Original Article

QUALITY OF LIFE ASSESSMENT AND CO-MORBIDITIES OF MAXILLOFACIAL SURGERY DEPARTMENT PATIENTS UNDERGOING ILIAC CREST HARVESTING PROCEDURES

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ABSTRACT

Autogenous bone grafts are the gold standard for bone harvesting, namely the iliac crest. A retrospective, cross-sectional study was conducted, to assess the quality-of-life changes and donor site morbidity of patients who underwent anterior or posterior iliac crest autogenous bone graft harvesting procedures at King Abdulaziz University Hospital, using a survey instrument to obtain responses via phone call from 31 interviewed patients, mainly males (51.6%), with mean age of 36.77(17.1). Results revealed significant correlation between the pain level and time alone (p=0.006), and between pain level and time interacting with age (p=0.006). Most of the patients went back to baseline after 6 weeks of follow-up. The results further revealed that patients who had anterior iliac crest graft had better QoL and less pain than those who had posterior iliac crest bone graft.

Key words: Iliac crest, Quality of life, Autogenous graft, Anterior ilium, Posterior ilium, Harris hip score.

Introduction

Various etiologies account for severe alveolar ridge atrophies as non-restored edentulous spaces, (disuse atrophy), poorly constructed dentures, periodontitis and peri-implantitis [1, 2]. Jaws affected by neoplasms, trauma, and malformations require bone augmentation procedures to restore the function, anatomical features, and esthetics [3, 4]. The goal for prosthetic replacement is restoring the bone volume, through augmentation procedures utilizing harvested autogenous bone grafts, allografts, xenografts, alloplasts, or combinations of materials [1]. Autogenous grafts are the gold standard, they combine the properties of osteoconduction, osteoinduction, and osteogenesis, without risk of infection transmission or immunologic responses [5-7].

Iliac crest grafts are the most commonly utilized autogenous grafts for the ease of procedural accessibility and acquirement, and lowest morbidity [6, 8]. Iliac crest bone harvesting grafts, either anterior or posterior, depend on the type of surgery, as cancellous, cortico-cancellous, or vascularized grafts and allow for large quantities of bone available for harvesting [5]. Oral & maxillofacial surgeons prefer the anterior iliac crest due to the nature of their operations, requiring rich cancellous component needed for the augmentation, as well as the patient's position lying face-up [9, 10].

The aim of this study is to compare the pain and QoL and co-morbidity of patients who underwent anterior versus posterior iliac crest bone graft harvesting procedures at King Abdulaziz University Hospital (KAUH), at 3 different time intervals, and to correlate our findings with multiple subjective, objective, and socio-demographic factors.

Materials and Methods

A cross-sectional study was conducted using a post-operative survey instrument to obtain responses in a phone call interview. Confidentiality was secured through maintaining anonymous participants' information. Demographic data including age, gender, time and site of operation were obtained. Clinical notes and medical records were reviewed. Sample selection included all patients treated by the senior investigator (MYA) at KAUH and were under his care postoperatively from the period of Jan 1, 2012, to Aug 31, 2020. 31 patients were included (15 females and 16 males). 7 patients underwent posterior iliac crest, while 24 had their grafts harvested from the anterior iliac crest.

Questionnaire design

A single investigator (MRA) contacted all participants and informed them about the questionnaire thoroughly. No participants faced any difficulty answering the survey. A phone call-based interview was conducted three days later to obtain their verbal consent and the answers to the survey questions. (MRA) recorded all the answers on a Google Sheet document (Google Sheets, Google LLC, California), which was exported later to Microsoft Excel (Microsoft Excel, Microsoft Corporation, Washington DC) for data analysis purposes.

The questionnaire consisted of 3 main parts. The first part included general demographic questions **(Table 2)**. The second part consisted of only the first section of the Harris Hip Score [11], and since the entire sample was of Muslim religion, 2 questions regarding prayer were added: (were you able to perform Prayer? yes, normally; on a chair; or lying down. If the previous answer was "on a chair," did you pray on a chair before the procedure?. Arabic translation of the Harris Hip Score was validated for reliability using Cronbach's alpha. The third part consisted of post-operative co-morbidities **(Table 1)**. The questionnaire was validated for both content and face validity by the research team and three oral and maxillofacial surgery consultants.

