

Endoscopic Insertion of Tissue Expanders in Post Burn Scars: A Comparative Study between Endoscopic Versus Open Tissue Expansion at Post Burn Scars

DALIA M. ELSAKKA, M.D.; MUSTAFA M. AL ASSAL, M.B.B.Ch. and MEDHAT SAMY, M.D.

The Department of Surgery, Plastic Surgery Unit, Faculty of Medicine, Menoufia University

Abstract

Background: The use of endoscopic technology allows for clearer visualization of the tissue-expander pocket, making it possible to place more expanders in less time while maintaining superior control. This results in improved hemostasis, fewer infections, reduced complications, quicker expansion, shorter hospitalization, and a decrease in post-operative complications. Skin tissue expansion is a valuable option for the reconstruction of large skin defects, though the procedure carries a high rate of complications. An endoscopic approach for placing tissue expanders may help lower complications rate and shorten recovery time.

Objectives: In this study we will compare placement of tissue expanders with aid of endoscopy versus traditional open method for placement of tissue expanders to assess safety, feasibility and adequacy of endoscopic tissue expander placement.

Patients and Methods: This study, conducted prospectively, involved 20 patients who were divided into two groups: Group A, where 10 patients underwent endoscopic tissue expander placement, and Group B, where 10 patients had the traditional open approach. The procedures were carried out at Menoufia University Hospital from June 2018 to December 2024. Patient charts were reviewed, and the data were assessed to compare the outcomes of endoscopic versus open tissue expander placement.

Results: Ten patients in this study had 13 tissue expanders placed openly for reconstruction (3 with post burn cicatricial alopecia (PBCA), 7 with post burn scars (PBS), in areas such as the neck, chest wall, and limbs), and ten patients had 14 expanders placed endoscopically (7 with post burn cicatricial alopecia, 3 with post burn scars in the face, chest wall, and back). The open group average operating time was 75 ± 5 minutes, while the endoscopic group was 100 ± 5 minutes. However, the endoscopic group experienced a shorter hospital stay

(3-5 days compared to 5-9 days) and a shorter time to reach full expansion (6-8 weeks versus 9-11 weeks). Additionally, the endoscopic group experienced fewer major complications than the open group.

Conclusions: The reconstructive technique of endoscopic tissue-expander placement led to a shorter hospital stay, faster expansion, and a lower rate of major complications. Endoscopic placement is a safe and efficient technique for tissue-expander reconstruction of various cosmetic lesions, according to the study's findings.

Key Words: Endoscopic – Expansion – Surgery.

Ethical Committee: Approved by the ethical committee of the Faculty of Medicine, Menoufia University; Code (2/2029Plas 2).

Disclosure: No disclosure.

Introduction

Over the course of several weeks to months, a silicone elastomer balloon filled with sterile isotonic saline is inserted as part of the soft tissue expansion procedure. The surrounding tissue is stretched as the balloon expands, which promotes tissue growth and greatly expands the amount of tissue that is available for reconstructing nearby defects [1].

Reconstructing large skin defects is a common challenge for plastic surgeons, with choices such as skin grafts, local flaps, regional flaps, and free flaps. Each approach has its strengths and limitations: Skin grafts are effective but can lead to suboptimal cosmetic results; local flaps offer better aesthetics but may not cover larger defects; and free-tissue transfer provides robust, multilayered tissue for reconstruction, though it comes with donor-site morbidity and additional scarring [2].

Tissue expansion is frequently the recommended option for fixing cutaneous defects when

Correspondence to: Dr. Mustafa Al Assal,
E-Mail: Mostafaalassal@icloud.com

alternative reconstructive techniques are not optimal. Large wounds can be covered with new, healthy skin using this technique, which has several benefits, including low donor site morbidity and high-quality skin that blends in with the surrounding area's color, texture, and sensation. For more than 45 years, tissue expansion has been a common and crucial procedure in plastic surgery [3].

Various factors, such as the wound, the device, the expansion process, tissue quality, and incorrect surgical technique or expander placement, can contribute to complications in tissue expansion. These may include infection, hematoma, seroma, device failure, and necrosis of skin flaps. Therefore, the placement technique of the expander is essential in influencing the rate of complications [4].

