



## Customer Perception Towards E-Banking Services

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### ABSTRACT

*In today's demanding world, everybody needs instant banking solutions for a better lifestyle. Banks are playing a major role on making the customer to be more friendly with their services by including E-banking services in order to meet the customer demands and also to make use of the customers time in a more valuable way . E-banking is allowing the customers to conduct financial transactions on a secure way through website operated by their retail or virtual bank, credit union or building society. In the current scenario, almost every bank in India has the E-banking facilities.The purpose of this paper is to determine the customer's satisfaction toward the e-banking services. The result of the study clearly shows the usage of E-services differs according to different demographic factors like age and income levels of the customers. Finally, this study will help the bankers to understand the customers need in a better way.*

**KEYWORDS : E-banking, customer satisfaction, demographic factors, secure,E-banking services**

### I. INTRODUCTION:

Banks play a very more major role in improving the Nation and also for the economic development.Banks play a very important role in the Indian financial market as they are the biggest purveyors of credit and attract most of the savings from the population. Banking industry plays a very successful and healthy improvement of the economy of the country.Now a days banks are increasing their branches in order to meet the customer satisfaction but they are unable to meet the expectations due to time and also working conditions.Bank branches alone are no longer enough to offer services to meet the need of customer expectations . Advent and adoption of Internet by the industries has removed the constraint of time, distance and communication making globe truly a small village. Financial sector being no exception, numerous factors such as competitive cost, customer service, increase in education and income level of customers, etc. influence banks to evaluate their technology and assess their electronic commerce and internet banking strategies. In the last three decades, the Internet has grown to become one of the most amazing technological and social accomplishments of the last century. Banking sector is not an exception for this technological advancement So online banking or E-banking is the very innovative delivery concept channel by the retail banks in order to make customer to be satisfied with the banking services in a faster mode.They can make use of E-banking through mobile,internet by staying at home or office. The e-banking offers huge opportunities in every sphere of business as the competitive advantage, member/client retention, increased revenues and reduced costs. Understanding clients, organizational elasticity, availability of resources, system security, reputable brand name, having multiple integrated channels, e-channel specific marketing, support from top management and good client services are the vital factors for the success of e-banking.In E-banking system, banks are increasing their customer base with the help of multiple e-delivery channels like ATMs, Credit/Debit/Smart Cards, Internet banking, Mobile banking, Tele banking, EFTs etc.It has been produced by many of the banking institutions in order to meet the global competition. The customers can do their banking not only when they want to do but also from the convenience, comfort, confidentiality and security from their homes by using internet or other networks, television, telephone/modems. Due to various aspects of technology, there is a need to monitor efficiency of the banks to best judge their status in global environment. The banks with adequate electronic base are gaining momentum where the others are fighting for their survival.Some of the distinctive features of internet banking are: it removes the traditional geographical barriers as it could reach out to customers of different countries / legal jurisdiction, it has added a new dimension to different kinds of risks traditionally associated with banking, heightening some

of them and throwing new risk control challenges, and security of banking transactions, validity of electronic contract, customers' privacy etc., which have all along been concerns of both bankers and supervisors have assumed different dimensions given that Internet is a public domain, not subject to control by any single authority or group of users.

### II.REVIEW OF LITERATURE

Bahl ,Sarita ,(2012) describes that security and privacy issues are the only issues in e-banking. and if they are resolved the further usage of e-banking will be in a very tremendous and fruitful way.

Kaur ,Jasveen and Kaur ,Baljit ,(2013) from his study we came across that there is no difference in facilities provided and the customers' usage of internet banking services of Public-sector, Private-sector and Foreign Banks in India.

Rao, K. Rama Mohana and Lakew, Tekeste Berhanu (2011) examines the service quality perceptions of customers of public sector and private sector banks in the city of Visakhapatnam, India. The author reveals that the Reliability and Assurance dimensions of service quality scored the highest ratings while the Tangibles dimension got the lowest score. Moreover, the study found a strong dissimilarity in service quality perceptions between customers of private sector and public sector banks.

