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PROSPECTIVE STUDY ON THE SELECTION OF NEWER MODALITIES OF SKIN DERMATOME INSTRUMENTS TO CAUSE OPERATIVE SURGEON COMFORT AND TO STUDY THE DONOR SITE MORBIDITY IN SELECTED CASES OF MAXIMUM 20% SURFACE TISSUE LOSS

Plastic Surgery

Dr. Narendra Naik Associate Professor, Department Of General Surgery, Mgm Medical College And Hospital Navi Mumbai.

Dr. Samit Doshi 3rd Year PG Resident, Department Of General Surgery, Mgm Medical College And Hospital Navi Mumbai.

Dr. Sukhdev Adhikari* Consultant General Surgeon, Department Of General Surgery, Mgm Medical College And Hospital Navi Mumbai. *Corresponding Author

Dr. Alauddin Tungekar Consultant General Surgeon, Department Of General Surgery, Mgm Medical College And Hospital Navi Mumbai.

ABSTRACT

Skin graft is one of the most indispensable techniques in the field of plastic surgery and dermatology. Skin grafts are used in many clinical situations such as traumatic wounds, defects after surgical resection, burn reconstruction, scar and contracture release, congenital skin conditions, vitiligo, reconstruction of nipple-areola complex. There are three basic types of skin grafting instruments that have been designed to remove a split-thickness skin from the donor site- skin grafting handle and the electrical dermatome. The choice of instrument depends on the surgeon's comfort and experience. This prospective study of 50 patients is conducted at MGM Hospital Navi Mumbai, on the selection of newer modalities of skin dermatome instruments to cause operative surgeon comfort and to study the donor site morbidity in selected cases of maximum 20% surface tissue loss. In our study, the use of each blade and electric dermatome by trainee and trained surgeons respectively were compared based on the comfort level of the trainee and trained surgeons. In our study, trainee surgeon comparison score based on comfort level when used blade or electric dermatome for skin grafting showed that 50% have a good comfort level when used blade, 100% have a poor comfort level when used electric dermatome for skin grafting. In our study, trained surgeon comparison score based on comfort level when used blade or electric dermatome for skin grafting showed 100% have a good comfort level when used blade, 83.3% have a good comfort level when used electric dermatome for skin grafting and 16.6% have an average comfort level when used electric dermatome. In our study, donor site morbidity that is formation of hypertrophic scar at the donor site is less when used electric dermatome in comparison to blade, when particularly used by trained surgeon in comparison to trainee surgeon, as the trained surgeons have experience and skill. Our study showed that electric dermatome is used for wider areas of skin grafting, with less donor site morbidity and a good comfort level when used by trained surgeon, but an expensive instrument.

KEYWORDS

Blade, Dermatome, Trainee, Trained, Grafting

1. INTRODUCTION

1.1 Skin graft is one of the most indispensable techniques in the field of plastic surgery and dermatology.

1.2 Reverdin first performed skin auto-transplantation in 1869, many pioneers tried to improvise in the field of grafting[1].

1.3 Skin grafts are used in many clinical situations such as traumatic wounds, defects after surgical resection, burn reconstruction, scar and contracture release, congenital skin conditions, vitiligo, reconstruction of nipple-areola complex[2].

1.4 The principle of skin grafts is to take skin from a donor site that will heal and transfer the skin to an area of requirement.

1.5 There are three basic types of skin grafting instruments that have been designed to remove a split-thickness skin from the donor site- knife, drum type dermatome and the electrical dermatome[3].

1.6 The choice of instrument depends on the surgeon's comfort and experience.

1.7 Knives are generally popular with the Great Britain surgeons, whereas dermatomes are preferred in North America[4].

1.8 The principle on which all these instruments are based is that of sharp blade moves back and forth to cut a skin piece whose thickness is controlled by the instrumental calibrated setting or by the surgeon[4].

1.9 This prospective study is conducted on the selection of newer modalities of skin dermatome instruments to cause operative surgeon comfort and to study the donor site morbidity in selected cases of maximum 20% surface tissue loss.

2. AIMS AND OBJECTIVES

2.1 AIM-

The aim of this study is to improve the skill of the trainee surgeons in a teaching institution and make them aware about case and instrument selection in the cases of skin grafting.

