

Investigating the effect of gastric sleeve surgery in patients with high BMI on patellar malt racking and pain caused by patellar chondromalacia in these patients

Hosein Pirmohamadi¹, Mohamad kazem Emami Mebodi², Hamed Gholizadeh³, Saeid Roozpeykar⁴, Ramin Ghalandarzadeh⁵, Mohamad Hosein Mokhtari⁵

¹ Department of Orthopedic Surgery, Faculty of Orthopedic Surgery, Baghiatallah University of Medical Sciences, Tehran, Iran, Member of the Iranian MD, Associated Prof. Research Center and Orthopedic Department of Baqyatalla Medical University (BMUS) Tehran, Iran

² Department of Orthopedic Surgery, Faculty of Orthopedic Surgery, Baghiatallah University of Medical Sciences, Tehran, Iran, Member of the Iranian Association of Orthopedic Surgeons Student of Knee Surgery Fellowship in Beheshti University of Medical Science, Tehran, Iran

³ Department of Surgery, Faculty of Surgery, Trauma Research Center, Baghiatallah University of Medical Sciences, Tehran, Iran

⁴ Department of Radiology and Health Research Center, Surgery, Baghiatallah University of Medical Sciences, Tehran, Iran

⁵ Department of Orthopedic Surgery, Resident of Orthopedic Surgery, Baghiatallah University of Medical Sciences, Tehran, Iran

ABSTRACT

Introduction and Purpose: Gastric sleeve surgery is an effective intervention for the treatment of severe obesity and associated diseases. Most people with obesity will experience pain in the front of the knee over time. Thus, conducting more studies on the effect of the results of surgery to reduce BMI (Body Mass Index) on anterior knee pain caused by factors such as patellar maltracking and patellar chondromalacia will be useful for better determining appropriate treatment protocols in the future. Therefore, in this study, we will investigate the effect of sleeve surgery.

Materials and Methods: This study was conducted as a prospective cohort. The study population includes patients with high BMI who simultaneously had symptoms of anterior knee pain caused by patella chondromalacia, and in the second half of 2011, they referred to Baqiyat Elah Azam Hospital and underwent sleeve surgery. Sampling was done by census. Information such as age, gender, BMI at the time of surgery, comorbidities (rheumatoid arthritis, osteoarthritis, preoperative fractures and dislocations) and medications were collected from the patient records and recorded in the relevant checklist. Before the operation and six months after the operation, the patients underwent an examination of the lower limbs and knees in the clinic, and the patients were examined in terms of maltracking of the patella. Chondromalacia patella was also investigated by taking history and clinical examination before surgery and six months after surgery. The range of motion of the knee was measured before the operation and six months after the operation in the clinic using an orthopedic goniometer and reported according to degrees. Before the operation, axial patellar view radiographs were taken from the patients, and six months after the operation, the radiograph was repeated again and reported by a radiologist to investigate the changes related to tilt patella and the effect of surgery on it. Also, in this study, the quality of life of the patients before and six months after the operation was evaluated using a 36-question quality of life questionnaire. Finally, the obtained information was analyzed using SPSS vs. 24 statistical software.

Results: 35 patients participated in this study. The average age of the patients was 40.8 years \pm 10.14 years. 11 people (31.4%) men, 24 women (68.6%) participated in this study. Only 1 patient (2.9%) had alcohol and smoking. 16 patients (45.7%) had an underlying disease, and 12 patients (34.4%) were taking medication. The average body mass index of the patients before the operation is 39.2 and six months after the operation is 30.7. The study showed that patellar mal-tracking was present in 24 patients (68.6%) before the intervention, and this number was reported in 22 patients (62.9%) after the intervention, and this difference was not significant ($p>0.05$). Anterior knee pain caused by chondromalacia patella based on the VAS criterion before the intervention is 7.11 ± 0.75 and after the intervention is 5.6 ± 0.69 , and we saw a significant decrease in the anterior knee pain score caused by chondromalacia patella in patients after the intervention ($p<0.05$). The average knee range of motion before the intervention was 102.1 ± 1.26 and after the intervention this value increased by 117.68 ± 2.09 and this increase was statistically significant ($p<0.05$). Before the intervention, 42.9% of people had tilt patella, and after the intervention, 37.1% of people had tilt patella. Surgical intervention had no effect on the significant reduction of tilt patella ($p>0.05$). 6 months after the intervention, there was a significant difference in the reduction of the VAS score after the intervention ($p<0.05$).

