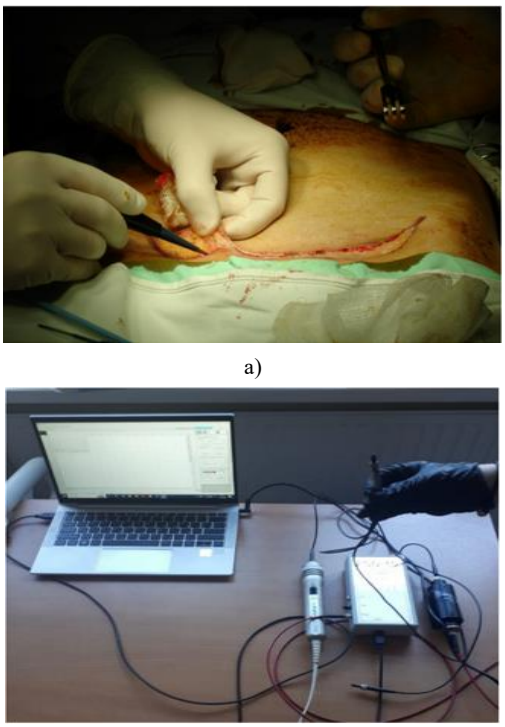
All patients, in the preoperative period, underwent the standard set of preoperative examinations, including: clinical and biochemical blood tests, coagulogram, blood type and Rh factor, general urine analysis, chest X-ray, and electrocardiography. Concomitant pathologies were evaluated by a cardiologist and an endocrinologist.

The autoluminescence measurement procedure was carried out directly during the operation. A special probe—a dual quartz fiber, 1 meter in length with an active working diameter of 450 µm, placed in a sterile sleeve—allowed registration of luminescence emission in the study area.

The probe was placed at a distance of 1–2 cm from the skin surface. To induce autoluminescence, pulsed radiation from an XeCl excimer laser with a wavelength of 308 nm was used for 3 minutes. The laser dosage strictly adhered to the current sanitary regulations, ensuring patient safety. Luminescence spectra were recorded in the range of 350–780 nm, with a step of 10 nm over a duration of 10 seconds. This allows the obtaining of detailed information on the spectral composition of the radiated emission, which is key for diagnostics.

The depth of dissection was determined intraoperatively using a needle connected to the probe. The needle was introduced layer by layer gradually into the subcutaneous fat, allowing precise identification of the intersection boundary of the skin-fat flap. This boundary was determined based on previously established patterns related to autoluminescence indicators.

In this study, the flap resection zone was set at the luminescence boundary of $0.95 \pm 0.15 \times 10^5$ photons at a wavelength of 410 nm **(Figure 2)**. In cases of fat deposits in problem zones, additional liposuction was performed during surgery in the experimental group.



a)

b)

**Figure 2.** Intraoperative luminescent spectroscopy: a) Measurement of luminescence in the dissected skin-fat flap; b) General view of the setup for luminescent spectroscopy

Luminescence registration was performed after patients signed written informed consent for diagnostic testing in accordance with the Declaration of Helsinki of the World Medical Association (2004). The study was approved by the local ethics committee of Kabardino-Balkarian University named after H.M. Berbekov, Protocol No. 2 dated 2020/01/30.

After completing the abdominoplasty and suturing, autoluminescence was measured again. This made it possible to monitor the dynamics of changes and evaluate the effectiveness of the surgery. In cases of doubt regarding the viability of the skin

flap, based on the obtained luminescence data, additional excision was performed, followed by correction of the flap.

In the postoperative period, the number of purulent complications was recorded. The area of purulent wounds was determined using planimetric methods. To perform the measurements, a sterile polyethylene film was applied to the wound surface, tracing the contour. The wound contour was then transferred onto graph paper to calculate the area in square millimeters. The volume of drainage output and the time of drain removal were also noted.

For statistical data processing and comparison of the study groups, SPSS Statistics 17.0 software was used. Results were expressed as mean ± standard deviation (SD). Differences in main postoperative indicators were assessed using the paired Student's t-test and considered statistically significant at $p < 0.05$. The Mann-Whitney U-test was used to assess differences between two small independent samples. Spearman's correlation coefficient was used to determine relationships between indicators. Statistical heterogeneity between groups was assessed using the $\chi^2$ test. A result of $p < 0.1$ and $I^2 > 50\%$ was considered statistically significant heterogeneity.