Endoscopic tissue expander placement is a good substitute to reduce complications. It was first used for the endoscopic forehead lift in the early 1990s, and since then, it has been used for other procedures like breast augmentation, flap harvest, and abdominoplasty. By improving visualization, this method leads to better control, faster expander placement, improved hemostasis (which lowers the risk of infection), fewer complications, faster expansion, shorter hospital stays, and lower post-operative morbidity [5].

Patients and Methods

Twenty patients participated in this prospective study and were split into two groups: Group A, which included ten patients treated with endoscopic tissue expander placement, and Group B, which included ten patients treated with traditional open tissue expander placement. The selection between two groups was done randomly. They were operated upon in Menoufia university Hospital. It was in the period from June of 2018 to December 2024.

Criteria of inclusion: Patients with age 6 years old or more and Patients with post burn scar more than 6 months.

Criteria of exclusion: Patients who were below 6 years were excluded from this study, Patients with exhibited unstable or infected donor tissue and Patients with malignant lesions.

Preoperative preparation:

- Written informed consent after complete discussion of the procedure with the patient and his relatives.
- Detailed history was taken including past history of burn and the period since its occurrence, Trauma, Previous operations.
- Careful Preoperative Examination was done to detect any associated problem whether congenital or traumatic and preoperative photography.

- Defect size, available donor tissue, number, size, shape, and location of expander units, expected scar line, estimated duration and frequency of expansion, and potential need for secondary expansion are all considered in the preoperative evaluation of expansion factors.

Surgical technique:

Endoscopic method for insertion of expanders Figs. (5,6):

- Ten patients who needed tissue expansion underwent endoscopic tissue expander placement.
- Incision of the skin to reduce the stresses of expansion forces, a remote incision, 1-2cm long, is made away from the defect site perpendicular (radial) to the implant and valve pockets. Sharp dissection is then performed through the incision using standard long narrow blade dissection scissors this is done to create a primary tunnel (optical cavity two inches in length one inch in width) to the planned expander site).
- A 10mm. sheath which is used for laparoscopic cholecystectomy is inserted through the incision. A laparoscope (10mm, 0 or 30 angle endoscope) which is attached to a camera, a monitor and a light source which are the same as used in laparoscopic cholecystectomy, was inserted through this sheath to visualize the optical cavity.

Another smaller incision (sometimes more than one) is made to introduce the instruments using port 5mm. it was found that its placement at one inch distance from the main incision allowed better manipulation of the instruments.

Through access portal (sometimes we use more than one) a scissors is introduced and used to dissect its way to the optical cavity until it is visualized by the scope. Then, the access portal(s) are connected to the optical cavity.

Statistical analysis:

Comparison between two groups as regarding:

- 1- Operative time.
- 2- Complications whether intraoperative as bleeding, difficult insertion of expanders and injury to skin flap or post-operative complications such as Hematomas, Seroma, Infection, Malposition, Valve exposure, Wound dehiscence.
- 3- Expansion time (time to full expansion).
- 4- Method of flap design and Cosmetic outcome.

Variables like age, operative time, the time taken for full expansion, and hospital stay length were recorded and analyzed. Patient charts were examined, and the data was evaluated to assess the results following open and endoscopic tissue expander procedures.

Results

Ten patients, three of whom had PBCA and seven of whom had PBS affecting the neck, chest wall, lower limb, and upper limb, had thirteen tissue expanders placed openly for reconstruction. Ten patients also had 14 expanders placed endoscopically in areas like the face, chest wall, and back; three of these patients had PBS, and seven had PBCA. (Table 1).

Operative time per expander placement was longer in the endoscopic group (100 ± 5 minutes) compared to the open group (75 ± 5 minutes). Table (2) and Diagram (1&2).

However, the endoscopic group had a shorter time to achieve full expansion (6-8 weeks) com-

pared to the open group (9-11 weeks). The hospital stay was also shorter in the endoscopic group (3-5 days) in comparison to the open method (5-9 days). The rate of major complications was significantly lower in the endoscopic group.

Table (1): Demographic data of patients in both groups.

	Endoscopic group (10)	Open group (10)
Number of expanders	14	13
Age ranges	(8 Y- 28 Y)	(6 Y- 31 Y)
Mean age	17.6	18.8
Sex	4 Females 6 Males	5 Females 5 Males

Table (2): Shows comparison between Operative time in both open and endoscopic groups.