Table 1. Post-operative co-morbidities

Question	Answers
Was there any numbness in the hip or leg? If you experienced any other abnormal sensation, choose (Other) and describe it.	No numbness Numbness in the leg Numbness in the hip Numbness over the scar Other
Describe any abnormal sensation you experienced on a scale from 1-3	1 (total loss of sensation) 2 (partial loss of sensation) 3 (totally normal sensation)
Are you able to live with it?	Yes No
How would you rate your cosmetic satisfaction?	Satisfied Unsatisfied Indifferent
Did you face any of these complications with your scar? (Choose all that apply)	Itching Itching with clothes Pain Pain with clothes Irritation Irritation with clothes Scar erythema Scar hypertrophy
Did you face any of these complications immediately after the procedure? (Choose all that apply)	Swelling Hematoma Inflammation Pyogenic granuloma Incisional hernias Pelvic fracture Chronic pain Infection

Surgical technique for the anterior iliac approach

The incision was carried out through the skin, subcutaneous layer, Camper's fascia, Scarpa's fascia, and ends on the periosteum. The lateral aspect was minimally dissected preserving the tensor fascia lata. Encroachment on the anterior-superior iliac spine was avoided to prevent injury to the inguinal ligament or the other six attachments. The medial aspect was fully retracted using Taylor retractor.

Two parallel anterior and posterior cuts on the medial aspect were connected via a superior crestal cut using a surgical saw, followed by a medial inferior osteotomy stop cut with a round bur.

Subsequently, serial osteotomes were used securing that their angles avoid harvesting a bicortical graft and or perforate the lateral cortical aspect of the bone.

Finally, cortex was delivered from the anterior aspect, measuring 2 by 4 centimeters, and excavating the amount of the needed cancellous bone, around 50CC, including the hip block from the anterior iliac crest.

The site was then irrigated, and a hemostatic agent (usually

microfibrillar collagen sheets) placed on the medial aspect, the wound was closed in layers, followed by sterostrip application and Tensoplast or Elastoplast on top of the surgical site.

The surgical technique for the posterior iliac approach
Landmarking started from the posterior superior iliac spine, and a curvilinear mark was marked along the superior aspect of the gluteus maximus muscle.

A curvilinear incision was done around that line, measuring 7 to 8 centimeters, avoiding injury of S1, S2, S3 or L1, L2, L3 branches.

Dissection through four layers, skin, subcutaneous layer, lumbodorsal fascia, ended on the periosteum, exposing the bone, and avoiding sciatic nerve exposure. Osteotomy was carried out through the surgical saw approach.

Anterior and posterior trapezoidal-like cuts connected from the crestal aspect, ended by inferior osteotomy stop cut with a round bur, followed by serial osteotomized cuts. Collected, bone block was, a 5-by 4-centimeter. Cancellous bone was excavated from the site, which along with the block, accounted for 70 to 80 and even up to 100 CCs in total, followed by irrigation and application of a hemostatic agent, mainly microfibrillar collagen. Insertion of a hemovac or a Jackson Pratt drain, size 16, with an exit through the skin, was followed by periosteum closure, and layers with application of sterostrip and pressure dressing.

Pain management
During the admission period, the patients were placed on narcotics, mainly morphine, 2 to 4 milligrams IV, with NSAIDs and paracetamol to wean the narcotic requirement before discharge. The NSAIDs used in the intraoperative course were between Toradol® (Roche Holding AG, Basel, Switzerland) or ibuprofen, which can go along with Perfalgan® (Aspen Laboratories Pvt Ltd, Delhi, India).

The at-home course was the combination of Solpadine (Omega Pharma, Nazareth, Belgium) and ibuprofen, usually two tablets of Solpadine 500mg and one tablet of ibuprofen 600 or 400 mg, depending on the patient's weight, with daily water intake, 2.7 liters for the females or 3.7 liters for the males.