## Results and Discussion

During assessment of the early postoperative period, technical success of the operation was noted in all observed cases across both study groups. No intraoperative complications were recorded. Intraoperative blood loss was comparable between the groups (experimental: 308.5 ± 14.8 mL, control: 325.2 ± 12.8 mL). The area of the mobilized skin-fat flap in the experimental group (formed under luminescent spectroscopy control) was significantly smaller than in the control group. Before excision, the area was 456.6 ± 12.8 cm² in the experimental group and 617.6 ± 13.8 cm² in the control group ($p = 0.001$). In the early postoperative period, subcutaneous hematoma developed in 1 (4.7%) patient from the experimental group and 2 (6.9%) from the control group, requiring wound revision within 1–2 days. During re-operation in the experimental group, luminescence of the free edge of the skin-fat flap was also measured. No statistically significant increase in luminescence compared to the first operation was noted.

On day 5, hyperthermia was observed in 7 (24.1%) patients in the control group and 5 (23,8%) in the experimental group. This correlated with leukocytosis and elevated C-reactive protein. Leukocyte level on day 5 was significantly lower in the experimental group (14.5 ± 1.8 g/L) compared to the control (18.8 ± 1.4 g/L), $p = 0.043$. Similarly, CRP levels were lower in the experimental group (223.4 ± 5.8 U/L) vs. the control (365.8 ± 11.7 U/L), $p = 0.015$ **(Table 2)**. No significant changes in blood biochemistry were noted.

**Table 2.** Ratio of purulent wound size after abdominoplasty vs. systemic inflammatory response

| Indicator | Group | Day 6 | Day 8 | Day 10 | Day 12 | Day 14 |
|---|---|---|---|---|---|---|
| **Leukocytes, g/L** | study | 13.2±1.2 | 11.8±1.9 | 12.2±1.5 | 9.8±1.9 | 7.6±1.4 |
| | control | 19.2±1.1* | 18.3±1.2* | 20.1±3.5* | 17.1±1.8* | 15.8±3.3* |
| **hg, g/L** | study | 124±7.8 | 123±5.4 | 130±5.7 | 128±6.9 | 134±6.6 |
| | control | 132±2.8 | 134±1.4 | 125±7.7 | 129±5.8 | 130±4.4 |
| **CRP, mg/L** | study | 244.2±8.8 | 213.4±10.7 | 189.2±6.1 | 109.2±5.4 | 87.2±5.7 |
| | control | 369.4±7.8* | 333.4±5.7* | 290.5±8.8* | 296.4±7.4* | 190.4±5.8* |
| **procalcitonin, g/L** | study | 0 | 0 | 0 | 0 | 0 |
| | control | 0.63±0.08* | 0.83±0.02* | 0.59±0.03* | 0.44±0.03* | 0.22±0.03* |
| **Mean area of the septic wound, cm²** | study | 16.7±1.4 | 10.1±4.3 | 6.2±1.1 | 3.8±1.9 | - |
| | control | 93.6±5.8* | 107.2±10.8* | 120.6±4.2* | 156.5±6.6* | 187.5±6.8* |

Note: * Statistically significant differences ($p < 0.05$)

During dressing, purulent wounds were found in 7 (24.1%) febrile patients in the control group and 4 (19.0%) in the experimental group ($p = 0.003$). The remaining 3 febrile patients did not develop purulent complications. Their hyperthermia was most likely due to the mesh implant response. Antibiotic therapy (ceftriaxone 1.0 IM daily) resolved the fever by day 7. No other purulent complications occurred during hospitalization in either group. In the control group, wound suppuration was accompanied by marginal flap necrosis. No such complications were observed in the experimental group.

Subjects from both groups underwent wound revision due to suppuration. Under local infiltration anesthesia with 0.25% Novocaine, sutures were removed, wound edges separated, pus evacuated, and the wound cavity irrigated with antiseptics and fitted with rubber drains.

In the experimental group, the mean area of the purulent wound by day 7 was 16.8 ± 1.9 cm² (planimetric method). No further cavity enlargement was observed. Notably, wound healing progressed positively. By day 14, all experimental group patients had complete wound closure by secondary intention.

In the control group, necrotic skin-fat tissue required not only suture removal but also excision of the necrotic flap edge. Local treatment was difficult due to ongoing necrosis spreading across the wound, involving subcutaneous fat. The initial wound area, measured by planimetric method on day 7, was 98.6±7.8 cm², and by day 14 it had reached 187.5±6.8 cm². Under these conditions,

staged debridement with prolonged dressings was required, first in the hospital and then in the outpatient clinic. Secondary intention healing of skin wounds in patients with purulent complications in the control group occurred on average after 57.5±2.8 days.

Regarding laboratory dynamics from day 5 of the study, the control group showed a progressive increase in leukocytosis and C-reactive protein, and elevated procalcitonin levels, which overall characterizes the development of systemic inflammatory response syndrome. On day seven after detection of purulent wound complications, leukocytosis and C-reactive protein levels in the study groups differed significantly. In the experimental group, leukocytosis was 11.2±1.3 g/L, in the control group, 19.3±1.2 g/L ($p=0.025$). Similar data were obtained when comparing C-reactive protein (experimental– 134.4±7.8 U/L, control – 311.1±19.1 U/L; $p<0.05$). Procalcitonin was negative throughout the study in the experimental group.