Santhiyavalli, G. (2011) determined the customer's perception of service quality of the select branches of State Bank of India and study the major factors responsible for their satisfaction. In this research SERQUAL Model has been used and study indicates that among five dimensions 'Reliability', 'Responsiveness', 'Empathy' and 'Tangibility' are the major factors responsible for customer satisfaction.

Padhy, K.C. (2007) studied the impact of technology development in the banking system and he also highlights the future of banking sector. The core competencies will provide comparative advantages.

Mavri and Ioannou, (2006), Banks know that the e-banking is going to bring a tremendous change in local business and also among global frontiers.

### III.objectives of the study:

1. To identify the overall customer perception towards the E-banking services
2. To study whether demographic variables are influencing on customer satisfaction on E-banking services.

**IV. HYPOTHESIS OF THE STUDY**

H1: There is a significant difference between Age of the customer and their perception toward the services of E- banking.

H2: There is a significant difference between income of the customer and their perception toward the services of E-banking.

**V. RESEARCH METHODOLOGY**

The research has been proceeded in a systematic way by detailed study of obtaining the opinions of the customers under the category of descriptive research. Both primary and secondary data collection methods are used. Primary data collection was done through questionnaire and secondary data is collected from journals, magazines and books, websites. The questionnaire includes both demographic profile and their perception on E-banking services and a five point LIKERT scale has been used in order to rate the perceptions of customers. About 150 questionnaires has been circulated among the customers of different banks in Hyderabad city through direct method and received a response of 100 customers and 50 questionnaires were found to be incomplete. From 100 responded questionnaires data has been edited, coded and analysed by using SPSS 23.0 package and ANOVA TEST has been used.

		sum of squares	df	Mean square	F	sig.
bankacc	Between Groups	0.000	4	0.000	.	.
	Within Groups	0.000	95	0.000		
	Total	0.000	99			
banktype	Between Groups	11.202	4	2.800	8.572	0.000
	Within Groups	31.038	95	0.327		
	Total	42.240	99			
ebservices	Between Groups	1.173	4	0.293	10.450	0.000
	Within Groups	2.667	95	0.028		
	Total	3.840	99			
accnum	Between Groups	10.093	4	2.523	6.949	0.000
	Within Groups	34.497	95	0.363		
	Total	44.590	99			

**V. LIMITATIONS OF THE STUDY**

The study was conducted in Hyderabad city and sample is very small and hence the results cannot be generalized.

		sum of squares	df	Mean square	F	sig.
educating about services	Between Groups	5.469	4	1.367	7.973	0.000
	Within Groups	16.291	95	0.171		
	Total	21.760	99			
awareness security	Between Groups	3.193	4	0.798	5.921	0.000
	Within Groups	12.807	95	0.135		
	Total	16.000	99			
awareness fraud	Between Groups	6.891	4	1.723	10.321	0.000
	Within Groups	15.859	95	0.167		
	Total	22.750	99			
satisfaction	Between Groups	7.368	4	1.842	6.746	0.000
	Within Groups	25.942	95	0.273		
	Total	33.310	99			
debitcard	Between Groups	7.421	4	1.855	1.941	0.110
	Within Groups	90.819	95	0.956		
	Total	98.240	99			
creditcard	Between Groups	12.426	4	3.106	1.693	0.158
	Within Groups	174.324	95	1.835		
	Total	186.750	99			
mobile	Between Groups	30.890	4	7.723	6.917	0.000
	Within Groups	106.070	95	1.117		
	Total	136.960	99			
frequency	Between Groups	63.254	4	15.813	22.175	0.000
	Within Groups	67.746	95	0.713		
	Total	131.000	99			

