Published in final edited form as:

Microsurgery. 2012 May ; 32(4): 255–260. doi:10.1002/micr.21950.

ASSESSMENT OF DONOR SITE MORBIDITY FOR FREE RADIAL FOREARM OSTEOCUTANEOUS FLAPS

Catherine F. Sinclair, M.D.¹, John P. Gleysteen, B.S.¹, Terence M. Zimmermann, M.P.H.¹, Mark K. Wax, M.D.², Babak Givi, M.D.², Daniel Schneider, M.D.², and Eben L. Rosenthal, M.D.^{1,*}

¹Department of Surgery, Division of Otolaryngology-Head and Neck Surgery, University of Alabama at Birmingham, Birmingham, AL

²Department of Otolaryngology-Head and Neck Surgery, Oregon Health and Science University, Portland, OR

Abstract

Purpose—Assessment of donor site morbidity and recipient site complications following free radial forearm osteocutaneous flap (FRFOCF) harvest and evaluation of patient perceived upper limb disability for free radial forearm osteocutaneous versus fasciocutaneous flaps (FRFF).

Methods—First a case series was undertaken of 218 patients who underwent an FRFOCF at two tertiary referral centers between February 1998 and November 2010. Outcomes included forearm donor site morbidity and recipient site complications. Second, the disability of the arm, shoulder, and hand (DASH) questionnaire assessing patient perceived arm disability was administered by phone to 60 consecutive patients who underwent an FRFOCF or FRFF.

Results—Mean patient age was 63 years with male predominance (62.8%). Median bone length harvested was 8 cm (range, 3–12 cm) with prophylactic plating of the radius following harvest. Donor site morbidity included fracture (1 patient, 0.5%) and sensory neuropathy (5 patients, 2.3%). Mean DASH scores were comparative between groups and to established normative values. Mandibular malunion rate was 3.2% and hardware extrusion at the recipient site occurred in 15.6%.

Conclusion—Reluctance to perform FRFOCF by surgeons usually centers on concerns regarding potential donor site morbidity and adequacy of available bone stock; however, we identified minimal objective or patient perceived donor site morbidity or recipient site complications following harvest of FRFOCFs. Mild wrist weakness and stiffness are common but do not impede ability to perform activities of daily living. Data from this and other reports suggest this flap is particularly useful for midfacial and short segment mandibular reconstruction.

The free radial forearm fasciocutaneous flap (FRFF) is the most frequently used free flap for reconstruction of soft tissue defects of the head and neck.¹ The development of osteocutaneous free flaps revolutionized reconstruction of bony defects of the head and neck and enabled superior functional and aesthetic results compared with previously used techniques. A number of donor sites for bone flaps have been described including the fibula, scapula, and iliac crest. The free radial forearm osteocutaneous flap (FRFOCF) was first described by Song et al. in 1974² however widespread use was limited by early reports of

unacceptable donor site morbidity, most commonly fracture of the radius, with resultant negative impact on arm function and quality of life. With experience harvesting this flap and the introduction of prophylactic plate fixation of the radius, donor site morbidity has been significantly reduced, reportedly to levels comparable with the fasciocutaneous FRFF. However, many reconstructive surgeons continue to avoid using the FRFOCF because of potential donor site morbidity and concerns regarding quality and volume of available radial bone stock. This study was designed to assess donor and recipient site morbidity in a large population of patients following harvest of free radial forearm osteocutaneous flaps and to evaluate patient perceived upper limb disability for osteocutaneous versus fasciocutaneous radial forearm free flaps.

