

## Original Article

### The use of recycled tissue expander in soft-tissue reconstruction: our experience in a resource-constrained setting.

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#### Abstract

**Background:** Reconstruction of scar excision defects with expanded flaps is a veritable option in reconstruction but unaffordable to patients in resource-poor settings. The recycling of the expanders is avoided for fear of infection. The study presents our preliminary experience with recycled tissue expanders in a resource-constrained setting.

**Patients/Methods:** This is a retrospective study of all patients who had tissue expansion using recycled expanders. The expanders were sterilized by boiling intermittently in sterile water over 12 hours and washed with ceftriazone just before surgery.

**Results:** A total of 14 expanders were used in all female patients with mean age of 25 years. About 71% of cases had successful expansion while 29% had implant extrusion of which only 7% was severe and had termination of expansion.

**Conclusion:** The success with recycled tissue expanders presents an opportunity to offer a reconstructive care to resource-constrained patients and improve the volume of patients undergoing expansion.

**Keywords:** Recycled expanders, Resource-poor settings, Scar defect reconstruction

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#### Introduction

Scars arising from various forms of soft tissue injuries affect forms or function of different parts of the body and constitute a major reconstruction challenge to the reconstructive plastic surgeon. They are usually as a result of poorly managed wounds. These wound burdens are themselves a form of neglected epidemics in the developing nations.[1] A major factor that contributes to poor wound management and eventual development of unsightly scars is the paucity of work force especially in the specialty of reconstructive and aesthetic plastic surgery in Nigeria who are routinely faced with this daunting task [2]. The impact of function limiting scars on the work force remains disturbing in the resource poor nations where the affected persons are mainly in the active age group.[3]

The reconstruction of wounds and defects caused by excision of these scars is currently done with several options with their respective merits and demerits. These include direct closure, split thickness and full thickness skin grafting techniques, pedicled and free

flaps, and the use tissue expansion techniques, which make up the reconstructive tool box.[4] The use of split-thickness skin graft though the commonest reconstruction modality employed by the plastic surgeons especially in the developing countries has limitations in which the need for a flap reconstruction often arises.[5,6] The use of flap option in reconstruction on the other hand is a highly preferred modality where applicable due to provision of sensate, stable cover, with aesthetic superiority.[7] Many flap options exist in the armamentarium of the reconstructive plastic surgeon for managing these defects. The common types are broadly classified as pedicled and free flaps respectively. Both free and pedicled flaps could be raised as expanded flaps exist which is produced by tissue expansion technique to achieve adequate size for complete coverage.[8]

Tissue expansion is a technique that expands soft

tissues to attain an optimal aesthetic and functional size required to achieve coverage of defects when direct closure is not feasible.[8] This modality in addition to providing sensate, stable and aesthetically stable flaps, also ensures contour and colour match.[9] The expanded flaps also have vascular superiority over the non-expanded immediate flap counterparts, and are thinner and more pliable. It was first introduced by Neumann and later popularized by Charles Radovan.[9,10] It has found application in different soft tissue defect reconstruction of the craniofacial, truncal regions and the breast. It is also used in upper extremities but very rarely in the lower extremities.[9]

Tissue expanders are a form of implant with their attendant complications.[10] Of these complications, infections are major disaster that should always be prevented. It is one reason they have been employed in a non-reusable manner. However, the cost of procuring the tissue expanders is relatively high and unaffordable to the majority of the patients in the resource-poor setting.[11] They are therefore not readily available even when their needs are obvious. This therefore creates a need for an affordable and readily available alternative. We therefore resorted to recycling of the tissue expanders to obviate the constraint placed by cost. The aim of this was to compare the infection profile in the application of the recycled tissue expanders with the single use tissue expanders. We therefore wish to share our experience and challenges in using recycled tissue expanders in achieving soft tissue coverage of defects in a resource poor setting. The idea of reusing tissue expanders have been advocated for developing nations by researchers and practitioners in other climes who have also practiced the concept. [12,13]. It was also advocated that used expanders be therefore sent the developing countries to ease the financial challenges in procuring new ones.[13]

### Patients and Method

The study is a three year retrospective survey of patients who had tissue expansion using recycled tissue expansion from January 2010 to December 2012. Patients' folders were retrieved from the medical records department of the hospital. All single use expanders were excluded from the study. Data from the case notes were extracted using a proforma designed for the study. Expanders were of varied sizes ranging from 70cc to 500cc chosen to match the patient and the size of the defect preoperatively. All expanders were textured with remote filling ports. They had not been used on patients with chronic infections like hepatitis B or C viruses, or retroviral disease. The expanders were boiled intermittently in water at 100°C for about 10 minutes and allowed to cool for about 1 hour and the cycled repeated continually over a period of 12hour. This method was adapted by the researchers as a modification of Tyndallization to reduce number of days and duration of heating viz-a-

viz the effect of heating on the expander[14]. On the day of surgery the expanders were washed ceftriazone constituted with sterile water at 1gm of the drug per expander. A preliminary microbiological study showed negative growth on the inner and outer parts of the expanders.

All procedures were done under general anesthesia with endotracheal tubes. Strict aseptic cleaning and draping were carried out. Strict asepsis was observed throughout the procedures. Prophylactic parenteral antibiotics were given at the induction of anesthesia. Incisions were made in the vicinity of the defect and pockets created with blunt dissection with incremental sizes of Hegar's dilators. The pockets were all located in the subcutaneous plane[7,9]. Haemostasis was ensured and the pockets washed with antibiotic solutions. The expanders were inflated to 10-20% of their volume. Wounds were closed in two layers with simple interrupted technique. All procedures were carried out by the most senior consultant of the unit. Post-operative antibiotics were given for 7-10 days. Wound inspection was done on the post-operative day 4. Patients were discharged home if there was no wound complications and given 2 weeks appointment for removal of stitches and subsequent expansion. Wounds with any form of complication necessitated continuing in-patient care till properly managed. Wound dressings were subsequently changed on alternate day basis. Expansion was commenced after wounds have healed. Complications observed were managed accordingly with procedure continuing in minor cases but aborted in the major cases.