**VI. ANALYSIS AND INTERPRETATION**

		sum of squares	df	mean square	F	sig.
secured transaction	Between Groups	26.295	4	6.574	16.563	0.000
	Within Groups	37.705	95	0.397		
	Total	64.000	99			
status symbol	Between Groups	22.712	4	5.678	6.116	0.000
	Within Groups	88.198	95	0.928		
	Total	110.910	99			
timely service	Between Groups	10.207	4	2.552	6.414	0.000
	Within Groups	37.793	95	0.398		
	Total	48.000	99			
familiarity	Between Groups	29.377	4	7.344	4.818	0.001
	Within Groups	144.813	95	1.524		
	Total	174.190	99			
convenience	Between Groups	58.697	4	14.674	13.632	0.000
	Within Groups	102.263	95	1.076		
	Total	160.960	99			
direct transactions	Between Groups	4.986	4	1.247	3.218	0.016
	Within Groups	36.804	95	0.387		
	Total	41.790	99			

To analyze the two hypotheses, different demographic variables are considered. They are Age Group of the respondents and income level of the respondents.

Hypothesis 1: There is no significant difference between income of the customer and their perception toward the services of E- banking.

**Table:1.1 Income levels and perceptions of customers on E-banking services**

**Table:1.2 Income levels and perceptions of customers on E-banking services**

**Table:1.3 income levels and perceptions of customers on E-banking services**

Table 2.1 age group and perception of the customers on E-banking services

		sum of squares	df	mean square	F	sig.
bankacc	Between Groups	0.000	1	0.000	.	.
	Within Groups	0.000	98	0.000		
	Total	0.000	99			
banktype	Between Groups	1.180	1	1.180	2.816	0.097
	Within Groups	41.060	98	0.419		
	Total	42.240	99			
accnum	Between Groups	10.325	1	10.325	29.530	0.000
	Within Groups	34.265	98	0.350		
	Total	44.590	99			
ebservices	Between Groups	0.781	1	0.781	25.028	0.000
	Within Groups	3.059	98	0.031		
	Total	3.840	99			

**Table 2.1 age group and perception of the customers on E-banking services**

educating-about-services	Between Groups	3.050	1	3.050	15.975	0.000
	Within Groups	18.710	98	0.191		
	Total	21.760	99			
awareness-security	Between Groups	0.819	1	0.819	5.289	0.024
	Within Groups	15.181	98	0.155		
	Total	16.000	99			

The above tables depicts the relationship between the income and customer satisfaction on e-banking services at 5% level of significance. Based on the income levels of the consumer the accounts he is holding on and educating the services by bank and E-banking services, credit card mobile usage and frequent usage of the services and familiarity of usage of e-banking services are significant and the other factors like bank type, awareness about the security, awareness about the fraud, secured transactions and status symbol and timely services of the e-banking services and convenience of the customers are insignificant according to the sample collected.

B. Hypothesis 2. There is no significant difference between age of the customer and their perception toward the services of E-banking

**Table:2.2 age group and perceptions of customers on E-banking services**

		sum of squares	df	Mean square	F	sig.
secured transaction	Between Groups	1.134	1	1.134	1.768	0.187
	Within Groups	62.866	98	0.641		
	Total	64.000	99			
status symbol	Between Groups	3.463	1	3.463	3.158	0.079
	Within Groups	107.447	98	1.096		
	Total	110.910	99			
timely service	Between Groups	0.819	1	0.819	1.702	0.195
	Within Groups	47.181	98	0.481		
	Total	48.000	99			
familiarity	Between Groups	12.033	1	12.033	7.272	0.008
	Within Groups	162.157	98	1.655		
	Total	174.190	99			
convenience	Between Groups	2.689	1	2.689	1.665	0.200
	Within Groups	158.271	98	1.615		
	Total	160.960	99			
direct access transactions	Between Groups	7.273	1	7.273	20.648	0.000
	Within Groups	34.517	98	0.352		
	Total	41.790	99			

**Table:2.3 Age group and perception of customers on E-banking services**

The above tables depicts the relationship between the age groups and customer satisfaction on e-banking services at 5% level of significance. Based on the age groups of the customers the accounts he is holding on and educating the services by bank and E-banking services, mobile usage and frequent usage of the services and familiarity of usage of e-banking services, bank type, awareness about the security, awareness about the fraud, secured transactions and status symbol and timely services of the e-banking services and convenience of the customers are significant and the other factors like credit card and debit card are insignificant and the analysis clears us that different age group people are satisfied with services of E-banking as if the sample was collected mostly among young generation.