Statistical analysis
Data analysis used IBM SPSS version 23 (IBM Corp., Armonk, NY, USA). A simple descriptive statistic was used for categorical and nominal variables, while continuous variables were presented by mean and standard deviations. An average score was calculated called "QoL" derived from the questions with a hundred-point scale as follows:

- Pain
  - None, or ignores it=100
  - Slight, occasional, no compromise in activity=80
  - Mild pain, no effect on average activities, rarely moderate pain with unusual activity, may take aspirin=60
  - Moderate pain, tolerable but makes concessions to pain=Some limitations of the ordinary activity or work=40
  - Marked pain, serious limitation of activities=20
  - Totally disabled, crippled, pain in bed, bedridden=0

- Support
  - None=100
  - Cane/Walking stick for long walks=80
  - Cane/Walking stick most of the time=60
  - One crutch=40
  - Two Canes/Walking sticks=20
  - Two crutches or not being able to walk=0

- Distance walked
  - Unlimited=100
  - Six blocks (30 minutes)=75
  - Two or three blocks (10-15 minutes)=50
  - Indoors only=25
  - Bed and chair only=0

- Limp
  - None=100
  - Slight=66.7
  - Moderate=33.3
  - Severe or unable to walk=0

- Activities- shoes, socks
  - With ease=100
  - With difficulty=50
  - Unable to fit or tie=0

- Using stairs
  - Normally without using a railing=100
  - Normally using a railing=50
  - Unable to do stairs=0

- Sitting
  - Comfortably, an ordinary chair for one hour=100
  - On a highchair for 30 minutes=50
  - Unable to sit comfortably on any chair=0

- Were you able to drive/leave the house?
  - Yes=100
  - No=0

- Were you able to perform Salah (Prayer)?
  - Yes, normally=100
  - Yes, on a chair=50
  - Yes, lying down=0

Each question is separated by the time interval of IAS, 6w,

and Current Time. A Reliability Analysis was used with an Alpha (Cronbach) model to study the properties of measurement of the "QoL" scale, the items that compose it, and the average inter-item correlation. A Pain scale was also used in the comparison by converting the existing scoring of "Rate the pain from 0-10" by multiplying each response by tens to achieve a hundred-point equivalent score for each time interval of IAS, 6w, and Current Time. After conversion and calculation of the scales, a repeated measure ANOVA with a Greenhouse-Geisser correction was used as a test to correlate the scales to the demographical data. Lastly, a conventional p-value <0.05 was the criteria to reject the null hypothesis.

Results and Discussion

The QoL and pain levels at different time points were investigated. Most of the patients underwent anterior iliac crest graft harvesting (77%, n=24). Other demographic and characteristics of the participants are shown in **Table 2**.

Using a 100-point scale, the mean pain scores showed decrease from the IAS period (63.23 ± 30.4) to after 6w (30.97 ± 30.4) and to current time (4.84 ± 11.2), suggesting an improvement in their pain management, a similar trend was found in the other evaluated aspects **(Figure 1)**.

The pain profile showed a decreasing trend of mean pain scores among patients across time, (IAS), after 6w, and at the current time, with improvement between IAS and 6w (93.5%, n=29) and between 6w and the current time (96.8%, n=30).

Cronbach's alpha was used to test the reliability (internal consistency) of the items composing the QoL scale at different time points. The values obtained were 0.893 for IAS, 0.885 for 6w, and 0.678 for the present. Using the rule of thumb which states that > 0.9 is excellent, > 0.8 is good, > 0.7 acceptable, > 0.6 – Questionable, > 0.5 – Poor, and < 0.5 is unacceptable", items in QoL at IAS and 6w had a good internal consistency, while QoL at current time was questionable, due to variation of time elapsed since surgery differs amongst the patients.