Conclusion: The result of our study showed that gastric sleeve surgery can reduce anterior knee pain caused by patellar chondromalacia and increase the range of motion of the knee joint and improve the quality of life. It also has a significant effect on patellar maltracking and patellar tilt.

Keywords: patellar malt racking, patellar chondromalacia, knee Range of Motion (ROM), patellar tilt, quality of life

Address for correspondence:

Ramin Ghalandarzadeh

Department of Orthopedic Surgery, Resident of Orthopedic Surgery, Baghiatallah University of Medical Sciences, Tehran, Iran

E-mail: mhmokhtari1369@gmail.com

Word count: 4062 **Tables:** 03 **Figures:** 02 **References:** 27

Received: 21 May, 2024, Manuscript No. OAR-24-136614

Editor Assigned: 22 May, 2024, Pre-QC No. OAR-24-136614(PQ)

Reviewed: 05 June, 2024, QC No. OAR-24-136614(Q)

Revised: 12 June, 2024, Manuscript No. OAR-24-136614(R)

Published: 19 June, 2024, Invoice No. J-136614

INTRODUCTION

In addition to the destructive effects that obesity has on the body of sick people, it also affects their psychological and social dimensions. Although medical treatments reduce the symptoms, they themselves cause issues and problems that disrupt the patient's lifestyle. Therefore, one of the important goals in the treatment of this type of patients is to improve the patient's quality of life. Bariatric surgery has evolved over the past 50 years. In the past, various surgical methods have been used to reduce weight. During the last decade, the advent of laparoscopic surgery has reduced the complications during surgery and also increased the popularity of this procedure. Among these methods, gastric sleeve surgery, gastric bypass and gastric ring are three common methods in bariatric surgery. Today, after 50 years, it is still not possible to name a particular method as the best choice. During these years, many efforts have been made to reduce complications and obtain better results, which include the use of a medical team with different specialties and follow-up of patients for their entire lives [1-3]. Knee pain is one of the most common health concerns in the population, and obese patients have a positive relationship with knee joint problems. Treatment of knee pain is symptom-based and highly dependent on the patient's report of symptoms and functional limitations. Abnormality of the patella is one of the causes of knee pain, which occurs as a result of the imbalance of the relationship between the patella and the trochlea, often secondary to the anatomical morphological abnormality. Young people, especially women, usually suffer from the consequences of this disorder. It is a known cause of anterior pain and in severe cases presents as an acute and often recurrent patellar dislocation which is usually transient. Early diagnosis is essential, as chronic abuse leads to patellofemoral cartilage damage and osteoarthritis [4-6]. Treatment options for knee pain are usually no different for obese patients compared to their non-obese counterparts and range from non-surgical options, including physical therapy, oral analgesia, and knee injections, to surgical intervention options with total knee arthroplasty as the definitive treatment. Patients with increased body mass index show more complications and increased risk during surgery. Historically, orthopedic surgeons have been reluctant to accept surgical intervention in morbidly obese patients due to increased postoperative risk as well as concern about the longevity and efficiency of the implant. Considering the increasing number of obese population, it may be worthwhile to review the current treatment pathways for knee pain in obese patients [6-8]. Future therapeutic considerations should include re-evaluation of criteria for determining successful treatment in obese patients while maintaining postoperative recovery and the chance of long-term recovery and symptom relief. There are also things such as basic methods of treatment for patients who meet the criteria for bariatric surgery and knee arthroplasty, improving the results of patients after bariatric surgery compared to their general population and the bariatric control group under conservative treatment, determining the appropriate time of procedures and determining cost benefits and Comparison and quality of life considerations regarding obesity and arthroplasty methods should be investigated more carefully [9-11]. Thus, further study on the results of sleeve surgery in obese patients with knee pain will be useful to better determine appropriate treatment protocols in the future. so in this study, we investigated the effect of gastric sleeve surgery on patellar maltracking and patellar

chondromalacia [12, 13].

MATERIALS AND METHODS

This study was conducted as a prospective cohort. The study population includes patients with high BMI who simultaneously had symptoms of anterior knee pain caused by patellar chondromalacia, and in the second half of 2011, they referred to Baqiyat Elah Azam Hospital and underwent sleeve surgery. Sampling was done by census. Information such as age, gender, BMI at the time of surgery, comorbidities (rheumatoid arthritis, osteoarthritis, preoperative fractures and dislocations) and medications were collected from the patient records and recorded in the relevant checklist.