**VII. RECOMMENDATIONS**

Above analysis reveals that customers are satisfied with the e-banking services provided by banks. Different age groups and different income levels of the customers have different perception towards the e-banking services. Mainly the old age people are having the reluctance of using e-banking facilities, so importance to be given to those

people and proper training on the usage of e-banking should be given to them and bankers have to adopt the right strategies to attract different age group and give more information about the e-banking services. Most of the customers prefer e-banking services for the quickness and also for flexibility. So banks should try in all the ways that e-banking is working 24/7 hours and the services are available to customers without any hassles and hurdles. Online Customers are mainly concerned on safety and security issues so the banks should educate their customers on the safety usage of their passwords and pin numbers and it should insist the customers that they should change the passwords and pin numbers frequently so no unauthorized fraudulent practices happen in the E-banking.

**VII. CONCLUSION**

This study has analyzed the overall perception of customers regarding the services of e-banking. Age and income levels of the customers are the important demographic factors in the banks which have been used to measure the perception of the customers on e-banking services. E-Banking can be succeeded with a strong commitment in understanding the customer needs and requirements of customers. Banking services and majorly E-banking will be successful only when they have Commitment towards their services along with a deeper understanding of customer needs. By this they can bring the E-banking services very familiar and flexible and convenient to the customers. The study concluded that different income level of the customers usage of E-banking services is different and have different perceptions towards E-banking services so the banks should concentrate on low level income levels to the high end business people income levels and if do come across the analysis they are showing keen interest in using the E-banking services. It also has been observed that different age groups of the customers are more satisfied with the usage of e-banking services. The old age people are refusing in using of E-banking services due to improper perception on security concerns. The banks should concentrate in such a way that all the age group people are satisfied with their services.

**REFERENCES**

1. Kaur, Jasveen and Kaur Baljit, "Determining Internet Banking Service Quality & Customer Satisfaction in India shows", Tenth AIMS International Conference on Management, 2013.
2. Bahl, Sarita, "Emerging Challenges in E-Banking Upheavals in Global Scenario", RIJEB Volume 1, Issue 7 (July) ISSN: 2277 – 1018, 2012
3. Santhiyavalli, G, "Customer's perception of service quality of State Bank of India - A Factor Analysis", IJMBS Vol. 1, Issue 3, September 2011
4. Rao, K. Rama. Mohana and Lakew. Tekeste Berhanu, "Service Quality Perceptions of Customers: Study of The Customers' of Public Sector and Private Sector Commercial Banks in India", International Journal of Research in Commerce & Management, Volume No. 2 (2011), Issue No. 11 (November)
5. Ronak A. Mehta, Banking Services and Customer Satisfaction – A Study of Public and Private Sector Banks in Navsari City, Volume : 2 | Issue : 3 | March 2013 ISSN - 2250-1991
6. Surabhi Singh and Renu Arora, A Comparative Study of Banking Services and Customer Satisfaction in Public, Private and Foreign Banks, J Economics, 2(1): 45-56 (2011)
7. Avasthi G P M (2000-01), "Information Technology in Banking: Challenges for Regulators", Prajnan, Vol. XXIX, No. 4, pp. 3 – 17.
8. Dadabhoy K. Bakhtiar (2013) "Barons of Banking" Random House.
9. Reddy, Y. V. 2005. "Banking Sector Reforms in India: An Overview." RBI Bulletin. June.
10. Sethi Jyotsna, Bhatia Nishwan (2012) "Elements of Banking and Insurance" New Delhi, PHI Learning Pvt. Ltd.
11. Report on Trend and Progress of Banking Sector in India [http://rbidocs.rbi.org.in/rdocs/Publications/PDFs/ORTP21112013\\_F.pdf](http://rbidocs.rbi.org.in/rdocs/Publications/PDFs/ORTP21112013_F.pdf)
12. Uppal, R.K, E-delivery channels in banks-A fresh outlook, Journal of Arts Science & Commerce ISSN 2229-4686, www.researchersworld.com Vol.- II, Issue -1, January 2011
13. Wandaogou, Abdil Mumuni Moro and Jalulah, Stephen Pambini, Evaluation of Customer Satisfaction with Internet Banking Service Quality in the banking Industry in Ghana: A case study of Ghana Commercial Bank Ltd and Merchant Bank of Ghana Ltd, Master Thesis, Lulea University of Technology, pure.ltu.se/portal/files/33883934/LTUEX-33771234.pdf, 2011