PATIENTS AND METHODS

There were two parts to this study. First, a cross-institutional retrospective medical chart review was undertaken of 218 consecutive patients who underwent an FRFOCF at the University of Alabama at Birmingham and the Oregon Health and Science University between February 1998 and November 2010. The Institutional Review Board approval was obtained from each participating center. There were no exclusions. For the second part of the study, the Disability of the Arm, Shoulder and Hand (DASH) questionnaire³ was administered by phone to consecutive patients who underwent a FRFF or FRFOCF between January 2007 and October 2008 (FRFF) or April 2010 (FRFOCF). We attempted to contact 284 consecutive patients (175 FRFF/109 FRFOCF) in order to obtain 60 completed questionnaires (30 for each group), for a response rate of 21.1%.

Pre-and Peri-Operative Procedure

Patients were initially assessed in a clinic setting to determine the type of reconstruction required based on the location, size, and type of recipient site defect. Recipient sites amenable to FRFOCF reconstruction included segmental mandibular defects <10–12cm in length and maxillary and nasal defects. Physical examination and a negative Allens Test following radial artery occlusion were used as indicators of adequate hand vascularity. The nondominant upper extremity was used preferentially for flap harvest unless there were contraindications to harvest from this arm including a positive Allens test, prior forearm surgery or patient preference. The distal edge of the skin paddle was positioned 1–2 cm proximal to the wrist crease and a pneumatic tourniquet was used during flap harvest. During flap harvest, the flexor pollicis longus (FPL) muscle belly was divided longitudinally to allow access for the proximal and distal keel-shaped volar osteotomies. Approximately one third of the diameter of the radius was harvested and a minimum of 3–4 cm distal radius was preserved to allow for subsequent plate fixation. Proximally, bone was harvested up to the attachment of pronator teres muscle depending on the length of bone required. The lateral soft tissue margin of the flap was then dissected out with identification and preservation of radial nerve branches and the lateral intermuscular septum containing radial artery perforating branches to the radius periosteum. Prior to ligation of the proximal vascular pedicle, the tourniquet was released, flow to the flap checked and hemostasis assured. The pedicle was ligated, flow to the hand was assured and the pedicle divided. Locking plates ranging from 2.0 to 3.5 mm were used to plate the radial defect, forearm muscles were reapposed over the plate, and a split thickness skin graft harvested from the thigh or from the donor site on the arm was placed over the distal forearm. The graft was secured using a bolster dressing and the patient was placed in a volar forearm splint for 5 days. On the 5th postoperative day, a lighter weight volar splint was applied for 2 weeks. After 2 weeks, the splint was removed and the patient was allowed to begin both passive and active range of motion.

Outcome Measures

Primary outcome measure was forearm donor site morbidity. Donor site morbidities included radial fracture, forearm neuropathy and skin graft failure. Data was also collected on recipient site complications (fracture, malunion, hardware extrusion) and various patient, disease and operative characteristics including medical comorbidities, length and width of radius harvested, and type of radial plating system used. For assessment of patient-perceived donor site morbidity, the Disability of the Arm, Shoulder and Hand (DASH) questionnaire³ was administered. The DASH questionnaire is a 30 item standardized and validated measure of upper limb disability. It measures how much difficulty an individual has when doing itemized activities regardless of which arm, shoulder or hand they use to perform the activity with the aim of determining their degree of disability as defined by the Disablement Process.⁴ A DASH score of zero indicates least disability and 100 indicates most disability. Patients were asked to rate how easily they could perform each activity on a 5-point scale using preoperative ability as baseline. Additionally, they were asked specifically about function in their operated arm.

Descriptive characteristics were summarized by means (sd) for continuous outcomes and percentages for categorical variables. Comparative data between FRFOCF and FRFF groups was analyzed using the paired *t*-test for continuous or chi-square test for categorical variables. A *P* value of < 0.05 was deemed statistically significant.