2.2 OBJECTIVES-

2.21 To compare the operative surgeon comfort in handling various skin dermatomes.

2.22 To compare the donor site morbidity.

2.23 To compare the cost effective instrument.

2.24 To compare the operative result by use of different dermatomes in same patient.

3. MATERIALS AND METHODS

3.1 Type of Study: Prospective Randomized Comparative Study

3.2 Place of Study: MGM Medical College and Hospital, Navi Mumbai

3.3 Period of Study: October 2021 to March 2022

3.4 Institute Ethics Committee approvals and consent will be obtained before the start of the study

3.5 Sampling type- Simple random sampling technique.

3.6 Sampling method- Convenient sampling.

3.7 Statistical analysis plan and data will be collected by using standard tool and stored in MS excel. Basic descriptive statistics like frequency, percentage, mean, mode, median, standard deviation and graphs will be prepared by using MS excel.

3.8 To test the significance 0.01 or 0.05 in the level of significance will be used for parametric and non-parametric tests.

3.9 To test the test of significance statistical package SPSS24 will be used.

3.10 Size= 50 cases

3.11 Instruments used-
1) Small and large skin grafting handle.
2) Electric Dermatome.

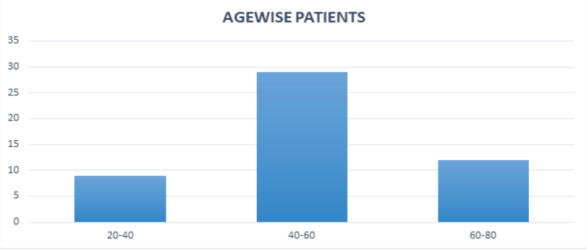
3.11 Plan Of Study:
All cases with raw area of maximum 20% of body surface area due to infection and trauma.

4. Inclusion Criteria And Exclusion Criteria
4.1 Inclusion Criteria-
1) Maximum raw area of 20% of body surface area due to infection and trauma.

4.2 Exclusion Criteria-
1) Raw area due to burns.
2) Patient who do not consent to participate in the study.

5. OBSERVATIONS AND RESULTS
1) AGE GROUP-
TABLE 1-

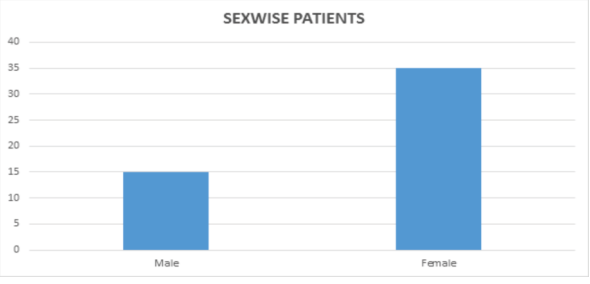
AGE GROUP	NO. OF PATIENTS
20-40	9
40-60	29
60-80	12