## Introduction:

In burn care, during the past decades survival of patients with severe burns has improved significantly. Since more patients survive with a large percentage of total body surface area burned, many more patients now have to deal with the sequel of scarring; burn scars frequently remain with a poor functional outcome. Functional problems related to burn scarring are often caused by scar contractures.

Full hand motion is useless if elbow contracture prevents the hand to keep in optimal functional position.<sup>1</sup> Elbow contractures commonly result from deep burn especially when adequate rehabilitation such as active and passive exercises, use of pressure garments and immediate splinting in extension and forearm supination are not given to the patient. Contractures also form in cases of full thickness skin burns when primary grafting is not done. After release of these contractures the resulting raw areas need a suitable covering. The methods for resurfacing range from split-thickness skin graft, Z-plasties, local and regional flaps up to the most complicated repair with free microvascular flaps. Each technique has its unique advantages and drawbacks.

In this article we present a prospective study of 38 patients in order to evaluate the efficacy of different procedures for resurfacing defects after release of post burn elbow contractures with reference to functional recovery and aesthetic improvement.

## Material and Methods:

A non-randomized prospective study was conducted on 38 patients operated in 2 years time period from January 2012 to December 2013 at Kolkata Medical college, Kolkata. Patients with non-burn elbow contracture and those having elbow joint pathology (e.g. heterotopic ossification, osteoarthritis) were excluded from study.

In this study, out of 38 patients 22 were male and 16 were female, between 4 years and 60 years of age. Maximum number of patients (47%) belonged to the age group of 1 to 10 years.

**Preoperative assessment of elbow extension loss:** The contractures were classified into mild, moderate and severe categories according to the severity of elbow extension loss.<sup>2</sup>

Mild contracture: 11° – 49° extension loss

Moderate contracture: 50° – 89° extension loss

Severe contracture: > 90° extension loss

According to above classification majority (76%) of the patients in the present study had mild to moderate contractures.

**Anatomical types of contracture:** The patients were also classified according to the anatomical type of contracture into (1) *longitudinal band contracture* (medial, lateral or central) with normal healthy pliable skin on either side, and (2) *diffuse contracture* that extends across the entire antecubital region to opt for a suitable resurfacing method. Both the anatomical type had almost similar incidence.

## Operative techniques:

Informed consent was taken from all the patients before operation in their respective native language. All the operations were done under general anaesthesia. The options of surgical treatment were chosen according to the contracture type, with individualization (**Table: 1**).

Patients with longitudinal band contracture of elbow were resurfaced with multiple Z-plasty, local advancement flaps, or propeller flaps with STSG according to the condition of the scar and, the release procedure was tailored accordingly with preoperative marking. Thin band contractures were successfully treated with multiple Z-plasty, whereas thick hypertrophic bands were covered with advancement of the uninvolved cubital fossa skin to fill the raw area created after release procedure. If the band contracture was of moderate severity, then these procedures were supplemented with STSG to cover the remaining area after flap inset, or the propeller flap was used along with STSG above and/or below the joint area.