RESULTS

Patient, Disease, and Treatment Characteristics

Patient and disease characteristics are summarized in Table 1. Mean patient age was 63 years with a male predominance (63%). Defects of the mandible and maxilla were the most common recipient sites. Malignancy was the most frequent indication for surgery at the recipient site. The left arm was the FRFOCF donor site in 86% of cases and median bone length harvested was 8 cm (range, 3–12 cm). Eighty-seven percent of patients had between one third and 40% of the radial diameter harvested and following harvest the radius was plated. Operative records that specified the size of reconstruction plate used were available for 133 patients (61.0%) and of these, 2.4 mm locking reconstruction plates were utilized most commonly (64 patients, 48.1%) followed by 2 mm (30 patients, 22.6%), 2.5 mm (18 patients, 13.5%) and 3–3.5 mm (18 patients, 13.5%). Overall, 3 patients (1.4%) underwent successful dental rehabilitation; patients not undergoing dental restoration were generally partially or completely edentulous prior to their surgery and were either not interested in undergoing dental restoration or encounter financial barriers to implantation.

Donor and Recipient Site Morbidity

Donor site morbidity included fracture (1 patient, 0.5%), sensory neuropathy (5 patients, 2.3%), and skin graft failure > 50% (10, 4.6%) (Table 2). Median follow-up time was 5 years (range, 0.5–12 years). The fracture occurred at the proximal aspect of the arm where over two thirds of the radial diameter had been harvested. The arm had been plated; however, the patient presented to clinic with a radial fracture 3 weeks later. The fracture was treated with open reduction and internal fixation with iliac crest bone grafting without functional deficits.

Hardware extrusion was the most common complication at the recipient site (34 patients, 15.6%) followed by malunion (7 patients, 3.2%). Compared with patients who did not have hardware extrude, those with hardware extrusion were significantly more likely to have had repair of a mandibular defect (*P* = 0.002). Patients with vascular comorbidities including peripheral vascular disease and coronary artery disease were less likely to have hardware

extrude; however, this did not reach statistical significance (23.5% vs. 50.7%, $P = 0.08$). Pre- or postoperative radiotherapy, postoperative chemotherapy, diabetes, age > 60 years, size of plating system used and gender were not predictive of increased hardware extrusion rates at the recipient site. No factors including size of reconstruction plate were predictive of increased risk of fracture or neuropathy at the donor site or of malunion or fracture at the recipient site.

Patient Perceived Donor Site Morbidity—DASH Questionnaire

Baseline characteristics for surveyed FRFF and FRFOCF patients were similar between groups (Table 3). However, FRFOCF patients had significantly shorter median follow-up time than FRFF patients (35 vs. 44 months, $P = 0.009$). Importantly, mean DASH scores were not statistically different between groups (18.9 vs. 11.2, $P = 0.12$) and were within one standard deviation of established normative values (10.1 ± 14.7).⁵ Age < 60 years ($P = 0.04$) was predictive of a higher than normative DASH score (indicating worse arm function) in the FRFF group, with a similar trend in the FRFOCF group that did not reach statistical significance ($P = 0.09$). Although more females than males who underwent FRFOCF had higher than normative DASH scores (66.7% vs. 33.3%), this was not statistically significant ($P = 0.10$). Time from operation was not predictive of worse DASH score in either group and length of bone harvested did not predict worse scores for FRFOCF patients.

With regards to the ability to execute specific tasks as assessed by the DASH questionnaire, significantly more FRFOCF patients had moderate or greater difficulty in performing forceful recreational activities, changing a light bulb, carrying a heavy object and performing household chores ($P < 0.05$). All other assessed activities were comparable between groups and were performed with no to mild impairment. With regards to specific symptoms, 63.3% of patients in both groups were pain free and 6 (20.0%) FRFOCF/4 (13.3%) FRFF patients had intermittent mild pain ($P = 0.50$). Significantly more FRFF than FRFOCF patients had some degree of ongoing intermittent hand tingling [17 (56.7%) vs. 9 (30.0%) patients, $P = 0.04$] that generally caused only mild disability and significantly more FRFOCF than FRFF patients had some degree of ongoing hand and arm weakness [21 (70.0%) vs. 10 (33.3%) patients, $P = 0.04$] that was rarely rated as greater than mild (Table 4). Overall, 4 patients (13.3%) in the FRFOCF group and 2 patients (6.7%) in the FRFF group felt less capable, confident or useful because of their arm, shoulder, or hand problem ($P = 0.40$).