Exclusion criteria also included

Previous injury to the knee on the same side, history of orthopedic knee surgery in the past such as previous history of knee arthroplasty, incomplete patient record, and joint infection. Then, information such as age, gender, BMI at the time of surgery, comorbidities (rheumatoid arthritis, osteoarthritis, preoperative fractures and dislocations) and medications were collected from the patient records and recorded in the relevant checklist. Before the operation and six months after the operation, the patients underwent an examination of the lower limbs and knees in the clinic, and the patients were examined in terms of patellar maltracking. Patellar chondromalacia was also investigated by taking history and clinical examination before surgery and six months after surgery. The range of motion of the knee was measured before the operation and six months after the operation in the clinic using an orthopedic goniometer and reported according to degrees. Before the operation, axial patellar view radiographs were taken from the patients, and six months after the operation, the radiograph was repeated again by a radiologist. To investigate the changes related to patellar tilt and the effect of surgery on it. Also, in this study, the quality of life of the patients before and six months after the operation was evaluated using a 36-question quality of life questionnaire. Finally, the obtained information was analyzed using SPSS *vs.* 24 statistical software. This questionnaire had 36 items in 8 health dimensions of physical function, physical limitation, physical pain, general health, vitality, social function, mental problems and mental health. In Abbasi et al. study, this questionnaire has been tested for validity and reliability with a coefficient of 7.2 [14]. Finally, the obtained information was analyzed using SPSS *vs.* 24 statistical software. In the descriptive analysis of the results, frequency and percentage of frequency and central indicators of mode and mean and dispersion index of standard deviation and range and IqR are used. To analyze the data, we first used univariate analysis methods such as independent T-test and chi square test.

RESULT

35 patients participated in this study, the average age of the patients was 40.8 years \pm 10.14 years. 11 people (31.4%) men, 24 women (68.6%) participated in this study. Only 1 patient (2.9%) had alcohol and smoking. 16 patients (45.7%) had an underlying disease, and 12 patients (34.4%) were taking medication. The average body mass index of the patients before the operation is 39.2 and six months after the operation is 30.7.

In figure 1, we examine the effect of gastric sleeve surgery on maltracking patella before and six months after the surgery. The findings showed that before gastric sleeve surgery, patellar maltracking was present in 24 patients (68.6%) and this number was reported in 22 patients (62.9%) six months after gastric sleeve surgery and this difference was not significant. In this way, the patella maltracking criterion improved after the operation, but it had no statistical value ($p>0.05$).

In table 1, we examine the effect of gastric sleeve surgery on anterior knee pain caused by patellar chondromalacia, which is compared with the VAS scale before and six months after the surgery. As the results show, we saw a significant decrease in the anterior knee pain score in patients six months after surgery.

In table 2, we compare the average knee range of motion before and

six months after gastric sleeve surgery. Our study showed that the average range of motion of the knees before gastric sleeve surgery was 102.1 ± 1.26 and after surgery this value increased to 117.68 ± 2.09 and this increase was statistically significant ($p<0.05$).

In figure 2, we examine the effect of gastric sleeve surgery on patellar tilt before and six months after gastric sleeve surgery. Before the surgery, 42.9% of people had patellar tilt and after surgery 37.1% of people had patellar tilt. Surgery had no significant effect on patellar tilt ($p>0.05$) (Figure 2).

In table 3, we compare the sub-scales of the quality of life score. As the results show, the sub-scales of the patients' quality of life scores have improved with a significant difference after 6 months of surgery.

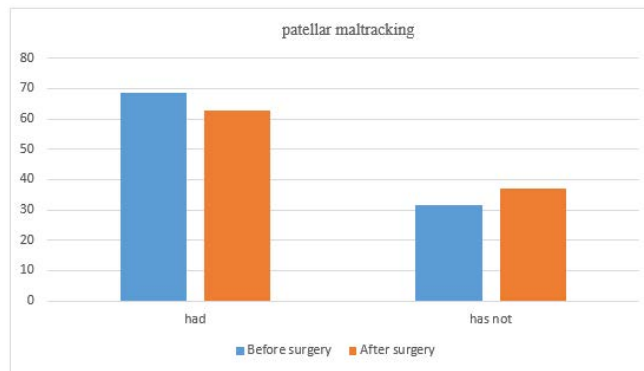


Fig. 1. Investigating the effect of gastric sleeve surgery on patellar maltracking before and six months after gastric sleeve surgery