Patients with diffuse elbow contracture, the contracture was released

up to the subcutaneous tissue with fish tailing at the apices to gain full or maximum possible extension of the elbow joint preoperatively, covered either with split thickness skin grafts or with any one of the two fasciocutaneous flaps, namely forearm fasciocutaneous flap or reverse medial arm flap, depending on the condition of the surrounding skin and whether vital structures were exposed or not.

**Post operative course:** In case of skin grafts the dressing was opened on the 5<sup>th</sup> postoperative day. All the patients in whom skin grafting alone was used were advised to continue elbow splintage in extension for at least 3-6 months, along with range of motion exercises. In cases where one of the flaps had been used for resurfacing, early post operative range of motion exercises were started and elbow splintage was not used.

Functional assessment was done at 6 months post operatively by measuring the angle of elbow extension with a goniometer. Aesthetic appearance was also assessed at the same time in terms of color, texture and, contour match with the surrounding skin and rated them as excellent, good, fair and poor.

## Results:

**Functional outcomes:** The median post-operative gain of elbow extension at 6 months in the mild, moderate and severe contracture groups were 35° (range 20°- 45°), 55° (range 45° - 65°) and 90° (range 75° - 90°) respectively (**Table 2**). Achievement of full elbow joint extension was possible in 78% (11 out of 14) cases of mild contracture, 86% (13 out of 15) cases of moderate contracture, and 55% (5 out of 9) cases of severe contracture. The recovery of range of elbow joint extension in all the three groups (i.e., mild, moderate and severe contracture) varied slightly across the different surgical procedures and the differences were not statistically significant ( $p > 0.5$ ). Overall, full elbow extension was achieved in 76% cases (29 out of the total 38 cases) in the study.

**Recurrence of contracture:** At 6 months follow up after surgery, the contracture recurrence rate was 44% (4 out of 9 cases) in the split thickness skin graft (STSG) group in spite of advising prolonged use of elbow extension splint. However, the severity of elbow extension loss in the cases with post-operative contracture recurrence was much less severe as compared to the preoperative elbow deformity in all the cases. In this study, there was no recontracture after multiple Z-plasty, local advancement flap, propeller flap, forearm fasciocutaneous flap and reverse medial arm flap. **Recipient site complications:** There was minor flap tip necrosis in two cases of multiple Z-plasty both of which healed secondarily. Also, there was partial flap necrosis of reverse medial arm flap in a single case, which was managed by debridement and skin grafting.

**Donor site morbidity:** There was mild infection at the donor site in one case of split thickness skin graft, which resolved with antibiotic treatment and local dressing. There was hypertrophic scar formation at the STSG donor site in five cases, which was managed by local application of steroid ointment and pressure garment.

**Aesthetic outcomes:** The aesthetic outcome was acceptable in terms of color, texture, contour match and subjective analysis for overall appearance in all the cases except in three patients. The patient acceptance of the aesthetic outcome of surgery was 77% in the STSG group versus 100% in the other procedures.

## Discussion:

Upper extremity burn contractures are a major challenge to the reconstructive surgeon. Elbow contracture commonly result from deep burn especially due to inadequate primary burn management and rehabilitation. Flexion contracture of the elbow is a common consequence of severe burn. According to Schneider et al, elbow is the second most common joint involved among four major joints (shoulder, elbow, hip and knee).<sup>3</sup>

After release of post burn elbow contractures the resulting raw area needs a suitable covering. The various methods used for this purpose range from split-thickness skin graft,<sup>4,5</sup> Z-plastie,<sup>6</sup> local and regional flaps,<sup>7</sup> up to the most complicated repair with a free microvascular flaps.<sup>8</sup>

