LOCAL FLAPS AND SPLIT;
SENSORY DEFICIT IN TERM OF TWO POINT DISCRIMINATION (TPD) THICKNESS SKIN GRAFTS (STSG)

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ABSTRACT… Background: Two point discrimination (TPD).is the minimum distance between two stimulus points on the skin, which are perceived as distinct points, Among the two types of TPD i.e., static and dynamic, static two-point discrimination (STPD) is commonly used to determine digital nerve integrity. Local flaps usually do well in maintaining sensibility of the covered area in terms of two point discrimination in contrast to s-plit thickness skin grafts (STSG). **Objective:** The objective of this study was to determine the frequency of sensory deficit in terms of TPD in STSG and local flaps for soft tissue defects of fingers after three months. **Study design:** It was a Quasi experimental study. **Settings:** Patients admitted in the indoor of Plastic surgery department, Services Hospital Lahore. **Period:** February 2009 to January 2010. **Material and Methods:** Thirty five patients underwent local flap coverage and other thirty five underwent split thickness skin grafting for soft tissue defects of fingers depending upon nature of defect. Patients were followed up at 2, 4, 8 and 12 weeks. **Results:** The sensory deficit observed at the end of 12th week post operatively was in 8.6% of the patients with local flap coverage (3 patients) and 45.7% of those with STSG (16 patients). Patients with no sensory deficit were 91.4% (32 patients) in the local flap coverage and 54.3% (19 patients) in the STSG at 12th week of follow up. The relative ratio of sensory deficit in local flaps and STSG was 5 (>2). **Conclusions:** The results of this study show that Local flaps are better options in terms of TPD preservation as opposed to STSG for soft tissue defects of fingers.

Key words: TPD, STSG, Local flaps.

INTRODUCTION

Hand is a structure with finely articulated cantilever digits radiating from a fixed semicircular carpal base, arranged and endowed for prehension by precision movement, strength, and sensibility - so perfect in design, that little change or specialization was needed for compliance and adaptability to the creativity so essential in human cultural development[1].

Hands are more involved in performing daily activities thus rendering them to trauma or other injuries. These injuries can be as trivial as minor cuts to more complex ones that encompass soft tissue defects, fractures, tendon cuts or even amputations[2].

Detailed account of these injuries must be made before embarking on to their treatment. Soft tissue defects require special attention as the skin is the prime organ for sensation. Of these sensations, two point discrimination is a unique ability of the skin to discriminate two simultaneous stimuli[3].

Two-point discrimination testing in human subjects is a reasonably easy clinical procedure and also a reliable method available for evaluating tactile gnosis in human subjects[4].

Various options exist in treating soft tissue defects of fingers. These include skin grafts (full or split thickness), local flaps (e.g. Z-plasty, V-Y advancement, cross finger flap etc), regional, distant and free flaps[1]. These various options have different cosmetic and functional outcomes (motor & Sensory).

Skin graft is part of skin of varied thickness (FTSG or STSG) that is removed from the donor site and is attached or transplanted to the recipient site[1]. Due to this translocation of part of skin, grafts have a decreased number of mechanoreceptors unlike flaps that not only retain their blood supply but also a greater number of sensory receptors[5].

Flap is defined as the tissue that carries its own blood supply to the recipient site with exception of free flap that

requires microvascular anastamosis at the recipient site[1]. Skin grafting may be a simple procedure as compared to flaps but the local flaps not only have superior cosmetic results,[1,6,7] they also prove to be better options in terms of blood flow and TPD[5].

This study focuses on determining the frequency of sensory deficit in terms of TPD, when local flaps or STSG are employed in the coverage of soft tissue defects of fingers.

MATERIAL AND METHODS

Study was conducted in the department of Plastic Surgery, Services Hospital, Lahore and total 70 patients were analysed from febuary 2009 to January 2010.

Sample of 35 patients in each group. With 8% margin of error, 80% power of study taking expected percentage of sensory deficit of 30% with STSG and 3.5% with local flaps.Study design was Quasi experimental and sample size was non probability purposive sampling

Inclusion and exclusion criteria: Patients of thirteen to sixty years of age, belonging to either gender, with soft tissue defects of fingers due to burns, trauma or others determined by inspection and physical examination were included in the study.

Patients with soft tissue defects more than 3cm either due to injury or as a result of release of contractures, patients with injuries of fingers involving neurovascular bundle on clinical examination and diabetic patients with peripheral neuropathy.were exluded

Data Collection

Patients who fulfilled the inclusion criteria were recuruted.Informed consent obtained. Soft tissue defects measured in cm by measuring tape. The surgery performed either with fasciocutaneous local flaps; obtained from neighboring finger or dorsum of hand or STSG that was taken by humbies knife blade containing epidermis and variable thickness of dermis. Flaps utilized if bone or tendons were bared and STSG for finger defects involving skin only. The flap donor site closed primarily or covered with split thickness skin graft. Post operatively TPD assessed by using pre-bent set of paper clips set at a distance of 7 & 8mm, at the flap and the STSG at 2, 4, 8 and 12 weeks. Values up to 7mm considered as normal while values equal to or more than 8mm considered as sensory deficit. Effect modifiers like mode of injury, nature and size of defect addressed through stratification.