Throughout the observation period, the experimental group showed no signs of multiple organ failure, even with the development of local purulent complications. In the control group, with the development of purulent complications in 3 patients after 5-7 days, elevated levels of nitrogenous waste products were noted (urea - 7.5±1.1 mmol/L, creatinine – 187.2±1.6 mmol/L; $p=0.022$). Increased transaminase activity was also observed. One patient from the control group had to be transferred to the intensive care unit for veno-venous hemodiafiltration for extrarenal indications due to the development of abdominal sepsis. This patient also developed floating thrombosis of the right femoral vein, requiring cava filter placement.

The next complication observed in 100% of cases in all study groups was lymphorrhea. It should be noted that the mobilization of the skin-fat flap differed between the experimental group and the control group, from a technical standpoint. In the experimental group, mobilization was performed under luminescent control, leaving part of the subcutaneous fat tissue on the aponeurosis. This led to a reduction in the volume of supra-aponeurotic dead space.

In the control group, dissection of the skin-fat flap directly from the aponeurosis with complete "exposure" of the latter was performed in all cases. It is important to note that in both cases, surgeons followed the technique of preserving perforator vessels. When evaluating lymphorrhea volume in the early postoperative period, statistically significant differences were noted between study groups. For example, on day 3, the drainage output volume in the experimental group was 214.8±15.8 ml, while in the control group it was 389.4±21.4 ml ($p=0.025$). Additionally, the timing of the Redon drain removal differed. In the control group, this occurred after 10.5±1.3 days, while in the experimental group it occurred after 8.5±1.1 days ($p=0.017$). Thus, drains were removed later in the control group **(Table 3)**.

**Table 3.** Drainage output volume in the early postoperative period

| | Day 2 | Gay 4 | Day 6 | Day 8 |
|---|---|---|---|---|
| **Study group** | 145.2±20.8 | 226.8±11.8 | 140.9±11.8 | 71.1±10.2 |
| **Control group** | 159.2±21.4 | 382.4±17.4* | 302.2±10.2* | 182.2±15.1* |

Note: * - differences are statistically significant ($p<0.05$)

Despite different methods of skin-fat flap mobilization, aesthetic results were achieved in all cases. All patients were satisfied with the results, and no critical comments or complaints regarding the performed operation were received from patients. No fatal outcomes were observed in either the experimental or control groups during the hospitalization period (Ağaçkıran *et al*., 2023; Attenborough *et al*., 2023; Du *et al*., 2023; AlShammasi *et al*., 2024; Ravoori *et al*., 2024).

In the study groups, there were no signs of respiratory failure due to compartment syndrome development in the early postoperative period. There were no cases of acute cardiovascular catastrophes or pulmonary embolism. All patients were discharged from the hospital for outpatient observation and dressings.

During further observation, re-admissions were recorded in 3 (14.3%) patients from the experimental group and 6 (20.7%) from the control group ($p=0.003$). This includes patients who had no complications during the early postoperative period of inpatient treatment. Two main reasons for repeat hospital admissions can be identified: infected subcutaneous seroma and postoperative wound suppuration (Enwa *et al*., 2022; Özatik *et al*., 2023; Savva *et al*., 2023; Shahzan *et al*., 2023; Bona & Lozano, 2024; Figueroa-Valverde *et al*., 2024; Suchy & Jurkowski, 2024).

In the first case, seroma punctures under ultrasound guidance were performed in 1 (4.8%) patient from the experimental group and 2 (6.9%) from the control group; however, the effect of these manipulations was short-term, and seroma reaccumulated. Given the persistent nature of acute fluid accumulation, these patients underwent drainage with a course of non-specific antibiotic therapy. In all cases, after resolution of inflammatory phenomena, drains were removed, wounds were sutured, and patients were discharged in satisfactory condition. It is important to note that in 5 (83.3%) patients from the control group, whose early postoperative period proceeded without complications, wound suppuration and readmission were associated with skin-fat flap necrosis, requiring excision and staged necrectomies. In the experimental group, marginal skin necrosis was not observed in readmitted patients (Ruchin *et al*., 2022; Rudayni *et al*., 2022; Spirito *et al*., 2022; Sugimori *et al*., 2022; Bulusu & Cleary, 2023; Ikhile & Enabulele, 2023; Kiedrowicz *et al*., 2023; Kulkarni *et al*., 2023; Dorn *et al*., 2024; Mao *et al*., 2024).