Operative time	≤ 1 hour	1-2 hours	2-3 hours	≥ 3 hours	Operative time / Expander
Endoscopic Group	–	5 cases	4 cases	1 case	1.5-3 hours With mean = 100 ± 5 minutes
Open Group	1 case	7 cases	2 cases	–	1-2 hours With mean = 75 ± 5 minutes

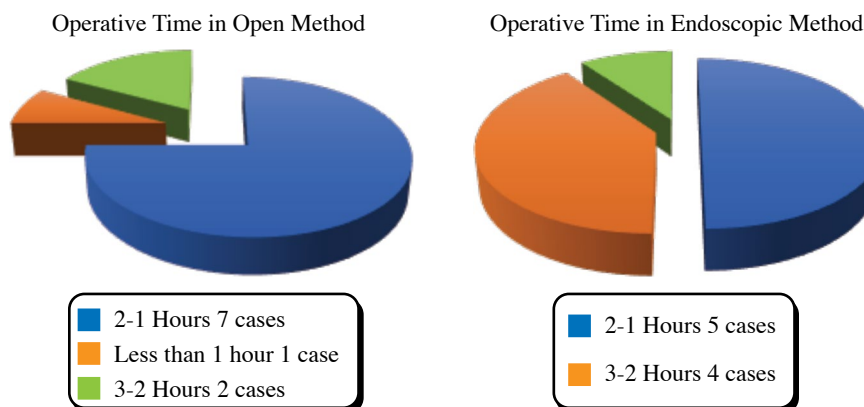
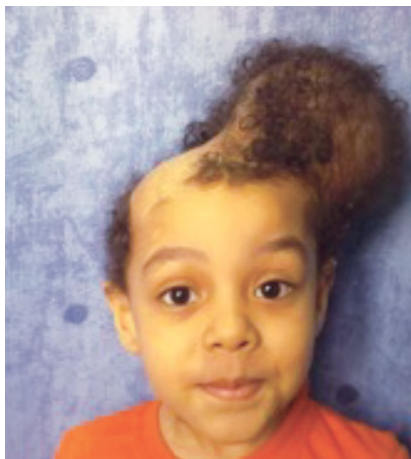
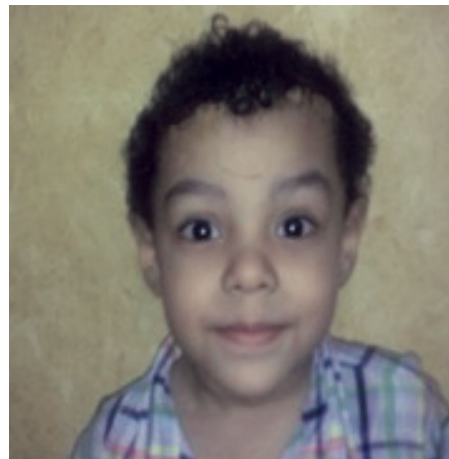


Diagram (1&2): Diagram showing operative time in both open and endoscopic groups.



Figs. (1,2): Photos of 7 years old male with post burn cicatricial Alopecia after endoscopic insertion of tissue expander and full expansion (Ant. & Lat. views).



Figs. (3,4): Postoperative photos (Lat. & Ant. Views).

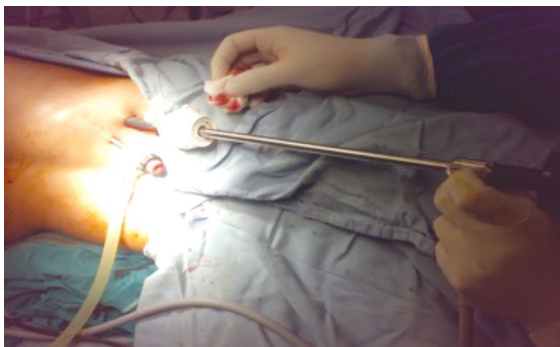


Fig. (5): This picture shows the introduction of port 10mm. for camera and port 5mm. for surgical instruments used for dissection.



Fig. (6): This picture shows retraction of tissues using Langenbeck retractor to maintain optical cavity for the endoscope.