Variable	Before Surgery	After Surgery	p-value
Pain score	7.11 ± 0.75	5.6 ± 0.69	0.001

Variable	M (Mean) ± SD (Standard Deviation)	p-value
ROM	Before surgery	102.1 ± 1.26
	6 month after surgery	117.68 ± 2.09
		0.001

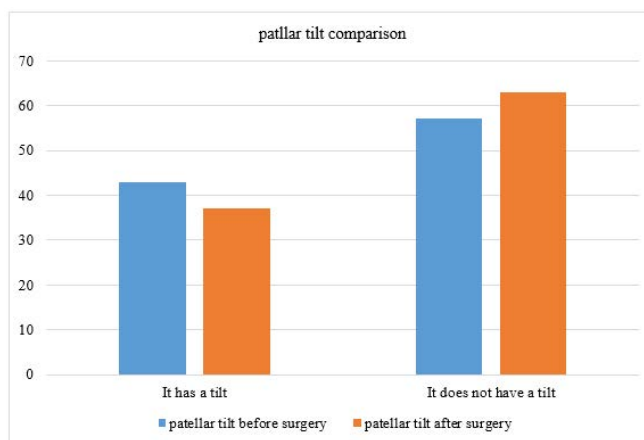


Fig. 2. Investigating the effect of gastric sleeve surgery on patellar tilt before and six months after gastric sleeve surgery

Quality of Life Scales	Before Intervention	6 Month after Intervention	p-value
Physical performance	55.85 ± 7.96	76 ± 7	0.001>

Playing a physical role	54.2 ± 9.12	63.57 ± 7.85	0.001>
Physical pain	54.42 ± 3.79	69.2 ± 4.54	0.042
General health	45.34 ± 5.05	62.05 ± 5.34	0.01
Playing an emotional role	52.5 ± 4.91	66.51 ± 4.61	0.001>
Energy-fatigue	47.22 ± 5.9	58.22 ± 6.79	0.001>
Emotional well-being	71.34 ± 7.66	80.08 ± 8.31	0.001>
Social performance	53.05 ± 4.13	68.6 ± 4.76	0.256

DISCUSSION

In general, the consequences of increased BMI on patellar cartilage are well understood. Previous studies have reported that high BMI is associated with increased pressure on the articular cartilage of the medial and lateral parts of the patella [15]. An increase in BMI is also associated with an increase in the prevalence of patellar cartilage defects [16]. A reduction in patellar cartilage volume of 13 mL per 1 unit increase in current BMI has been reported, with a decrease of 27 mL per unit increase in BMI over a 10-year period [16]. McAlindon et al. found obesity to be a significant risk factor for patellofemoral, tibiofemoral and combined patterns of osteoarthritis changes in the knee. However, in their study, they found a statistically insignificant increase in the prevalence of grade 3 or 4 cartilage abnormalities in the obese group [17]. On the other hand, the effect of obesity on patellofemoral instability is generally a poorly studied topic. There have been few studies to date that have addressed BMI-related outcomes in patellofemoral instability. Obesity is one of the risk factors for arthritis that can be modified, so maintaining a suitable body weight at all ages is recommended to prevent complications [18]. This study was conducted with the aim of determining the effect of gastric sleeve surgery on maltracking and chondromalacia patella, and the results of our study indicated improvement in knee range of motion, as well as improvement in pain and quality of life scores in patients. Knee disorders can be treated in a variety of ways, including medications, exercise (with or without diet), and bariatric surgery. In the United States, the overall prevalence of knee pain in the adult population is 20%, affecting more than 61 million people. It is expected to increase to 25% of the affected population by 2025 [10]. Studies show that for every kilogram of weight loss, the extra load on the knee is reduced twice. With this comorbidity increasingly occurring in young patients, the demand for "faster" weight loss has increased dramatically, and therefore bariatric surgery has become more common [10]. Vicente et al. found data showing that people with knee joint pain had improvements in the period after bariatric surgery, and it is considered a predictor of better quality of life [4, 19]. As our study also showed that the quality of life of patients increases after gastric sleeve surgery. According to Abu-Abeid et al. the female population (68%) was most affected by obesity, while in the study by Gruen et al [20]. The results of these studies confirm the results of our study in which the female population (70%) constituted the most cases. These results were also obtained in our study, and we also saw an increase in physical activity after bariatric surgery, taking into account the facilitation of patient movement [21]. Many authors associate knee