The choice of reconstructive procedure, however, depends on the type of contracture (longitudinal band contracture or diffuse contracture), the severity of contracture, condition of adjacent skin, and exposure of vital structures. When the cause of the contracture is a longitudinal hypertrophic scar band with pliable skin on either side, local tissue rearrangement with the Z-plasty or any of its modifications will usually suffice, whereas diffuse contracture that extends across the entire antecubital region will require a transverse incision across the axis of the scar extending into unscarred tissue and breaking into a Y (fishtail) at both ends to enhance complete release. Resurfacing is done with a sheet of thick split-thickness skin graft or full-thickness skin graft.<sup>9</sup>

In our study, mild band contractures were resurfaced with multiple Z-plasty, local advancement flap or propeller flap with acceptable functional results with full gain in angle of extension in almost 80% cases. Aesthetically all the patients were satisfied with the postoperative results.

In moderate band contractures, Z-plasty seemed insufficient to cover the extensive raw area, and therefore local advancement flaps with or without skin grafting were used. The propeller flap and the forearm fasciocutaneous flap are also good options in such cases, depending on the condition of the forearm skin and perforator. Advantages of the propeller flap are easy design and rapid flap elevation that permits a single stage correction of the deformity without further sacrificing an artery or muscle.<sup>10</sup> Using the local flaps in the moderate contracture group achieved full extension in more than 85% cases in our study.

None of the patients in our study who presented with severe contracture had band contracture. In patients with severe contractures, sequential release of deeper structures may be indicated. After such surgery, the bed may be unfavorable for grafting, and in such cases flap coverage is indicated.<sup>1</sup> Flap coverage is also indicated when subsequent deep reconstructive surgery, such as nerve or tendon repair, is contemplated. The reverse medial arm flap seems to be a suitable option for severe contractures of elbow when there are exposed vital structures or preoperative full extension has not been achieved.<sup>11</sup> Due to the inherent property of the flap to expand and grow there are minimal chances of recontracture especially in case of children. Additionally postoperative gradual extension splintage can be used if full extension not achieved preoperatively.<sup>12</sup> In our study, skin grafting was done only in those cases in which donor area was not available for flap surgery. Functional outcome was acceptable in majority of the cases.

However, diffuse contractures resurfaced by skin grafting had 44% recontracture rate in our study in spite of using extension splint in postoperative period. Other studies have observed that the recontracture rate may be more in children, due to poor compliance for postoperative regime.<sup>13</sup> The split thickness skin graft take was 80% to 100% in our study, with minimal complications. However, we noted overall five cases of hypertrophic scar at donor site which was managed with pressure garments and topical use of steroid. Aesthetically, unmeshed thick sheet grafts were found to be better than meshed thin grafts in terms of color and texture match.

**Conclusion**

We conclude that post burn elbow contractures need categorization according to the anatomical type of contracture, involvement of surrounding skin and severity of contracture, so that adequate method of resurfacing must be planned preoperatively. Mild longitudinal band contractures are best managed with multiple Z plasty or local flaps. Following release of moderate contractures the raw area is so extensive that Z-plasty procedure would not be sufficient to cover; therefore we recommend either V-Y advancement or propeller flap from healthy adjacent cubital fossa skin, and skin grafts may be used to cover remaining raw area.

In cases of severe contractures, obtaining full release at the first attempt is unusual. After the release, rigorous physiotherapy is needed. Therefore, flap coverage is required. However, if the raw area following the release of diffuse contracture irrespective of severity is vascular enough to take a skin graft then it would be easy quick and simple option. The risk of recontracture can be minimized with the use of postoperative use of extension splint and active full range of motion exercises. Fasciocutaneous flaps like reverse medial arm flap and fore-

arm fasciocutaneous flaps can achieve acceptable functional and aesthetic results with early postoperative full range of motion exercises in appropriately selected cases.