Table 3 demonstrates multivariate tests on the QoL against time and other socio-demographic factors. Results revealed a significant effect between the QoL and time alone (p=0.002). ANOVA with repeated measures with a Greenhouse-Geisser correction showed mean QoL scores to be statistically significantly different between time points (F(2.000, 23.000) =8.260, p=0.002). Using Mauchly's Test of sphericity, a p-value of 0.806 was obtained, suggesting normality in the distribution of the statistical data. The normality in the distribution of patients was explicitly found in the QoL at IAS, at 6w, and at current periods, by p-values greater than 0.05 obtained using Levene's Test of equality of error variances.

Estimated marginal means were measuring the improvement in the QoL of patients at different time points. The estimated mean QoL increased, as shown by values of 43.801 (SE=3.401) at IAS, 76.709 (SE=4.106) at 6w, and 94.177 (SE=1.621) at the current time. The pairwise comparison revealed that the patients had an overall statistically significant improvement (p < 0.001) in the QoL at all three time points **(Figure 2)**.

Table 2. Demographic characteristics, pain, and QoL scores of 31 study samples

Demographics	N	Min	Max	Mean	SD
Age	31	13	70	36.77	17.1
Weight	31	30	112	67.77	18.4
When was the surgery	31	1	8	3.23	1.8
			Count	%	
Total			31	100.0	
Gender	Male		16	51.6	
	Female		15	48.4	
Marital status	Single		15	48.4	
	Married at least one		16	51.6	
Highest level of education	High school and below		14	45.2	
	Bachelors and above		17	54.8	
Which floor do you live on?	Ground		15	48.4	
	First		16	51.6	
How do you get to your house?	Not applicable		9	29.0	
	Stairs		19	61.3	
	Elevators		3	9.7	

What type of job do you work?	Office job	3	9.7
	Field job	10	32.3
	I don't work	18	58.1
Does your job involve the handling of heavy objects?	Yes	5	16.1
	No	8	25.8
	Not applicable	18	58.1
If your workplace is on a high floor, what do you use to get to it?	NA	19	61.3
	Stairs	10	32.3
	Elevator	2	6.5
Donor site	Right anterior hip	8	25.8
	Right posterior hip	5	16.1
	Left anterior hip	16	51.6
	Bilateral posterior hip	2	6.5

Scores	N	Min	Max	Mean	SD
QoL IAS	31	10.0	76.67	43.13	18.6
QoL 6w	31	17.22	100.0	76.40	23.9
QoL Now	31	66.30	100.0	94.13	9.2
Pain /10 IAS	31	0.00	100.0	63.23	30.4
Pain /10 6w	31	0.00	100.0	30.97	30.4
Pain /10 now	31	0.00	50.0	4.84	11.2

Multivariate tests on the pain scores against time and other socio-demographic factors were performed **(Table 4)**. Results revealed a significant effect between the pain level and time alone (p=0.006) and between pain level and time interacting with age (p=0.006), Moreover, ANOVA with repeated measures with a Greenhouse-Geisser correction revealed that the mean pain scores were statistically significantly different between time points [(F(2.000,23.000)=6.413, p=0.006), (F(2.000,23.000)= 6.462, p=0.006)]. Using Mauchly's Test of sphericity, a p-value of 0.304 was obtained, suggesting lower normality in the distribution of the statistical data, less normality in the distribution of patients was still found specifically in the pain scores in the IAS, 6w, and at the current time groups, as shown by p-values less than or equal to 0.05 obtained using Levene's Test of equality of error variances.

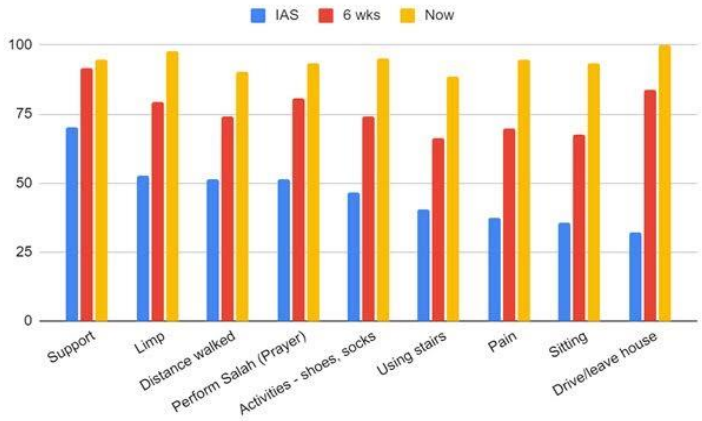

Figure 1. QoL mean scores at different time point

Table 3. Multivariate Tests on QoL against time and other socio-demographic factors.