Discussion

Endo-insertion of tissue expanders is a modification of the standard technique of tissue expanders implantation which can be used in treatment of different broad scars and burn [6].

Endoscopic tissue expander placement shares the same indications and contraindications as the open technique. There are no specific restrictions regarding the endoscopic procedure [7].

Tissue expanders can be placed using the endoscopic approach in any area where a soft tissue pocket can be created.

In contrast to the open group, the endoscopic group in this study did not experience a reduction in the total operating time for the placement of a tissue expander in a single patient. It was longer but gradually with increasing learning curve the operative time for endoscopic method was reduced. The mean operative time for endoscopic method were 100 ± 5 minutes compared to 75 ± 5 minutes in open method (Table 2). The open group was found to have a lower mean operative time for placement

per expander. However, with increasing experience in endoscopic technique we think that operative time will be reduced much more especially when we insert more than one expander from the same incision. The complications that were developed with endoscopic method were not related to the proper placement of the expander but were related to the process of expansion itself. On the contrary in open method these complications were related to the technique as wound dehiscence or infections. In case of endo-insertion, if dehiscence develops it was considered as minor complication and did not interfere with the completion of the process of expansion obtaining the desired expanded tissues [8].

It was approved that Infections were the most frequent complications in the open group (48.6%), while tissue-expander deflation was the most common complication in the endoscopic group (42.9%). Major complications in the endoscopic group included expander extrusion and deflation due to a needle puncture, both requiring replacement. When comparing the two approaches, the endoscopic group had a significantly lower major complication rate per expander (2.7%) than the open group (22.0%) [9].

In this study, surgical complications were; Infection (40% in open group versus 30% in endoscopic group). Haematoma (30% in open group versus 20% in endoscopic group). Implant exposure (40% in open group versus 10% in endoscopic group). Wound dehiscence (30% in open group versus no cases in endoscopic group). Expander leak

was happened in one case in open groups and did not happen in endoscopic group. Minor complications were more common in open group as transient pain related to inflation (40% in open group versus 10% in endoscopic group) and were usually related to the scar of previous insertion. Table (3) and Diagram (3).

Table (3): Comparison shows incidence of complications between open versus endoscopic methods of placement of tissue expanders.

Types of Complications	Open insertion of expanders	%	Endoscopic insertion of expanders	%
Infection	4	40%	3	30%
Haematoma	3	30%	2	20%
Implant exposure	4	40%	1	10%
Wound dehiscence	3	30%	No	–
Expander leak	1	10%	No	–
Valve exposure	No	–	1	10%
Seroma	3	30%	2	20%
Total	19		9	

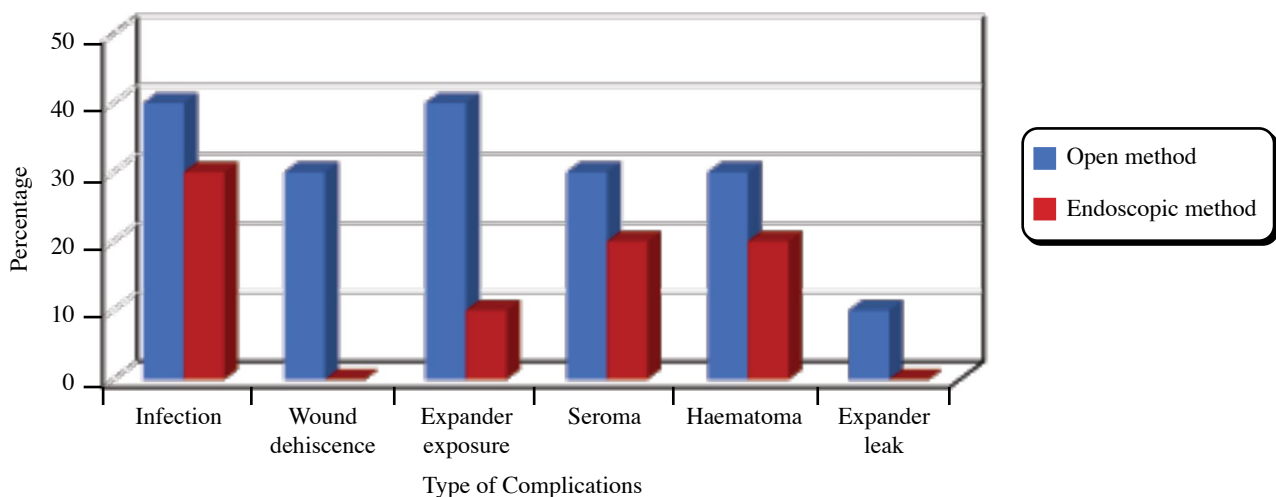


Diagram (3): Show incidence of complications of both groups.