The qualitative variables like sex, nature of defect and sensory deficit in both groups presented as frequency, percentage and proportions. Relative ratio(RR) evaluated to see the strength of association of TPD between the two groups. RR >2+ considered significant.

RESULTS

A total of 70 patients with soft tissue defects of fingers were included in this study from February 2009 to January 2010. Patients underwent surgery on the basis of soft tissue defect of fingers. Patients with skin defects underwent STSG where as patients with deeper defects underwent local flap coverage.

The frequency of male gender was 45 (64.3%) and female gender was 25 (35.7%) The frequency of age was highest in age group of 10-20 yrs with frequency of 35 (50%) and was least in the age group of 41-50yrs with frequency of 2 (2.85%) with a mean of 22.47 (SD=11.431) (Table I).

The frequency and percentages of mode of injury being 21 (30%) for trauma, 32 (45.7%) for burns and 17 (24.3) for others causes (Table II). The frequencies and percentages for nature of defects were 43 (61.4%) for skin only, 23 (32.8%) for tendons deep and 4 (5.7%) for bone deep defects (Table III).

The frequency and percentages for size of defect was 5 (7.1%) for 0-1cm, 47 (67.1%) for 1.1-2cm and 18 (25.7%) for defects of 2.1-3cm (mean 2.19, SD=.546) (Table IV).

The frequencies and percentages for the location of the soft tissue defect were 26 (37.1%) for proximal phalynx, 34 (48.6%) for middle phalynx and 10 (14.3%) for distal phalynx (Table V).

The sensory deficit observed at the end of 12th week post operatively was 8.6% in the patients with local flap

Table-I. Gender frequencies and age group		
Gender	**Frequency**	**%age**
Male	45	64.3
Female	25	35.7
Total	70	100.0
Age in years		
10-20	35	50
21-30	23	32.8
31-40	07	10
41-50	02	2.85
> 50	03	4.28
Total	70	100.0
Mean age in years = 22.47, SD = 11.431		

Table-II. Mode of injury		
Mode of injury	**Frequency**	**%age**
Trauma	21	30.0
Burns	32	45.7
Others	17	24.3
Total	70	100.0

Table-III. Nature of defect		
Nature of defect	**Frequency**	**%age**
Skin only	43	61.4
Tendons bare	23	32.9
Bone deep	04	5.7
Total	70	100.0

coverage (3 patients) and 45.7% with STSG (16 patients). Patients with no sensory deficit were 91.4% (32 patients) in the local flap coverage and 54.3% (19 patients) in the STSG at 12th week of follow up. The relative ratio of sensory deficit in local flaps and STSG was 5 (>2) (Table VI). It is seen in the table that patients who underwent STSG, suffered more sensory deficit in terms of TPD as opposed to patients with local flap coverage for their soft issue defects.

Table-IV. Size of defect		
Size of defect	**Frequency**	**%age**
0-1 cm	05	7.1
1.1 - 2cm	47	67.1
2.2-3 cm	18	25.7
Total	70	100.0
Mean size of defect = 2.19, Std. Dev. = 0.546		

Table-V. Location of defect		
Location of defect	**Frequency**	**%age**
Proximal phalynx	26	37.1
Middle phalynx	34	48.6
Distal phalynx	10	14.3
Total	70	100.0

The sensory deficit was observed to be the least in patients whose mode of injury was trauma (21.1%) and other (5.3%) and was the greatest in patients with burns (73.7%). (Table VII).

The sensory deficit was observed to be the least in patients whose nature of defect was either tendon (10.5%) or bone deep (0.00%). Whereas defects involving skin only had significant difference 89.5% vs 51%. (Table VIII) The sensory deficit did not have significant association with the location or size of defect.

DISCUSSION

Two-point discrimination testing in human subjects is a reasonably easy clinical procedure. In addition, Moberg[4] has stated that two-point testing is the most reliable method available for evaluating tactile gnosis in human subjects[4]. Skill and technique in two-point testing obviously play a significant part in assuring accuracy and reliability of test results. With regard to methods commonly used to test two-point discrimination, several areas of potential difficulty exist and should be kept in

Table-VI. Sensory deficit in flaps and grafts

			Sensory deficit		Total
			Present	Absent	
Operation procedure (soft tissue cover)	Flap	Count	3	32	35
		% within operative procedure (soft tissue cover)	8.6%	91.4%	100.0%
	Graft	Count	16	19	35
		% within operative procedure (soft tissue cover)	45.7%	54.3%	100.0%
Total		Count	19	51	70
		% within operative procedure (soft tissue cover)	27.1%	72.9%	100.0%

Relative ratio = Graft with deficit present / flap with deficit present = 16/3=5 (rounded) So RR is 5.