pain and obesity due to the extra load that this joint bears with excess weight [22-24]. Increasing evidence shows that regardless of weight loss method, reducing body fat can reduce the mechanical and biochemical stressors that contribute to joint destruction. Compared to our study, after sleeve surgery, a significant increase in quality of life score after surgery was observed [25]. According to a study by Vincent et al. improvement in back and knee pain was significant after three months of bariatric surgery. By the third month after surgery, those who had no pain increased from 25%-50%. The most pronounced pain reduction effects occurred in the knee and back compared to other joints. Weight loss appears to be directly related to the amount of pain relief in the back and knees, but not as strongly for other joints. In our study, the quality of life score and its subscales were evaluated, which confirms the results of the studies. The results of another study that was conducted with the aim of investigating the effects of bariatric surgery on knee joint pain showed that women made up the largest number of participants in the research and after surgery, more people began to do physical activities and the number of regular physical exercises. Increased. Edward et al. evaluated 24 patients with knee pain 6 months and 12 months after bariatric surgery and also reported that the Knee Injury and Osteoarthritis Outcome Score (KOOS) and WOMAC score decreased significantly [13]. The present study supports these results, as our results show that rapid weight loss due to bariatric surgery can lead to improvement in knee joint symptoms. However, in a retrospective evaluation of 15 patients, Trafo et al. observed that an increasing number of bariatric surgery patients underwent total joint arthroplasty [26]. The authors concluded that rapid weight loss may increase the risk of requiring total joint arthroplasty, as improvement in symptoms may allow for a more physically active lifestyle, which can place more stress on affected joints and progress to OA accelerate. In this study, rapid weight loss was considered as a risk factor for the development of OA. As observed by Trafo et al. we found that patients' physical function and physical limitations improved [26]. Also, improvement in radiographic findings was observed. This could be due to the shorter follow-up period of the present study. Hamdi et al. studied the effects of rapid weight loss in 30 patients, and found positive effects on exercise performance, but no effect on pain, stiffness, or daily knee function [10]. Overall, the quality of life of the patients in this study improved due to the changes in their physical and physiological conditions caused by weight loss. Also, ROM and joint space were significantly improved in our study. As in the study of Abu Obeid et al. they evaluated 59 patients who underwent bariatric surgery using conventional radiology and reported a statistically significant increase in the width

of the inner space of the left and right knee joint 3 months after surgery [20]. The results of a similar study showed that bariatric surgery may be effective for improving knee pain, function and quality of life in early period female patients, but the effectiveness is not directly related to the amount of weight loss. Therefore, it can be said that more studies are needed to study the long-term effects of bariatric surgery on knee OA and the musculoskeletal system [27].

In their study on chondromalacia patella in obese people, James Choi and Jonathan Schaffer state that knee pain is one of the most common health concerns in the population, and obese patients have a positive relationship with knee joint problems. Treatment of knee pain is symptom-based and highly dependent on the patient's report of symptoms and functional limitations. Abnormality of the patella is one of the causes of knee pain, which occurs as a result of the imbalance of the relationship between the patella and the trochlea, often secondary to the anatomical morphological abnormality. Young people, especially women, usually suffer from the consequences of this disorder. It is a known cause of anterior pain and in severe cases presents as an acute and often recurrent patellar dislocation which is usually transient. Early diagnosis is essential, as chronic abuse leads to patellofemoral cartilage damage and osteoarthritis [4, 5]. In the article by Dr. Daniel B. Jones and Dr. Brian Yang, it is stated that treatment methods for knee pain are generally no different for obese patients compared to their non-obese counterparts and range from non-surgical options, including physical therapy, oral analgesia, and knee injections, to surgical intervention options with total arthroplasty. The knee as a definitive treatment is variable. Obese patients can present more complications for the treatment of intraoperative knee pain. Historically, orthopedic surgeons have been reluctant to accept surgical intervention due to increased postoperative risk as well as concerns about implant longevity and performance. Given the increasing number of obese populations, it may be worthwhile to review current treatment pathways for knee pain in obese patients. Future treatment considerations should include re-evaluation of criteria to determine successful treatment in obese patients while continuing to improve patient risk after surgery. from the operation and the chance of long-term recovery and relief of symptoms. Therefore, things such as basic treatment methods and knee arthroplasty in comparison of the general population and the obese control group under conservative treatment and determining the benefits of cost and comparison as well as quality of life considerations regarding obesity and arthroplasty methods should be investigated more carefully [9-11].