GRAPH 1-

2) SEX-
TABLE 2-

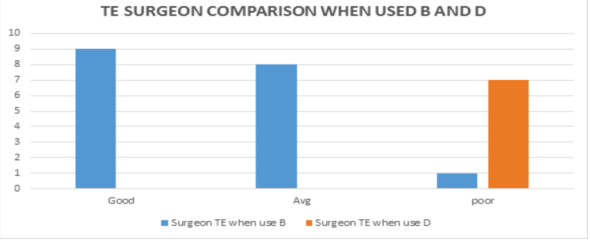
SEX	TOTAL
MALES	15
FEMALES	35



GRAPH 2-

3) TRAINEE SURGEON COMPARISON-
TABLE 3-

COMFORT LEVEL	TE WHEN USED B	TE WHEN USED D
Good	9	0
Avg	8	0
Poor	1	7

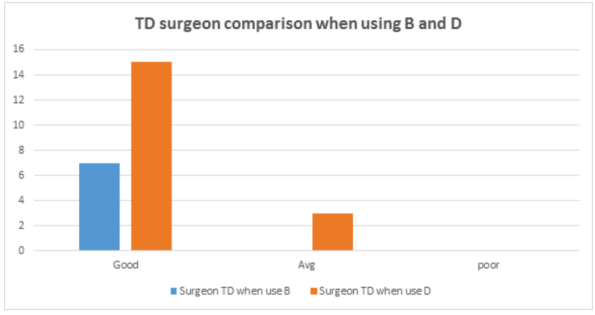


GRAPH 3-

TE- Trainee, B- Blade, D- Dermatome, Avg- Average

4) TRAINED SURGEON COMPARISON-
TABLE 4-

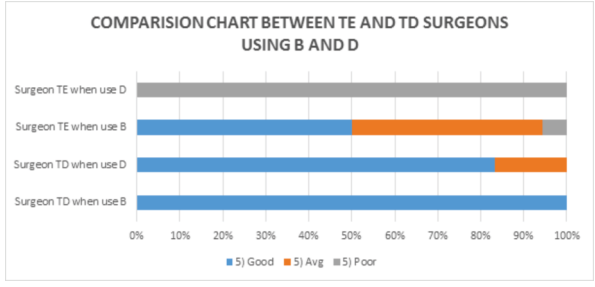
COMFORT LEVEL	TD WHEN USED B	TD WHEN USED D
Good	7	15
Avg	0	3
Poor	0	0



GRAPH 4-
TD- Trained, B- Blade, D- Dermatome, Avg- Average

5) TRAINEE AND TRAINED SURGEONS COMPARISON USING BLADE AND DERMATOME
TABLE 5-

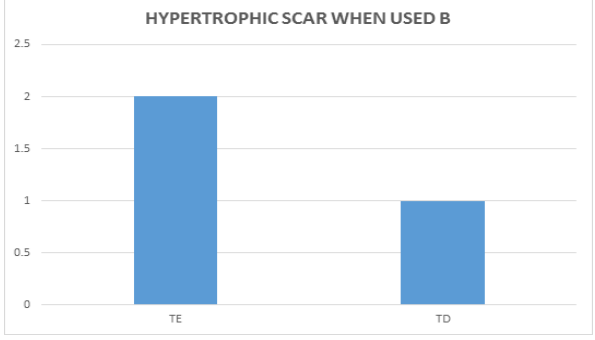
COMFORT LEVEL	TD WHEN USED B	TD WHEN USED D	TE WHEN USED B	TE WHEN USED D
Good	7	15	9	0
Avg	0	3	8	0
Poor	0	0	1	7



GRAPH 5-
TE- Trainee, TD- Trained, B- Blade, D- Dermatome, Avg- Average

6) DONOR SITE MORBIDITY WHEN USED BLADE
TABLE 6-

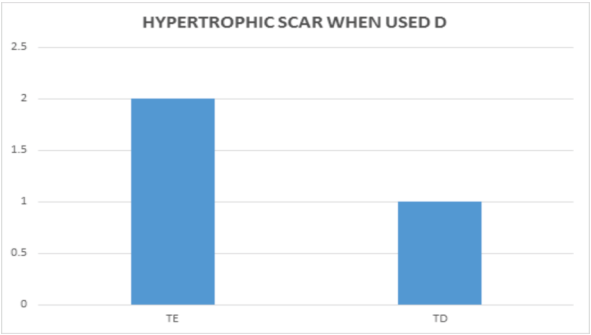
DONOR SITE	TE	TD
HYPERTROPHIC SCAR	15	5



GRAPH 6-
TE- Trainee, TD- Trained, B- Blade

7) DONOR SITE MORBIDITY WHEN USED DERMATOME
TABLE 7-

DONOR SITE	TE	TD
HYPERTROPHIC SCAR	2	1



GRAPH 7-
TE- Trainee, TD- Trained, D-Dermatome

5.1 All the patients included in the study were comparable for age. Majority of the patients were in the age group of 40-60 years followed by 60-80 years of age. The results were displayed in table 1 and graph 1.

5.2 All the patients included in the study were comparable for sex. 70% were females and 30% were males. The results were displayed in table 2 and graph 2.

5.3 The results displayed in table 3 and graph 3 shows trainee surgeon comparison score based on comfort level when used blade or electric dermatome for skin grafting. 50% have a good comfort level when used blade, 100% have a poor comfort level when used electric dermatome for skin grafting.