Patients with postoperative wound suppuration, previously discharged from the hospital in satisfactory condition, were also readmitted due to signs of abscess formation in the postoperative scar area. These phenomena were observed in 3 (14.3%) patients from the experimental group and 5 (17.2%) from the control group ($p=0.225$). After surgical wound debridement and drainage, followed by antibiotic therapy, recovery occurred. In the late postoperative period, no cases requiring repeat abdominoplasty for aesthetic indications were noted.

This study confirms the effectiveness of intraoperative luminescence spectroscopy in classical abdominoplasty (Abrahimi & McClure, 2022; Deng *et al*., 2022). The method provides an objective assessment of tissue viability in real time, helping to determine the safe boundaries for flap removal. This technique is of particular value in patients with diabetes mellitus, where, due to

the presence of metabolic disorders, there is a decrease in tissue regeneration (Sadovoy *et al*., 2017; Wu *et al*., 2022). The use of luminescent spectroscopy significantly reduces the risk of postoperative complications, including wound infection and lymphorrhea. This diagnostic method proved to be quite accurate, making it possible to determine with impeccable accuracy the width of the separation of the skin-fat flap and the dissection boundary in the experimental group (Zhou *et al*., 2024; Chen *et al*., 2025).

It is important to emphasize that these results were accompanied by a significant reduction in complications during abdominoplasty in patients with diabetes mellitus under the control of luminescence spectroscopy. The cause of purulent processes in the control group was necrotic changes in the skin-fat flap, which required additional sanitation. Purulent complications in this group had a more malignant course, with a constant increase in the wound area, despite the performed sanitation necrectomy.

In patients of the control group, the development of purulent-necrotic postoperative wound complications on the background of pre-existing metabolic disorders caused a systemic inflammatory response syndrome, in some cases accompanied by the development of multiple organ failure (Brakenridge *et al*., 2024; Srdić *et al*., 2024). It is important to note that purulent complications in some respondents appeared after discharge from the hospital during follow-up (Martins *et al*., 2022). The proportion of these complications was also significantly higher in the control group and was associated with necrosis of the skin-fat flap (Zhitny *et al*., 2020; Oleck *et al*., 2022).

Thus, the use of intraoperative luminescent spectroscopy in performing classical abdominoplasty in patients with diabetes mellitus makes it possible to effortlessly determine its volume and reduce the frequency of postoperative complications associated with excessive mobilization of the skin-fat flap and its ischemia.

## Conclusion

This prospective comparative study demonstrates that the integration of intraoperative luminescence spectroscopy into classical abdominoplasty significantly enhances surgical outcomes for patients with diabetes mellitus. The technique proved highly effective in objectively determining tissue viability in real-time, allowing for precise delineation of safe resection boundaries. This resulted in a statistically significant reduction in the area of the mobilized skin-fat flap in the experimental group—456.6 ± 12.8 cm² compared to 617.6 ± 13.8 cm² in the control group (p=0.001). This precision directly translated into a markedly lower incidence of severe postoperative purulent complications. Only 19.0% of patients in the spectroscopy-guided group developed wound suppuration, a figure significantly lower than the 24.1% observed in the control group (p=0.003).

Furthermore, the clinical course of complications was substantially less severe in the experimental cohort. The mean area of purulent wounds was drastically smaller (16.8 ± 1.9 cm² on day 7 vs. 98.6±7.8 cm² in controls), showed no progression, and healed completely by secondary intention within 14 days. In stark contrast, wounds in the control group expanded to 187.5±6.8 cm² by day 14 and required an average of 57.5±2.8 days to heal. The spectroscopy-guided approach also mitigated systemic repercussions, as evidenced by significantly lower levels of inflammatory markers (CRP of 223.4 ± 5.8 mg/L vs. 365.8 ± 11.7 mg/L on day 5) and the absence of procalcitonemia or multiple organ failure, which complicated the recovery of control patients.

Additional benefits included a notable reduction in lymphorrhea, with a lower drainage output (214.8±15.8 ml vs. 389.4±21.4 ml on day 3) and earlier drain removal (8.5±1.1 days vs. 10.5±1.3 days), contributing to shorter recovery times. The rate of readmissions was also lower in the experimental group (14.3% vs. 20.7%), underscoring the long-term efficacy of the method. Therefore, intraoperative luminescence spectroscopy emerges as a reliable, invaluable tool for improving the safety and efficacy of abdominoplasty in high-risk diabetic patients, reducing local and systemic complications by preventing flap ischemia and excessive mobilization.

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**Conflict of interest:** None

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**Ethics statement:** Luminescence registration was performed after patients signed written informed consent for diagnostic testing in accordance with the Declaration of Helsinki of the World Medical Association (2004). The study was approved by the local ethics committee of Kabardino-Balkarian University named after H.M. Berbekov, Protocol No. 2 dated 2020/01/30.

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