DISCUSSION

The FRFOCF maintains all the soft tissue advantages of the fasciocutaneous FRFF while providing up to 10–12 cm of radial bone for reconstruction of head and neck defects. It is useful for reconstruction of maxillary and segmental mandibular defects and provides a low morbidity alternative to other forms of osteocutaneous free flaps. Despite these positive attributes, early reports of high donor site morbidity, in particular radial fracture, plus concerns regarding adequacy of bone stock have limited its widespread acceptability and use within the head and neck reconstructive community.^{6–8} We have shown that patients undergoing FRFOCF with prophylactic radial bone plating for reconstruction of head and neck defects have a low incidence of postoperative donor and recipient site complications and acceptable long-term patient-perceived arm function that is comparable to patients undergoing fasciocutaneous FRFF. Although the thickness of the harvested radius in the FRFOCF appears thin and inadequate to support forces of mastication, the data suggests that it is more than sufficient. In the current series, bony malunion was rare (3.2%) in concurrence with previous studies that reported comparable rates of malunion and bone-related complications for the FRFOCF and free fibular flap.^{9–12}

The free fibular flap (FFF) is commonly utilized for reconstruction of mandibular defects due to the length and quality of bone available. A prior study noted that although FRFOCF and FFF have comparable donor and recipient site morbidity rates, peripheral vascular disease in the elderly head and neck cancer population can limit use of the FFF in addition to months of postoperative antalgic gait.⁹ When <10 cm of bone length is required, the FRFOCF is thus a suitable alternative to the FFF, especially in the elderly population where impaired mobility is a clinical concern. As shown in this series, up to 12 cm of bone length may be harvested with an FRFOCF although this varies somewhat depending on the length of the patient's radius. Contraindications to FRFOCF harvest include requirement for bone length >10–12 cm, need for >1 osteotomy, or very large associated mucosal or cutaneous defect. Peripheral vascular disease is not a contraindication to harvest of the FRFOCF and does not increase risk of donor site complications.

Earlier series reported a 12–17% rate of radial fracture following FRFOCF without prophylactic radial plating.^{6–8} Three years later, a biomechanical assessment of radial strength with and without prophylactic plating of radii after FRFOCF harvest demonstrated that while removal of an 8 cm segment of radius decreased torsion and bending strength, prophylactic plating of the radial defect with 3.5 mm dynamic compression plates significantly restored the strength of the radius.¹⁰ Although this study was performed on cadaver radii, it is the only one of its kind to quantitatively measure bone strength after FRFOCF harvest and the extremely low rate of fracture seen in the current series where patients had prophylactic radii plating clinically confirms these cadaveric findings. The cadaveric study suggested that all screw holes over the site of the defect in the osteotomized radius be filled with a screw as this was shown to confer greater torsional strength than either not filling any screw-hole over the defect or only filling every other screw-hole. However, a study in 2000 found an increased incidence of subclinical radial fractures occurring intraoperatively at screw sites within the bone graft defect.¹¹ In this study, two screws are placed distally and three proximally in a monocortical fashion, avoiding screw placement directly over the osteotomized segment.