### Ethical Considerations

Ethical clearance was obtained from the Research and Ethics Committee of National Orthopaedic Hospital Enugu to conduct the study and report on these cases. The selected patients had given informed consent for the procedure, for clinical photography and eventual publication without disclosing their identity.

### Results

A total eight patients had tissue expansion with recycled expander over the period. Records of two were missing and could not be included in the study. Six patients managed with a total of 14 expanders were analyzed all of whom were females with age range of 24 years to 28 years and the mean age of 25 years. Indications were mainly due to abnormal scars resulting either from burns or road traffic accident. One was due plexiform neurofibroma excision scar.(Table 1) The upper limb had the highest number of expanders while the trunk had the least.(Table 2) The length of stay and the mean duration of commencement of expansion was similar for other parts of the body except the head which is about half the duration for others.(Table 3)

**Table 1: Indications**

S/No	Indications	Frequency	Percentage
1	Post-burn Scars	3	50%
2	Hypertrophic Scars following Road traffic Accident	2	33%
3	Facial plexiform neurofibroma excision scars	1	17%
4	Total	6	100%

**Table 2: Expander distribution at various sites**

Region of the body	No of expanders	Percentage
Scalp	4	29
Neck	2	14
Upper trunk	2	14
Upper limb	6	43
	14	100

**Table 3: post-operative hospital stay and average period of commencement of out-patient expansion**

Site of expander	Average hospital post-operative stay	Average time of commencement of out-patient expansion post surgery
Head	3.5 days	8 days
Neck	14 days	15.5 days
Upper trunk	8 days	15 days
Upper limb	10 days	15 days

Minor complications observed were expander migration(33%), hematoma(33%), valve leaks (16%), swelling(16%), and epidermal necrosis (16%).(Table 4) There was expander extrusion in 4 out of 14 implants used necessitating premature termination of expansion and outright removal of the expander. In one of the four, there was severe infection. Another patient who had the procedure done in the upper limb developed a wrist drop, necessitating termination of further tissue expansion. However the already expanded flap was adequate for the reconstruction.

Successful reconstruction was achieved in 10 out of the 14 expanders (71.4%) involving 4 out of the 6 patients (66.7%). Patients were all satisfied with the successful outcome and the reduced cost of care.

### Discussion

Unightly scars may affect either form or function. The growing interest in appearance has necessitated revision of most socially visible scars. All the patients in the study were females. This is not unconnected to their higher aesthetic concerns. It is similar to indications found in other published re-

ports.[11,15] The average age was 25 years which is a time of image consciousness. And also it is a time of excellent wound healing potentials.

The use of tissue expansion to resurface scar excision defect is one of the modalities currently applied in scar revision procedures. This among other factors might have contributed to the relative increase in both the demand and the cost of procuring tissue expanders making it more difficult for economically constrained patients to benefit in the procedure. This notwithstanding, tissue expansion remains a highly sought option of scar reconstruction partly because of its advantages in providing a cover with color and contour match as well as its ease of use in setting where free tissue transfer skills are not readily available.[7] Our environment is therefore one that could benefit maximally from tissue expansion option soft tissue reconstruction. Yet the practice has been limited by both cost and consequently, the availability of the tissue expanders. Our choice of recycled tissue expanders was to obviate the challenges of the cost of procuring the expanders though not without the fears of infective complications.

Generally, complications in tissue expansion varies from 13-40%[10]. The complications in this study affected 28.5% of tissue expanders which is similar to the rate observed in another study [10]. They all had implant extrusion which led to the outright termination of the process according to the tradition [7]. The implant extrusion might be related to the pressure necrosis and the poorer blood supply in the subcutaneous layer compared to the sub-fascial plane. The resultant ulceration exposed the implants. The extrusion might have been mitigated if the implants had been placed sub-fascially as against subcutaneous placement used in this study.[16]

There was only one case that had a major infective complication in the study. This low infective complication is very similar to the rate of infective complications in other studies [7,17]. In the sub-saharan Africa one might expect higher infection rate being a tropical sub-region with high temperature and humidity that support faster bacterial colonization.[18] There was however paucity of literature to show any peculiar pattern of infective complication in the sub-region. The use of recycled tis-

sue expanders was not documented in the sub-region either. More so, the financial backwardness of the region and absence of adequate health insurance coverage endears this option which evades this financial demand.[19]

To further reduce the likelihood of infection in recycled tissue expanders, the option of extended antibiotics may be used. This protocol has been recommended in another published work.[20] When infections are not significantly different from the single use practice, the recycling may be encouraged in the economically constrained settings.

This study however is limited by the sample size as well as by being a single centre and a retrospective study. Multicenter, large volume, prospective studies are therefore recommended to establish the value or otherwise of the use of recycled tissue expanders in reconstruction in resource poor settings.

#### **Conclusion**

The success with recycled tissue expanders which are sourced at relatively no added cost to the patient presents an opportunity to offer reconstructive services to the resource constrained patients who are usually not covered by health insurance services in developing countries. This would improve the practice of tissue expansion in the sub-region while not putting added cost on the patients.

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#### **Conflict of interest**

We declare that there was no conflict of interest affecting this study.

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