Table-VII. Sensory deficit vs mode of injury

			Mode of injury			Total
			Trauma	Burns	Others	
Sensory deficit	Present	Count	4	14	1	19
		% within sensory deficit	21.1%	73.7%	5.3%	100.0%
	Absent	Count	17	18	16	51
		% within sensory deficit	33.3%	35.3%	31.4%	100.0%
Total		Count	21	32	17	70
		% within sensory deficit	30.0%	45.7%	24.3%	100.0%

Table-VIII. Sensory deficit vs nature of defect

			Nature of deficit			Total
			Skins	Tendons	Bone	
Sensory deficit	Present	Count	17	2	-	19
		% within sensory deficit	89.5%	10.5%	-	100.0%
	Absent	Count	26	21	4	51
		% within sensory deficit	51.0%	41.2%	7.8%	100.0%
Total		Count	43	23	4	70
		% within sensory deficit	61.4%	32.9%	5.7%	100.0%

mind to avoid situations that might make the interpretation of test results unreliable[8].

Orhun et al[9] quantified TPD of 6-8mm as being within acceptable limit. In this study TPD below 7mm is

considered normal and TPD above or equal to 8mm is considered as sensory deficit.

According to Dellon[10] in terms of desirability of the testing device tip geometry, translation of interprong distance to numerical rating scale, and facility of alternating between one- and two-prong testing techniques, the paper clip was judged to be less favorable test device than the Disk-CriminatorTM. However Shooter[11] and Bleyenheuft[12] has stated paper clip method as reliable tool with inter examiner reliability, and Finnell et al[13], have found that a properly calibrated set of paper clips performed as well as the Disk-CriminatorTM. In this study TPD was determined using a prebent set of paper clips due to easy availably and reliability of this testing tool.

Sensory return in a split skin graft is an important factor in the protection of this graft from injury[14]. Nedelec demonstrated that the skin sensations do not return to normal levels after skin grafting in burn survivors. The elevation of thresholds and reduction of sensory intensity is accompanied by a general decrease in the density of nerve terminals. The lack, or numerical reduction of sweat glands and innervated blood vessels have been found to be indicative of diminished sensation on grafted skin[4]. In this study the sensory deficit was found out to be the greatest in patients with Burns (73.7%).

Skin grafts face the problem of decreased number of mechanoreceptors unlike flaps that not only retain their blood supply but also a greater number of sensory receptors. This observation has been demonstrated by Schliephake et al[5] that the rate of both blood flow and two-point discrimination on the surface of local flaps and island flaps was not statistically different from the corresponding area of the unoperated side. Free skin grafts exhibited incomplete restoration of thermal sensibility.

Ali J[14] reported that grafted skin did not recover pinprick sensation, even 15 years after surgery. Scott et al[15] found out that the impaired thermoregulatory function in grafted skin is due to loss of vasodilatation and sweat glands. In this study it has been seen that TPD did not return to normal in 45.7% of skin graft patients over a period of three months follow up.

According to Gellis and Pool[16] , The Kleinert and Kutler flaps (Bilateral V-Y Advancement Flaps) demonstrated the best two-point discrimination among the repaired fingertips defects.

Nicolai and Hentenaar[17,18] examined cross finger flap patients post-operatively, with particular reference to two-point discrimination and concluded that it significantly improved over time.

Orhun et al[9] demonstrated 76.47% of static two point discrimination recovery in their patients who underwent thenar and cross finger flaps. However, they only had deficit of 5.8% for DTPD. In this study, TPD in flaps for soft tissue defects of fingers resulted in sensory deficit of 8.6% and no deficit in 91.4% patients.

Rose et al[19] achieved similar results in terms of TPD between free flaps and skin grafts. The overall sensory deficit of TPD was 41.17% in skin graft cases with an average TPD of 7mm. Similar results have been obtained in this study with TPD sensory deficit of 45.7% in patients treated with skin grafts. This study shows that two point discrimination with use of local flaps for soft tissue defects of fingers resulted in sensory deficit of 8.6% in contrast to skin grafts that showed a deficit of 45.7%.

CONCLUSIONS

The results of this study show local flaps are better options in terms of preservation of two point discrimination as opposed to STSG for soft tissue defects of fingers.so as for as functional restoration is concern in fingers soft tissue defects local flaps are better option.

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