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ORIGINAL ARTICLE

Assessment of Donor Site Morbidity Following Fibula Flap Transfer

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Abstract
Purpose To assess donor site morbidity for patients who underwent mandibular reconstruction by fibula free flap.
Patients and Methods The data were recorded from medical records and clinical questioner of patients from 2013 to 2016. Predictor variables were drawn from demographics of patients who had mandible defect reconstructed with free fibula flap. The outcome variables were drawn from point evaluation system for pain, walking ability, activities of daily living, gait alteration, cosmetic appearance using validated 10-point self-assessment scale. The assessment was done postoperatively at intervals of 15 days, 1 month, 3 months and 6 months. ANOVA test was used to measure the statistical significance.
Results There was significant reduction in perception of pain, significant improvement in walking ability, activities of daily living, gait and cosmetic appearance postoperatively after 6 months ($P < 0.005$).
Conclusion Point evaluation system is a simple and effective tool to understand the postoperative morbidity. Donor site morbidity following fibula harvest was low without any major complications.

Keywords Fibula · Mandible reconstruction · Donor site morbidity · Point evaluation system

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Introduction

Donor site morbidity is a region of concern for the reconstructive surgeon. A meticulous planning is required to avoid loss of function at donor site along with total rehabilitation of recipient site. Though the recipient site is taken care through constant monitoring, the donor site is often neglected. There are many options for mandibular reconstruction like iliac crest, rib, scapula and radial forearm. Fibula flap is considered gold standard for reconstruction of mandible. The fibula has advantages like availability of 25 cm length of bone stock, ability to rehabilitate with dental implants, ease of doing microvascular anastomosis and soft tissue and hard tissue defect which can be reconstructed in a single operation by two-team approach [1]. A description of fibula flap harvest by lateral approach was given by Taylor [2], and later, it was modified by Gilbert [3]. Several studies have tried to assess the donor site morbidity by using objective [4, 5] and subjective [6, 7] techniques. A subjective evaluation can provide impact of functional disability which leads to useful understanding of deficiencies in treatment, thus enhancing physician–patient relationship and improving patient's quality of life [8]. Questionnaires are commonly used for subjective evaluation. We used point evaluation system (PES) for quality of life assessment. PES is a simple method to assess subjective experiences [9].Low morbidity

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with immediate reconstruction to restore facial form and function was our prime concern [10].

Materials and Methods

A prospective study on 32 patients who underwent mandibular reconstruction using free fibula flap from 2013 to 2016 was carried out. Twenty patients who met the criteria were included, and 12 patients who were lost to follow-up were excluded. Predictor variables were drawn from demographics of patients who had mandible defect reconstructed with free fibula flap. The outcome variables were drawn from point evaluation system for pain, walking ability, activities of daily living, gait alteration, cosmetic appearance using validated 10-point self-assessment scale. All patients underwent postoperative physiotherapy protocol which aimed at regaining full movements in the limb and gentle strengthening exercises. The exercises included limb elevation, flexion/extension of ankle and knee in sitting and supine positions for a period of 3–6 months. The intervention was conducted in intervals of 15 days, 1 month, 3 months and 6 months with PES. Thirty-two patients who consented were recruited to the study. Inclusion criteria were patients of age between 20 and 70 years, biopsy proven cases of carcinoma of oral cavity requiring resection and reconstruction, odontogenic tumors and other pathologies of mandible which require surgical resection of tumors. Patients with history of stroke, psychological disease,peripheral vasscular disease were excluded. Patients who underwent hip replacement were excluded from the study. The institutional review board approval was obtained IRB No. 2013/P/OS/16.

Patients were provided with standardized questionnaire to rate the various parameters through point evaluation system (PES). ANOVA test was used for statistical analysis. P value was set at < 0.05. Ten-point scale was validated tested for reliability (Cronbach's alpha; Table 1) for all five scales with high reliability.

Results

Twelve patients (60%) were male, and eight (40%) were female with mean age of 44.38 and 34.28 years, respectively. Patients were diagnosed of squamous cell carcinoma-13 (65%), spindle cell carcinoma-1(5%), ameloblastoma-3(15%), ossifying fibroma-2(10%) and odontogenic keratocyst-1(5%). Eighteen patients underwent immediate reconstruction, whereas two patients had secondary reconstruction of mandible. Fifteen cases (75%) required skin graft for covering the donor site, and in five patients (25%), surgical wound was managed by primary closure (Tables 1 and 2).