According to the study's findings, the endoscopic group time to full expansion was significantly shorter than that of the open group (6–8 weeks vs. 9–11 weeks). It took three weeks less at the endoscopic group to reach full expansion. Since tissue expansion began immediately during the procedure, which involved three sessions per week, this result was anticipated. But expansion in open group started postoperatively 2–3 weeks at least with twice weekly schedule, this was due to remote and small incision used in endoscopic technique so no fear from wound dehiscence (30% in open versus 0% in endoscopic) also this reducing the incidence of capsule formation as there is no time to the capsule to be formed and becomes thick. On the contrary in the open technique waiting 2–3 weeks post-operative to give chance for wound healing

gives chance to the capsule to be formed and becomes thick. The endoscopic group quicker expansion initiation and faster tissue expansion were the causes of the difference in time to full expansion between the endoscopic and open groups. Furthermore, the endoscopic group spent three to five days in the hospital instead of five to nine days like the open group did.

Conclusions:

Using less invasive methods to place tissue expanders can speed up the reconstruction process overall by reducing discomfort, major complications rate, and the time required for full expansion. Improved visibility during surgery increases precision and lowers the risk of immediate problems like seroma and haematoma. Through the reduction

of tension on the wound margins, the remote incision site helps minimize late complications, such as extrusion. These results imply that less invasive techniques may lead to fewer problems. Larger defects can also be reconstructed more safely and effectively with fewer operations when several expanders are inserted through a single, tiny site.

References

- 1- Selvaprithiviraj V., Vaquette C. and Ivanovski S.: Hydrogel based soft tissue expanders for orodental reconstruction. *Acta. Biomaterialia.*, 172 (12): 53-66, 2023.
- 2- Yan Y., Fu R., Ji Q., Liu C., Yang J., Yin X., et al.: Surgical strategies for eyelid defect reconstruction: A review on principles and techniques. *Ophthalmology and Therapy*, Aug. 11 (4): 1383-408, 2022.
- 3- McNamara C.T., Iorio M.L. and Greyson M.: Concepts in soft-tissue reconstruction of the contracted hand and upper extremity after burn injury. *Frontiers in Surgery*, May 3; 10: 1118810, 2023.
- 4- Geoghegan L. and Nikkhah D.: Ten technical considerations revisited in tissue expansion. *Journal of Surgical Case Reports*, Aug. 2020 (8): rjaa273, 2020.
- 5- Pendharkar S.S.: Endoscopic Perspective in Oral and Maxillofacial Surgery. *RGUHS Journal of Dental Sciences*, 15, 2023.
- 6- Alharbi Z.I., Moshref L.H., Badr R.E., Zahran O.A., Almaghrabi M.T. and Khamis S.F.: Post-Burn and Surgical Scar Reconstruction with Tissue Expanders: Review of the Literature and Our Local Experience. *Reports*, Dec. 21; 7 (1): 1, 2023.
- 7- Van Wanrooij R.L., Bronswijk M., Kunda R., Everett S.M., Lakhtakia S., Rimbas M., Hucl T., Badaoui A., Law R., Arcidiacono P.G. and Larghi A.: Therapeutic endoscopic ultrasound: European Society of Gastrointestinal Endoscopy (ESGE) technical review. *Endoscopy*, Mar. 54 (03): 310, 2022.
- 8- Manasyan A. and Johnson M.B.: Endoscopic Tissue Expander Implantation in Post-Burn Reconstruction: A Review of the Literature. *Journal of Burn Care & Research*, 2024. Jun 1: irae097.
- 9- Dong C., Dong L., Yu Z. and Ma X.: Endoscopy-assisted versus open tissue expander placement in plastic and reconstructive surgery: A meta-analysis. *Journal of Plastic Surgery and Hand Surgery*, Feb 28; 57 (1-6): 193-201, 2023.