Concern regarding adequacy of radial bone stock for reconstruction of head and neck defects with resultant inability to perform dental implantation and negative impact on recipient site function are other frequently cited criticisms of the FRFOCF. Although this study was designed to primarily assess radial donor site morbidity, hardware extrusion was the most common recipient site morbidity (15.6%) occurring significantly more commonly with mandibular than maxillary reconstructions. Although this rate of hardware exposure is higher than that generally quoted for fibular free flaps,^{12,13} it is comparable with previously quoted rates for FRFOCF and may relate to reduced bone stock.¹⁴ A previous study also suggested that type and size of plating system used to secure the graft may affect extrusion rates; however, no such correlation was observed in this study.¹⁴ Free fibular flaps are generally considered superior to FRFOCF for dental implantation due to increased available bone stock. Although it is well known that only a small fraction of mandibular reconstruction patients ever undergo implantation, it has been shown that implantation is possible with FRFOCFs particularly when augmented with bone grafts and bone morphogenetic protein-2 products.^{15,16} A recently published series comparing free fibular flaps to FRFOCF reported higher rates of dental implantation in FRFOCF patients (5.8% vs. 1%), although all three of the FRFOCF required tibial or iliac bone grafting.⁹ This study also showed that many patients are partially or completely edentulous prior to their cancer surgery and are either not interested in undergoing dental restoration or encounter financial barriers to implantation. Recipient site function was not specifically addressed in the current study; however, a prior series demonstrated comparable functional outcomes between FRFOCF and free fibular flaps.⁹

To assess patient perceived upper limb disability following FRFOCF harvest, postoperative DASH scores for patients who underwent FRFOCF were compared with those from patients who had undergone FRFF with the aim of demonstrating that the frequently cited “donor site morbidity” of the FRFOCF is in fact minimal and comparable with that of the widely accepted FRFF. Mean DASH values obtained for FRFF (11.2) and FRFOCF (18.9) patients in the current series fell easily within one standard deviation of established normative values.⁵ A prior study used the DASH questionnaire in addition to a functional upper limb examination to assess 12 patients who had undergone FRFOCF harvest, one of whom had sustained a pathologic radial fracture.¹⁷ They found that objective reductions in distal upper limb motion are frequent after FRFOCF harvest and concluded that wrist range of motion had the greatest impact on patient self-report of disability.^{17–19} Similarly, in our series the most common subjective deficits following FRFOCF were mild weakness and wrist stiffness. However, these deficits did not cause significant task related disability, which may be partly attributable to harvest of the flap from the nondominant hand in the majority of cases. Forceful recreational activities, changing a light bulb, carrying heavy objects and performing household chores were the activities most affected by FRFOCF harvest and the higher DASH scores (indicating worse arm function) observed for females and patients < 60 years may relate to more frequent arm use in these populations. However, overall despite these mild functional limitations patients did not feel less capable, confident, or useful due to their arm disability. Thus the previously reported objective decrease in arm strength following FRFOCF harvest may not translate into a clinically significant disadvantage.^{12,13,17}

The main limitation of this study is the lack of objective biomechanical measures of arm strength for operated versus nonoperated arms. The DASH questionnaire measures overall ability to perform certain itemized activities not specific to the patient’s affected limb and thus values obtained may not truly represent single arm morbidity, particularly given harvest generally occurred from the nondominant hand. Also patients were asked to compare their arm function at the time of questionnaire administration to preoperative function introducing an element of recall bias that could be eliminated had pre-operative DASH questionnaires been performed.

CONCLUSION

Reluctance to perform FRFOCF by surgeons usually centers on potential donor site morbidity; however, we identified minimal objective or patient perceived donor site morbidity following harvest of FRFOCFs. Mild wrist weakness and stiffness are common but do not impede ability to perform activities of daily living. Data from this and other reports suggest the value of this flap may be particularly useful for midfacial and short segment mandibular reconstruction.