Descriptive statistics was done using SPSS Ver.16 to find the minimum and maximum scores in each intervention and standard deviation. The results are shown in Table 3, and the overall donor morbidity was low and minimal concerns about functional ability on the donor leg.

Pain

Forty percent of patients had severe pain at post-op 15 days. Fifty percent of patients had moderate pain at 15 days which was unchanged at 30 days. On assessment at 3 months interval, pain had reduced. Forty-five percent had mild pain which reduced 35% at 6 months. Forty-five percent of patients were free of pain at 6 months

Walking Ability

Ten percent of patients needed assistance at 15 days. At 30 days, 85% patients had moderate restriction which reduced to 50% at 3 months and 10% had mild restriction in ambulation which improved to 35% at 6 months. Fifty percent of patients had no restriction in walking ability at 6 months.

Restriction in Daily Activities

Twenty-five percent of patients had major restriction in carrying out day to activities at 15 days. Sixty-five percent were not able to partake in any recreational activities at 30 days, but numbers worsened to 75% at 1 month with only 25% having minor restriction at similar interval. Results were encouraging at 6 months, where we found only 55% had minor restriction and 40% were free of any disabilities.

Gait Alteration

Most of the patients (75%) had major gait alteration at 15 days, and there was gradual improvement in subsequent assessment with 45% showing moderate alteration at 3 months. There was a noticeable improvement as only 50% had minor limitation and other 50% did not have report any gait deficit at 6 months.

Cosmesis

The linear scar and split-thickness skin graft were assessed under cosmetic appearance.

Two patients had dehiscence on the donor site, and two patients had skin graft failure which was managed by wet to dry and dry to moist dressing on a regular interval. Fifty-

Table 1 Patient's data

Sl. no	Age/gender/side of mandibular defect	Diagnosis
1	53yrs/Male/Left	SCC
2	57yrs/Female/Left	SCC
3	28yrs/Male/Left	Odontogenic keratocyst
4	49yrs/Male/Left	Ameloblastoma
5	54yrs/Female/Right	SPC
6	49yrs/Male/Right	SCC
7	39yrs/Male/Left	SCC
8	27yrs/Female/Right	SCC
9	28yrs/Male/Right	Ameloblastoma
10	60yrs/Male/Right	SCC
11	24yrs/Female/Right	SCC
12	38yrs/Male/Left	SCC
13	45yrs/Male/Left	SCC
14	43yrs/Male/Right	SCC
15	45yrs/Female/Right	SCC
16	17yrs/Female/Left	Ameloblastoma
17	26yrs/Female/Right	Ossifying fibroma
18	46yrs/Female/Right	SCC
19	51yrs/Male/Left	SCC
20	54yrs/Female/Left	Ossifying fibroma

SCC Squamous cell carcinoma, *SPC* spindle cell carcinoma

Table 2 Point evaluation system

Scale	0	1–3	4–6	7–10	Cronbach's alpha
Pain	None	Mild (Occasional, not intense)	Moderate (Frequent, intense)	Severe (Continuous, intense)	0.829
Walking ability	Same as pre-op	Mild (restriction in running)	Moderate (restriction on uneven terrain/uphill/stairs)	Severe (Use of support)	0.769
Restriction in daily activities	No disability	Minor limitation (Standing for long)	Intermediate limitation (Recreational restriction)	Major limitation (ADL restriction)	0.400
Gait alteration	None	Minor	Moderate	Major (Functional)	0.897
Cosmetic appearance	Excellent	Good	Intermediate	Bad	0.914

Table 3 Comparison of donor site variables at different time intervals

Variables	15 days Mean(SD)	30 days Mean(SD)	3 months Mean(SD)	6 months Mean(SD)	*F* value	*P* value
Pain	6.059 (2.187)	5.25 (2.268)	2.75 (2.53)	1.9 (2.3)	50.230	0.00001**
Walking ability	5.1 (1.619)	5.85 (4.727)	3.25 (1.970)	1.25 (1.743)	12.074	0.00001**
Restriction in daily activity	5.7 (1.750)	4.25 (1.773)	4.3 (1.490)	1.25 (1.517)	45.968	0.00001**
Gait	7.45 (1.820)	6.1 (2.573)	3.15 (2.084)	1.05 (1.234)	97.015	0.00001**
Cosmetic appearance	6.15 (1.899)	6 (1.716)	3.85 (1.785)	3.1 (1.771)	40.330	0.00001**

five percent of the subjects reported cosmesis as good at 6 months interval.