Effect (Pillai's Trace)	Value	F	Hypothesis df	Error df	Partial Eta Squared	Noncent. Parameter	Observed Power c	p-value
Time	0.418	8.260b	2.000	23.000	0.418	16.519	0.935	0.002

Time * Gender	0.096	1.225b	2.000	23.000	0.096	2.450	0.240	0.312
Time * Marital status	0.139	1.854b	2.000	23.000	0.139	3.708	0.346	0.179
Time * Highest level of education	0.036	.432b	2.000	23.000	0.036	0.864	0.112	0.654
Time * Which floor do you live in?	0.093	1.176b	2.000	23.000	0.093	2.351	0.232	0.327
Time * Age	0.178	2.497b	2.000	23.000	0.178	4.994	0.450	0.104
Time * Weight	0.063	0.775b	2.000	23.000	0.063	1.550	0.166	0.472

a-Design: Intercept + Gender + Marital status + Highest level of education + Which floor do you live in? + Age + Weight
Within Subjects Design: Time, b-Exact statistic, c-Computed using alpha = 0.05

The estimated marginal means were measured depicting improvement in the pain levels experienced at different time points **(Figure 3)**. The pairwise comparison revealed that the patients had an overall statistically significant improvement ($p < 0.001$) in the pain scores in the IAS, 6w , and at the current time.

The QoL score means for each patient in both the anterior and posterior approach groups, respectively, along with their relevant demographic data, are presented in all time intervals in **Tables 5 and 6**.

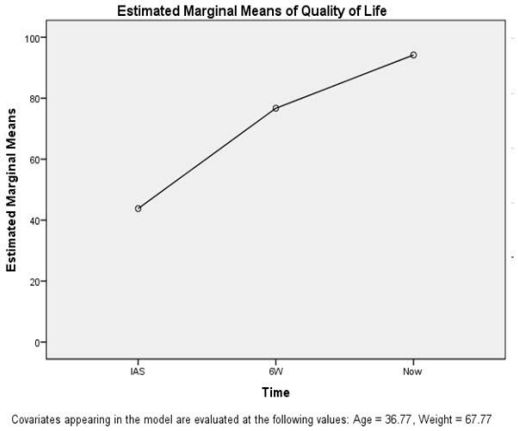

Figure 2. Estimated Marginal Means of QoL

Table 4. Multivariate Tests on pain scores against time and other socio-demographic factors.

Effect (Pillai's Trace)	Value	F	Hypothesis df	Error df	Partial Eta Squared	Noncent. Parameter	Observed Power c	p-value
Time	0.358	6.413b	2.000	23.000	0.358	12.826	0.860	0.006
Time * Gender	0.133	1.768b	2.000	23.000	0.133	3.536	0.332	0.193
Time * Marital status	0.148	2.001b	2.000	23.000	0.148	4.001	0.370	0.158
Time * Highest level of education	0.039	.465b	2.000	23.000	0.039	0.930	0.117	0.634
Time * Which floor do you live on?	0.053	.643b	2.000	23.000	0.053	1.286	0.144	0.535
Time * Age	0.360	6.462b	2.000	23.000	0.360	12.924	0.863	0.006
Time * Weight	0.262	4.092b	2.000	23.000	0.262	8.183	0.667	0.030

a-Design: Intercept + Gender + Marital status + Highest level of education + Which floor do you live in? + Age + Weight
Within Subjects Design: Time
b-Exact statistic. c-Computed using alpha = 0.05.