REFERENCES

1. Yang GF, Chen PJ, Gao YZ, Liu XY, Li J, Jiang SX, He SP. Forearm free skin flap transplantation: a report of 56 cases. *Br J Plast Surg*. 1997; 50:162–165. [PubMed: 9176001]
2. Song R, Gao Y, Song Y. The forearm flap. *Clin Plast Surg*. 1982; 9:21–26. [PubMed: 7094519]
3. Hudak PL, Amadio PC, Bombardier C. Development of an upper extremity outcome measure: The DASH (Disabilities of the Arm, Shoulder, and Head). *Am J Ind Med*. 1996; 29:602–608. [PubMed: 8773720]
4. Verbrugge LM, Jette AM. The disablement process. *Soc Sci Med*. 1994; 38:1–14. [PubMed: 8146699]

5. Hunsaker FG, Cioffi DA, Amadio PC, Wright JG, Caughlin B. The American academy of orthopaedic surgeons outcomes instruments: normative values from the general population. *J Bone Joint Surg A*. 2002; 84:208–215.
6. Zenn MR, Hidalgo DA, Cordeiro PG, Shah JP, Strong EW, Kraus DH. Current role of the radial forearm free flap in mandibular reconstruction. *Plast Reconstr Surg*. 1997; 99:1012–1017. [PubMed: 9091896]
7. Richardson D, Fisher S, Vaughan E, Brown JS. Radial forearm flap donor-site complications and morbidity: A prospective study. *Plast Reconstr Surg*. 1997; 99:109–115. [PubMed: 8982193]
8. Thoma A, Khadaroo R, Grigenas O, Archibald S, Jackson S, Young JE, Veltri K. Oromandibular reconstruction with the radial forearm osteocutaneous flap: Experience with 60 consecutive cases. *Plast Reconstr Surg*. 1999; 104:368–378. [PubMed: 10654679]
9. Virgin FW, Iseli TA, Iseli CE, Sunde J, Carroll WR, Magnuson JS, Rosenthal E. Functional outcomes of fibula and osteocutaneous forearm free flap reconstruction for segmental mandibular defects. *Laryngoscope*. 2010; 120:663–667. [PubMed: 20213660]
10. Bowers KW, Edmonds JL, Girod DA, Jayaraman G, Chua CP, Toby EB. Osteocutaneous radial forearm free flaps. The necessity of internal fixation of the donor-site defect to prevent pathological fracture. *J Bone Joint Surg A*. 2000; 82:694–704.
11. Werle AH, Tsue TT, Toby EB, Girod DA. Osteocutaneous radial forearm free flap: Its use without significant donor site morbidity. *Otolaryngol Head Neck Surg*. 2000; 123:711–717. [PubMed: 11112963]
12. Cordeiro PG, Disa JJ, Hidalgo DA, Hu QY. Reconstruction of the mandible with osseous free flaps: A 10-year experience with 150 consecutive patients. *Plast Reconstr Surg*. 1999; 104:1314. [PubMed: 10513911]
13. Peled M, El-Naaj IA, Lipin Y, Ardekian L. The use of free fibular flap for functional mandibular reconstruction. *J Oral Maxillofac Surg*. 2005; 63:220–224. [PubMed: 15690291]
14. Militsakh ON, Werle A, Mohyuddin N, Toby EB, Kriet JD, Wallace DI, Girod DA, Tsue TT. Comparison of radial forearm with fibula and scapula osteocutaneous free flaps for oromandibular reconstruction. *Arch Otolaryngol Head Neck Surg*. 2005; 131:571–575. [PubMed: 16027278]
15. Bell RB, Blakey GH, White RP, Hillebrand DG, Molina A. Staged reconstruction of the severely atrophic mandible with autogenous bone graft and endosteal implants. *J Oral Maxillofac Surg*. 2002; 60:1135–1141. [PubMed: 12378486]
16. Herford AS, Boyne PJ. Reconstruction of mandibular continuity defects with bone morphogenetic protein-2 (rhBMP- 2). *J Oral Maxillofac Surg*. 2008; 66:16–24. [PubMed: 18083410]
17. Deleyiannis FWB, Phil M, Sacks JM, Russavage JM. Patient self-report of disability of the upper extremity following osteocutaneous radial forearm free flap harvest. *Plast Reconstr Surg*. 2008; 122:1479–1483. [PubMed: 18971732]
18. Bialocerkowski AE, Grimmer KA, Bain GI. Validity of the patient-focused wrist outcome instrument: Do impairments represent functional ability? *Hand Clin*. 2003; 19:449. [PubMed: 12945642]
19. Adams BD, Grosland NM, Murphy DM, McCullough M. Impact of impaired wrist motion on hand and upper-extremity performance. *J Hand Surg Am*. 2003; 28:898. [PubMed: 14642503]