Majority of the patients were able to go through their daily routine like walking for 1000 m, climbing stairs up to three floors, standing for long hours, i.e., approximately 2 h. One female patient had numbness and difficulty standing for more than approximately 45 min. One patient complained of occasional numbness. Another female patient complained of mild pain and weakness after walking more than a mile. Primary closure of donor site in five patients left a linear scar, and fifteen patients required split-thickness skin graft. The appearance of scar satisfied eighteen patients. Two female patients were unhappy with the scar which was left behind after split-thickness grafting. By comparing all donor site variables at definite intervals, there was low donor site morbidity and it was statistically highly significant (Table 3) ($p < 0.05$).

Discussion

Free fibula flap provides an excellent option for aesthetic reconstruction and functional rehabilitation of the patient. However, morbidity of donor site can have a marked effect on the quality of life. Hence, understanding of the donor site morbidity provides us better understanding of management of such patients.

We established that donor site morbidity was low after analyzing the questionnaire. In our study, 40% of patients had severe pain at 15 days. This could be because of time taken for donor site to heal which on avaerage was 34 days. Tang et al. noted pain was largely worse after surgery which improved with time in majority of the patients and 4% of the patients complained of excruciating pain from donor site [6]. However, Vail [11] said neither discomfort nor aching decreased over time. The symptoms of limited mobility and reduced strength improved over time. Eighty percent had moderate limitation at initial assessment which worsened to 85% at 30 days. Patients rated a noticeable improvement at 6 months, 35% were free of walking disabilities, and only 55% had minor limitation. A high incidence of 57.1% late donor site morbidity affects daily activities. Twenty-three percent of patients complained of restrictions in daily life activities [12]. In our study, we had an almost similar finding with 55% of the patients having minor limitation at 6 months. Five percent of patients had moderate limitation and were unable to involve in recreational activities. Lin et al. [7] and Chou et al. [13] reported no substantial changes in the gait analysis on both legs between operated and control group. Gait alteration was evident at 15 days in 75% of patients which was again due to the pain at the donor site. At 6 months, 50% of patients did not have gait alteration which was similar to an objective study assessing gait in prolonged walking [14]. Twenty patients had an average stay of 15 days in hospital. One of the studies suggested prolonged postoperative in hospital is associated with gait abnormalities [12]. Four of our patients had a prolonged postoperative course due to poor healing and loss of skin graft at donor site. This was managed with closed dressings on outpatient basis. Zimmermann et al. [12] and Sieg et al. [15] reported no difference in sensory deficiencies. Ten percent of our patients had transient paresthesia on walking for long distance and standing for long hours at 6 months interval. Two studies said sensory deficit was temporary [16, 17]. Two patients expressed dissatisfaction with the cosmetic appearance of the skin-grafted donor site [18]. According to a study, twenty-six patients decided scar was not distracting, 13 concluded it as slightly distracting and in three patients, it was noticeable [12]. In our case, 40% patients were not satisfied by the appearance of scar (Figs. 1, 2 and 3).

Ling stated that patient age and elasticity of donor skin determine primary closure or split-thickness skin graft for donor site [19]. Immediate donor site morbidity was good with only 10% percent of patients undergoing skin graft loss. Utilization of split-thickness skin graft may prolong interim morbidity, [15] increase duration of bed rest and produce unaesthetic scar but did not change objective or subjective results of operated leg [13]. Shpitzer reported patients who underwent donor site skin grafting a longer hospital stay were present. Short-term morbidity did not increase with use of skin graft [20]. Donor site morbidity can be reduced by conserving 5–7 cm of distal fibula at ankle and 4–6 cm at knee [21].A mean length of 13 cm of osteomyocutaneous flap was harvested with preservation of 5–8 cm at knee joint and 5–7 cm at ankle joint. One patient had skin paddle necrosis, and re-exploration was required. Incidence of muscle weakness is directly linked with bulk of muscle harvested [22]. A muscle sparing technique also