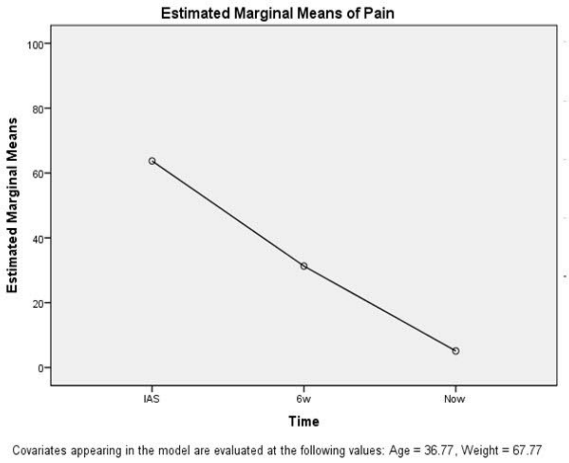

Figure 3. Estimated Marginal Means of Pain

Regarding the specific donor site, the majority of the patients with anterior iliac crest harvest rated their pain IAS to be 7 or above out of 10 (54.2%, n=13), while 37.5% (n=9) needed support to move around IAS. 29.2% (n = 7) stopped support needs 6w after surgery, while 8.4% still needed support until the current time, with the mean of the current time being 3.17±1.7 years.

62.5% (n=15) of the patients had limitations in the walking distance IAS, with good ability to move around indoors (37.5%, n=9). While, 54.2% (n=13) could walk unlimited distance after 6w,, and 87.5% (n=21) in the current time. Regarding limping, 66.7% (n=16) of the patients experienced limping IAS, which decreased to 25% (n=6) at 6w, and none at the current time. 66.7% (n=16) of the patients faced difficulties in performing daily activities IAS, while only 29.2% (n=7) faced difficulty at 6w. 33.3% (n=8) were unable to use the stairs IAS, but only 2 (8.3%) were still unable to use the stairs at 6w, but all patients can use the stairs normally at the current time. Most patients (62.5%, n=15) could not sit comfortably on any chair IAS. Most of the patients (66.7%, n=16) could not leave the house IAS due to pain (54.2%, n=13), tiredness and fatigue (8.3%, n=2), or fear of contaminating the wound (4.2%, n=1). Post-operative numbness was reported over the scar (25%, n=6), in the hip (20.8%, n=5), or in the leg (12.5%, n=3), 83.3% were able to live with it. The majority of anterior iliac crest graft (54.2%, n=13) were satisfied with their scar, while 29.2% (n=7) were indifferent. For immediate postoperative complications, only 12.5% (n=3) complained of swelling, 20.9% (n=5) hematoma and only 8.3% (n=2) had procedural site inflammation.

Table 5. QoL score means for anterior approach patients

Gender	Age	Weight (KG)	Follow-up (years)	Donor site	QoL IAS mean ± SD	QoL 6w mean ± SD	QoL now means ± SD
Male	13	30	4	LAH	26.67 ± 34.28	35.89 ± 30.91	93.33 ± 18.86
Female	37	54	1	LAH	43.67 ± 36.96	85.56 ± 21.14	100
Male	54	79	4	LAH	88.89 ± 33.33	100	100
Female	40	54	4	LAH	15.11 ± 25.5	73.33 ± 24.94	97.78 ± 6.29
Male	34	62	7	LAH	0.67 ± 2	53.67 ± 37.52	100
Male	40	75	5	LAH	66.22 ± 33.14	100	100
Female	70	112	6	LAH	15.56 ± 21.28	40 ± 37.42	72.22 ± 34.25
Female	15	53	3	LAH	77.78 ± 36.32	97.78 ± 6.29	100
Male	15	74	3	RAH	24.44 ± 43.33	83.33 ± 33.33	92.22 ± 16.18
Male	16	85	3	LAH	69.22 ± 38.83	81.78 ± 31.74	91.11 ± 25.14
Male	16	37	1	RAH	88.89 ± 33.33	88.89 ± 31.43	88.89 ± 31.43
Male	17	45	4	RAH	88.89 ± 33.33	100	100
Male	21	80	4	LAH	46.22 ± 46.94	88.44 ± 17.81	100
Male	24	55	6	RAH	73.33 ± 41.23	88.89 ± 31.43	100
Male	26	70	1	RAH	17.78 ± 22.79	93.33 ± 18.86	97.78 ± 6.29
Male	28	49	1	RAH	47 ± 35.9	92.22 ± 16.18	100
Male	33	77	3	LAH	35.89 ± 32.78	88.89 ± 17.28	94.44 ± 15.71
Male	33	70	3	LAH	35.11 ± 39.62	88.89 ± 20.79	94.44 ± 15.71
Female	38	72	2	LAH	87.78 ± 24.3	100	100
Female	41	75	3	LAH	11.11 ± 33.33	27 ± 31.67	88.89 ± 31.43
Female	54	70	1	LAH	37.33 ± 34.84	72.22 ± 37.05	100