Table 1**Patient, Disease, and Operative Characteristics**

		<i>n</i> (%)
Gender	Male	137 (62.8)
	Female	81 (37.2)
Age > 60 years	Yes	133 (61.0)
	No	85 (39.0)
Medical comorbidities	Vascular	76 (34.9)
	Diabetes	29 (13.3)
	COPD	19 (8.7)
Donor arm	Left	188 (86.2)
	Right	30 (13.8)
Recipient site	Mandible	136 (62.4)
	Maxilla	75 (34.4)
	Nasal vault	5 (2.3)
	Anterior skull base	2 (0.9)
Indication for surgery at recipient site	Malignancy	178 (81.7)
	Osteoradionecrosis	19 (8.7)
	Trauma	18 (7.8)
	Osteomyelitis	2 (0.9)
Percentage width of radius harvested	25%	2 (0.9)
	33%	79 (36.2)
	40%	46 (21.1)
	50%	17 (7.8)
	Not specified	74 (33.9)

COPD, chronic obstructive pulmonary disease.

Table 2

Objective Donor and Recipient Site Morbidity

Location	Morbidity	<i>n</i> (%)
Forearm	Fracture	1 (0.5)
	Sensory neuropathy	5 (2.3)
	Motor neuropathy	0
Recipient site	Hardware extrusion	34 (15.6)
	Malunion	7 (3.2)
	Fracture	4 (1.8)

Table 3

Group Characteristics and Mean DASH Scores for Patients after Free Radial Forearm Osteocutaneous vs. Fasciocutaneous Flaps

	FRFOCF, <i>n</i> (%)	FRFF, <i>n</i> (%)	<i>P</i>
Gender			
Male	18 (60.0)	17 (56.7)	0.80
Female	12 (40.0)	13 (43.3)	
Age > 60 years	17 (56.7)	15 (50.0)	0.61
Median time from operation, months (range)	35 (15–50)	44 (32–50)	0.009
Mean DASH score ^a (SD)	18.9 (22.0)	11.2 (15.3)	0.12

^aMean Normative DASH Value⁵ = 10.1 (SD = 14.7).

SD, standard deviation; FRFOCF, free radial forearm osteocutaneous flap; FRFF, free radial forearm fasciocutaneous flap.

Table 4

Comparative Symptom Severity as Reported on DASH Questionnaire

Arm, shoulder, or hand symptom	None–mild <i>n</i> (%)	Moderate– extreme <i>n</i> (%)	<i>P</i>
Pain—general			
FRFOCF	25 (83.3)	5 (16.7)	0.53
FRFF	23 (76.7)	7 (23.3)	
Pain, with specific activity			
FRFOCF	19 (63.3)	11 (36.7)	0.16
FRFF	24 (80.0)	6 (20.0)	
Tingling			
FRFOCF	27 (90.0)	3 (10.0)	0.10
FRFF	22 (73.3)	8 (26.7)	
Weakness			
FRFOCF	22 (73.3)	8 (26.7)	0.36
FRFF	25 (83.3)	5 (16.7)	
Stiffness			
FRFOCF	25 (83.3)	5 (16.7)	0.46
FRFF	27 (90.0)	3 (10.0)	
Difficulty sleeping due to pain			
FRFOCF	26 (86.7)	4 (13.3)	0.69
FRFF	27 (90.0)	3 (10.0)	

FRFOCF, free radial forearm osteocutaneous flap; FRFF, free radial forearm fasciocutaneous flap.