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**Table 1: Resurfacing methods used in the study**

Anatomical type of elbow contracture	Mild contracture	Moderate contracture	Severe contracture
Diffuse (total) contracture [n = 18]	- Split thickness skin graft (STSG) [n = 5]	- STSG [n = 1] - Forearm fasciocutaneous flap [n = 2] - Reverse medial arm flap [n = 1]	- Reverse medial arm flap [n = 5] - STSG [n = 3] - Forearm fasciocutaneous flap [n = 1]
Longitudinal band contracture [n = 20]	- Multiple Z-plasty [n = 5] - Local advancement flap [n = 2] - Propeller flap [n = 2]	- Forearm fasciocutaneous flap [n = 3] - Local advancement flap+STSG [n = 3] - Propeller flap [n = 5]	-

**Table 2: Functional improvement in elbow extension after surgery**

Severity of elbow contracture	Gain in elbow joint extension (degrees)		
	Minimum	Maximum	Median
Mild contracture (n = 14)	20°	45°	35°
Moderate contracture (n = 15)	45°	65°	55°
Severe contracture (n = 9)	75°	90°	90°



**Figure 1: seven days post-op following local advancement flap .**



**Figure 2: patient with moderate band contracture with pre-op marking of perforator with the help of hand-held doppler.**



**Figure 3: Seven days post-op picture following propeller flap .**



**Figure 4: Six days post-op picture following forearm fasciocutaneous flap.**



**Figure 5: Patient with Severe contracture with preoperative marking for reverse medial arm flap.**



**Figure 6: Per-op picture following inset of islanded reverse medial arm flap .**

#### References:

1. Robson MC, Smith DJ. Burned hand. In: Jurkiewicz MJ, Mathes SJ, Ariyan S, eds. Plastic surgery: Principles and Practice, St. Louis Mosby;1990:781.
2. Bennett GB, Helm P, Purdue GF, Hunt JL. Serial casting: a method for treating burn contractures. *J Burn Care Rehabil* 1989; 10:543-5.
3. Schneider JC, Holavanahalli R, Helm P, Golstein R, Kowalske K. Contractures in burn injury: defining the problem. *Burn Care Res* 2006; 27:508-14.
4. Donelan MB. Reconstruction of the burned hand and upper extremity. In: May JW Jr, Littler JW, eds: *The Hand*. Philadelphia, WB Saunders, 1990:5452-82.
5. Beasley RW. Burns of the axilla and elbow. In: Converse JM, ed. *Reconstructive Plastic Surgery*, vol 6. Philadelphia, WB Saunders, 1977:3391-3402.
6. Grishkevich VM, Moroz VY. Surgical treatment of burn consequences of lower extremities. *Medicina*: Moscow, 1996.
7. El-Khatib H. Island fasciocutaneous flap based on the proximal perforators of the radial artery for resurfacing of burned cubital fossa. *Plast Reconstr Surg* 1997;100(Suppl 1):919-25.
8. Burd A, Pang PCW, Ying SY, Ayyappan T. Microsurgical reconstruction in children burns. *J Plast Reconstr Aesthetic Surg* 2006; 59:679-92.
9. McCauley RL, Asuku ME. Upper extremity Burn Reconstruction. In: Hentz VR, ed: *The hand and upper limb*. Philadelphia, WB Saunders, 2006:605-46.
10. Aslan G, Tuncali D, Cigsar B, Baruteu AY, Terzioglu A. The propeller flap for postburn elbow contractures. *Burns* 2006; 32:112-5.
11. Maruyama Y, Onishi K, Iwahira Y. The ulnar recurrent faciocutaneous island flap: reverse medial arm flap. *Plast Reconstr Surg* 1987;79:381-7.
12. Schwarz RJ, Joshi KD. Management of post-burn contractures. *Journal of Nepal Medical Association* 2004; 43:211-7.
13. Stern PJ, Law EJ, Benedict FK, et al. Surgical treatment of elbow contractures in post-burn children. *Plast Reconstr Surg* 1985;76:441-6.