Female	54	70	4	RAH	37.33 ± 34.84	72.22 ± 37.05	100
Female	57	87	2	RAH	7.78 ± 17.16	36.67 ± 37.71	81.11 ± 28.46
Male	58	53	1	LAH	90 ± 21.21	100	100

LAH: left anterior hip, RAH: right anterior hip

Table 6. QoL score means for posterior approach patients

Gender	Age	Weight (KG)	Follow-up (years)	Donor site ± SD	QoL IAS mean ± SD	QoL 6w mean ± SD	QoL now means ± SD
Female	14	41	3	RPH	19.22 ± 23.35	58.44 ± 34.34	100
Male	28	48	1	BPH	35.89 ± 41.23	68.44 ± 30.72	60.67 ± 37.46
Female	38	72	3	RPH	12.22 ± 19.86	16.67 ± 20	94.44 ± 15.71
Female	48	80	3	RPH	7.78 ± 17.16	35.89 ± 38.87	100
Female	54	85	8	BPH	36.67 ± 35	76.67 ± 35.28	92.22 ± 16.18
Female	54	78	3	RPH	64 ± 38.72	100	100
Female	70	88	3	RPH	67.33 ± 22.23	67.33 ± 20.95	71.78 ± 18.82

RPH: right posterior hip, BPH: bilateral posterior hip

On the other hand, out of the posterior approach patients, 57.2% (n=4) had rated their pain IAS to be 8 and above out of 10. 71.4% (n=5) needed support to move around IAS. 28.6% (n=2) were able to move without support after 6w, with only one patient still needing support in the current time, with the mean of the current time being 3.43±2.1 years. 85.7% (n=6) had limitations in the walking distance IAS. After 6w, 71.4% (n=5) still had limitations, which ended in the current time. 85.7% (n=6) of the patients had a limp IAS, which decreased to 71.4% (n=5) after 6w, and 28.6% (n=2) in the current time. 85.7% (n=6) had difficulties in performing daily activities IAS, while at 6w, only 42.9% (n=3) still had difficulties. Using stairs was a problem IAS for 71.4% (n=5) of the patients, with gradual improvement towards baseline conditions at the current time. The majority of patients (71.4%, n=5) were unable to sit comfortably on any chair IAS. 85.7% (n=6) could not leave the house IAS, mostly due to pain (57.1%, n=4). Only 28.6% (n=2) reported post-operative numbness in the leg, with only one of them unable to live with it. Most patients who underwent anterior iliac crest graft harvesting (71.4%, n=5) were satisfied with their scar. The reported immediate postoperative complications were presented as swelling (14.3%, n=1), hematoma (14.3%, n=1), and procedural site inflammation (14.3%, n=1).

Quality of life (QoL) and pain level of 31 patients who underwent anterior (77.4%) or posterior (22.6) iliac crest bone graft harvesting surgery were assessed at different time intervals. QoL is described as the gap between a person's functional level and ideal standard [12, 13]. QoL and other patient-reported outcome measures (PROMs) may be more essential to the everyday patients' lives than objective clinical measures [14, 15].