5.4 The results displayed in table 4 and graph 4 shows trained surgeon comparison score based on comfort level when used blade or electric dermatome for skin grafting. 100% have a good comfort level when used blade, 83.3% have a good comfort level when used electric dermatome for skin grafting and 16.6% have an average comfort level when used electric dermatome.

5.5 The results displayed in table 5 and graph 5 shows trained and trainee comparison score based on comfort level when used blade or electric dermatome for skin grafting. So the results conclude that in our study trained surgeons have a good comfort level when used blade and electric dermatome for skin grafting that is 100% and 83.3% respectively, trainee surgeons have a good comfort level when used only blade that is 50% and 100% have a poor comfort level when used electric dermatome for skin grafting.

5.6 The results displayed in table 6 and graph 6 shows donor site morbidity when used blade that is formation of hypertrophic scar at the donor site by trainee and trained surgeons. 15 patients developed hypertrophic scar when used blade by trainee surgeons, 5 patients developed hypertrophic scar when used blade by trained surgeon.

5.7 The results displayed in table 7 and graph 7 shows donor site morbidity when used electric dermatome that is formation of hypertrophic scar at the donor site by trainee and trained surgeons. 2 patients developed hypertrophic scar when used electric dermatome by trainee surgeon, 1 patient developed hypertrophic scar when used electric dermatome by trained surgeon.

Thus, the chances of development of hypertrophic scar (donor site morbidity) is much less when used electric dermatome compared to blade. Trained surgeons have greater experience and skills as compared to trainee surgeon, thus there is less development of hypertrophic scar (donor site morbidity) when used particularly electric dermatome by trained surgeon.

6. DISCUSSION

6.1 Skin grafting is a fairly modern addition to the field of surgical therapy[5].

6.2 The majority of skin grafting has been performed in the last century, although its roots have been originated in Indian ancient times[5].

6.3 Mutilations of the ear, nose and lip were being treated as early as 2500 BC with the utilization of free gluteal pad of fat and skin grafts[5].

6.4 Besides using the pedicled flaps in nasal reconstruction, the Tilemaker caste in India are said to have successfully making use of free skin grafts, including the subcutaneous fascia taken from the gluteal region, after it had been beaten with the slippers made of wood until a considerable amount of swelling had taken place. They eventually used a secretive cement for the adhesion to develop, to which was ascribed specialized healing power. This was known as the "Ancient Indian Method" and was the earliest history of free whole-thickness grafting[6].

6.5 G. Baronio (1759-1811), a known physiologist, performed various experiments in 1804. He transferred various thickness of skin of various shapes and sizes at variable time intervals from the side of the root of sheep tail to the contralateral side. All the graft uptakes were successful and they bled when cut into 2 weeks after transplantation[6].
6.6 Sir Astley Cooper removed the skin from an amputated thumb and used it to cover the defect of stump in 1817[7].

6.7 Reverdin (1824-1929), a Swiss surgeon, reported to the Societe Imperiale de Chirurgie in Paris, in 1869, on the hastening of the granulation wound healing by means of small detached bits of transplanted skin called "epidermic grafts"[8].

6.8 John Reissberg Wolfe in 1875, of Glasgow, reported the successful repair of a defect about the lower eyelid with a free whole-thickness graft measuring 2.5cm x 5cm from the arm aspect[4].

6.9 Ash in 1870, Ollier in 1872 and Theirsch in 1886 used the split-thickness skin graft, the depth of the graft harvest has been recognized as an important factor in the healing of donor site. This led to a development of intruments with the ability to control thickness of the graft to some extent[9].

6.10 Initially attempts to harvest the split thickness skin grafts were performed by knives that were simply long cutting blades with a handle at one end without any adjustable mechanism to control the thickness of the graft. Blair knife, Catlin knife and Ferris-Smith knife were certain examples[10].

6.11 Humby evolved a machine that appeared to obviate all the obstacles in cutting skin grafts of appropriate size and appropriate thickness. It consisted of a rigid rectangular framework with limb strapping. Tiny needles on a crossbar allow stretching of the skin surface, while a simple ratchet mechanism adjusts the degree of tension[11].