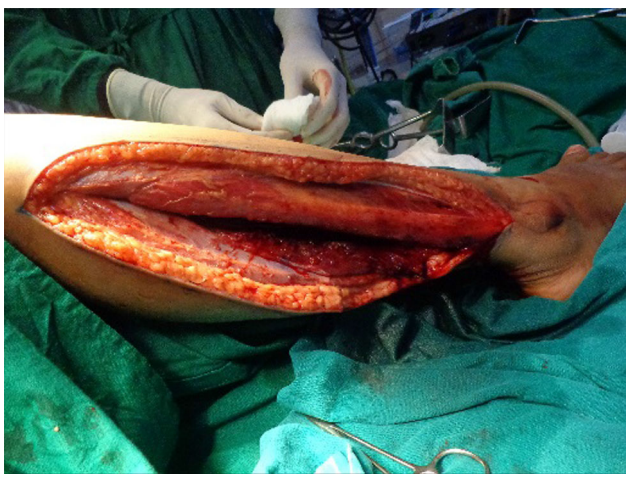

Fig. 1 Fibula free flap harvesting

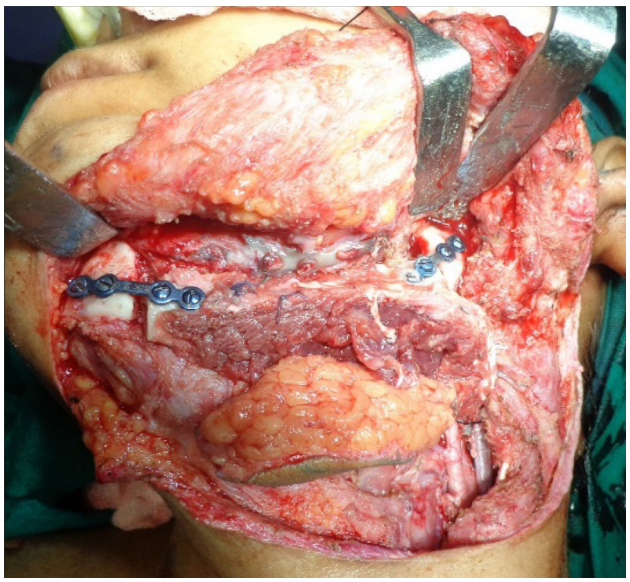

Fig. 2 Inset of fibula free flap and osteosynthesis with miniplates

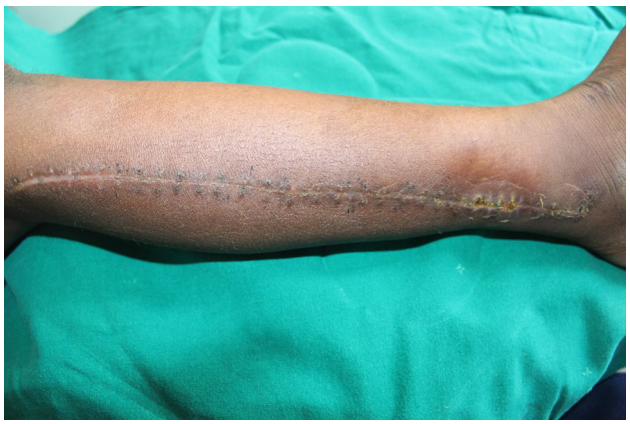

Fig. 3 Donor site postoperative at 1 month

reduces the collection of hematoma at donor site. Patients undergoing fibulectomy have increased objective measurable morbidity than subject-perceived morbidity [23]. Most of the patients in the study were undergoing oncosurgery and considered donor site morbidity as a minor limitation. These patients were more concerned about the long-term survival than the donor site.

Reconstruction of mandible with free fibula is a well-established method. A muscle sparing technique with early mobilization of the patient in postoperative phase reduces the morbidity. PES is a simple and effective tool to understand the postoperative morbidity. Donor site morbidity following fibula harvest is low which nearly all patients tolerated well, and it did not alter their lifestyle. There was a continual improvement in pain, gait, activities of daily life, walking ability, cosmetic appearance in our subjects. From this present study, we conclude that minimal morbidity of the fibula free flap in the immediate postoperative phase can be overcome by physiotherapy protocol which will outweigh all the advantages in making it a gold standard for mandibular reconstruction as a single-stage procedure.

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Compliance with Ethical Standards

Conflict of interest The authors report no conflicts of interest. The authors alone are responsible for the content and writing of this article.

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