According to the study of Sudhakar and Singh, the donor site was chosen by considering several factors, surgeon's preference, origin of the bone, required volume, and morbidity associated with the harvest, with the anterior iliac crest bone being the most common donor site for autogenous grafts. Anterior ilium is more favorable than the posterior ilium because of easier harvesting, better quality of bone, and simultaneous harvesting with oral procedures [16].

Our subjective hundred-point pain scale, revealed that pain decreases with time. The mean pain score is highest at IAS (63.23 ± 30.4) and lowest at the present time (4.84 ± 11.2). A similar trend is also observed in the estimated mean pain scores with values of 63.728 (SE = 4.878) at IAS, 31.303 (SE = 5.394) at 6w, and 5.105 (SE = 2.197) at the present time. Comparable results were found by Robertson and Wray, David and colleagues, and Salawu *et al*. [17-19].

Herford and Dean reported that 23% experienced difficulties in ambulation after 6w of surgery, and 10% experienced pain more than 16 weeks later [20]. Findings in a comparative study of Ahlmann and colleagues revealed that the anterior iliac crest bone was accompanied by a higher complication rate (8%) compared to the posterior iliac crest graft procedure (2%) [6].

Our results revealed an increasing trend in QoL with time. Multivariate analysis showed that QoL scores were significantly different between time points ($F(2.000, 23.000)=8.260$, $p=0.002$). The trend observed in our study concurs with other studies. Loeffler and colleagues in assessment of the QoL of patients who underwent anterior iliac crest bone grafting, found a significant increase and improvement in QoL from the time till the time of final

follow-up (mean of 22 months) [21]. Moreover, Hammuda and El-Asfahani studied the efficacy of iliac crest grafts combined with dental implants in mandibular reconstruction, and found improvement in the patient's satisfaction and QoL [22]. On the other hand, Skeppholm and Olerud reported that the pain from the harvesting site did not affect the QoL of patients at 4w postoperatively [23]. This might be attributed to the differences in patient's perception of pain, which are affected by physical, psychosocial, cognitive, behavioral, spiritual, religious, and cultural factors [24].

Our results revealed that patients with right posterior iliac crest experienced more pain, needed more support, had limited walking distance, and were moderately limp than other donor sites after IAS. Moreover, patients that had left anterior iliac crest surgery can only perform prayer while lying down. The QoL scores improved after 6w of surgery. However, patients that had right posterior iliac crest surgery gave the lowest rate in terms of pain, support, distance walking, limp, activities (shoes, socks), and using stairs. While, patients that had bilateral posterior iliac crests as bone grafts still could not sit comfortably or perform prayer while sitting. At 6w and the present time, all patients were able to drive/leave the house. This study thus revealed that patients with anterior iliac crest graft had better QoL than those with posterior iliac crest graft, due to the greater bone volume harvested from the posterior iliac crest. However, the present results contradict previous studies, who reported stronger pain after anterior iliac crest surgeries [1].

The only 70-year-old osteoporotic female **(Table 5)**, relying on crutches for support and has pain in her extremities regularly reported no variation in her QoL after anterior approach. Once correct techniques were implemented to prevent postoperative complication of hip fracture, a full return to baseline conditions was witnessed by this patient.

This study also investigated the socio-demographic characteristics associated with pain scores and QoL with no significant association of these characteristics.

The limitations associated with the study were being retrospective in nature, small sample size (31), procedures done by a single surgeon.

Conclusion

The results revealed a significant association between pain level and QoL with time, less pain and favorable QoL after 6 weeks of iliac crest graft harvesting surgery. Assessment of QoL based on donor sites showed that better QoL is experienced after anterior iliac crest bone graft surgery, while lesser activities could be performed after posterior iliac crest graft. This study concluded that iliac crest graft harvesting is a good and safe procedure for bone volume restoration with high patient satisfaction after surgery with the adherence to correct techniques and patient follow-up.

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