6.12 Humby then described a modified graft cutting razor, discarding the original large frame to steady the skin and returned to a solid blade that required sharpening. The knife had a rod with two adjustable screws on the superior surface to control the graft thickness while the width was determined by the pressure on the knife.

6.13 Denis Charles Bodenham introduced a replaceable blade for utilization in carriers equivalent to the standard Blair and Humby knives. This new blades could be easily changed, obviating the need for tedious sharpening that was previous required. The advantage of the blade is that it gives a much cleaner cut with minimal drag from bluntness. As a result, the adjustment markings present on the knife gives a setting that tends to vary with different blade sizes, and reliance on the markings will give inconsistence of graft thickness[12].

6.14 Dr. Earl Padgett, in 1939, aided by his engineering co-worker George J. Hood, developed a semi-cylindrical dermatome. It was based on the adhesion and traction principle and gave the surgeon a reliable instrument to cut accurately a uniform skin sheet of thickness 4" x 8" size. Reese constructed a more developed and refined dermatome, permitting a greater accuracy and graft thickness control[13].

6.15 Harry M. Brown, developed a new instrument, the electric dermatome. The original Brown electric dermatome and various modifications of it, developed in the United States and England, permit the rapid removal of long strips of split thickness skin, an advantage for grafting in a patient with burns[14].

6.16 The Reese dermatome, is a modification of Padgett dermatome. The thickness of the cute is determined by shims that are inserted with the blade to determine the graft thickness. The thickness calibration is more reliable than with the Padgett dermatome[15].

6.17 The Brown dermatome was the first electric dermatome to be developed, it is extremely valuable because a large amount of skin can be cut rapidly and do not require cement[4].

6.18 The Stryker and Padgett electric dermatomes are similar to Brown dermatome and the applications of these instruments are also similar.

6.19 The Castroviejo dermatome is an electric-keratotome developed by Castroviejo Briones (1904-1987). He designed it for the dissection of the lamellar corneal grafts, it has also proved useful for cutting buccal mucosal grafts for the treatment of eyelid and socket deformities. It is also used to shave of small tattoo remnants in the residual areas[16].

6.20 Thus the obstacles obtaining grafts of consistent thickness and quality led to various modifications in the field of skin grafting, which paved the way for more sophisticated instruments.

6.21 These skin grafting instruments form one of the basic tools and requirements of the plastic surgeons, and their evolution marks the development stages of the plastic surgery field specialty as a whole.

6.22 In our study the use of each blade and electric dermatome by trainee and trained surgeons respectively were compared based on the comfort level of the trainee and trained surgeons.

6.23 Thus, in our study electric dermatome showed a good comfort level when used by the trained surgeons and a poor comfort level when used by the trainee surgeons whereas the blade showed a good comfort level by both the trainee and trained surgeons.

6.24 In our study, electric dermatome showed less donor site morbidity that is hypertrophic scar formation at the donor site compared to blade. Trained surgeons have a greater experience and skill in comparison to trainee surgeons, thus less chances of development of hypertrophic scar when particularly used electric dermatome.

7. CONCLUSION

7.1 In our study, the use of each blade and electric dermatome by trainee and trained surgeons respectively were compared based on the comfort level of the trainee and trained surgeons.

7.2 In our study, trainee surgeon comparison score based on comfort level when used blade or electric dermatome for skin grafting showed that 50% have a good comfort level when used blade, 100% have a poor comfort level when used electric dermatome for skin grafting.

7.3 In our study, trained surgeon comparison score based on comfort level when used blade or electric dermatome for skin grafting showed 100% have a good comfort level when used blade, 83.3% have a good comfort level when used electric dermatome for skin grafting and 16.6% have an average comfort level when used electric dermatome.

7.4 In our study, donor site morbidity that is formation of hypertrophic scar at the donor site is less when used electric dermatome in comparison to blade, when particularly used by trained surgeon in comparison to trainee surgeon, as the trained surgeons have experience and skill.

7.5 Thus our study showed that electric dermatome is used for wider areas of skin grafting, with less donor site morbidity and a good comfort level when used by trained surgeon, but an expensive instrument.

Conflicts Of Interest- NONE
NO FUNDING REQUIRED

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