Thus, further study on the results of obese patients suffering from arthritic knee pain will be useful to better determine appropriate treatment protocols in the future, so in this study, we examined the effect of gastric sleeve surgery on maltracking and chondromalacia patella. In a research conducted by medical students under the supervision of Kraft and Hang, 100 people with obesity were investigated, 50 of them underwent bypass surgery and 50 underwent slimming drug treatment. In order to evaluate the quality of life, a 36 item questionnaire was initially administered randomly. 6 months later, the patients who underwent weight loss surgery lost 20 kg and the patients who received medicine lost 11 kg, and in general, the increase in quality of life was greater in the operated group [11]. Dowsey and colleagues aimed to determine whether outcomes would improve with bariatric surgery prior to TKA (Total Knee Arthroplasty) in subjects with a BMI greater

than or equal to 35 and with end-stage OA conducted a study, this randomized, parallel-group, assessor-blinded clinical trial was conducted between May 2012 and June 2020 with a minimum follow-up of 12 months after TKA. TKA was performed at a university-affiliated general hospital, and bariatric surgery was performed at a private hospital center and a university-affiliated private office. Data analysis was conducted from February to July 2021. The 82 participants, 66 (80.5%) were women, the average age (standard deviation) was 57.8 (4.9) years, and the average (standard deviation) BMI was 43.8 (5.5). 39 participants (95.1%) in the intervention group underwent laparoscopic adjustable gastric banding, and 29 (70.7%) subsequently underwent TKA. 39 patients (95.1%) in the TAU group underwent TKA. 6 patients (14.6%) in the intervention group suffered the primary outcome (median follow-up, 24 months), compared with 15 (36.6%) in the TAU group (median follow-up, 27 months) (difference, 22.0%, 95% CI, 3.7% to 40.3%; $p=.02$). Between-group difference in BMI at 12 months was -6.32 (95% CI), -7.90 to -4.50; $p<0.001$) was in favor of the intervention group. TKA was discontinued by 12 participants (29.3%) in the intervention group because of symptom improvement, whereas 2 participants (4.9%) in the TAU group discontinued TKA (difference, 24.4%; 95% CI, 9.0% to 39.8%; $p=0.003$).

The result of the study showed that weight loss following bariatric surgery reduced the risk of TKA complications in people with BMI greater than or equal to 35. Participants required significantly less TKA after weight loss, which contributes to this finding [12]. Studies have shown that osteoarthritis is strongly associated with obesity, and people who are clinically defined as obese ($BMI>30.0 \text{ kg/m}^2$) are four times more likely to develop knee osteoarthritis than the general population. Ann Rogers, the purpose of this study was to investigate whether individual weight loss improved knee symptoms in patients with osteoarthritis. Adult patients (age 18 years-70 years; $BMI>35 \text{ kg/m}^2$) with clinical and radiographic evidence of knee OA participated in a one-year trial in which the WOMAC and KOOS surveys were administered at baseline before surgery and six months and twelve months after surgery. Surgery was done. Statistical analysis was performed using Student's and Wilcoxon Signed Rank tests. Weight loss six months and twelve months after bariatric surgery was statistically significant compared to preoperative measurements. All variables from both the KOOS and WOMAC assessments improved significantly compared to baseline. Isolated weight loss through bariatric surgery led to statistically significant improvement in the patient's knee arthritis symptoms at six months and twelve months. More research needs to be done to determine whether symptom relief persists over time, and whether the benefits apply to people with symptomatic knee arthritis who are overweight but not obese [13].

CONCLUSION

Our study showed that gastric sleeve surgery can reduce pain in front of the knee caused by chondromalacia and increase the range of motion of the knee joint and improve the quality of life in obese patients with knee pain and also has a significant effect on patellar maltracking and tilt. Thus, gastric sleeve surgery is recommended to patients with this problem. Also, appropriate and timely action in these patients can prevent additional costs and subsequent orthopedic surgeries that have long-term postoperative complica-

tions and recovery.

ETHICAL APPROVALS

This article is the result of a research project entitled "evaluation of

the effect of bariatric surgery on the patellar maltracking and patellar softness" with the code of ethics IR.BMSU.REC.1402.093 and supported by the University of Medical Sciences and Health Services of Baqiyat Elah Azam AJ Done.

REFERENCES

1. Kelishadi R, Alikhani S, Delavari A, Alaedini F, Safaie A, et al. Obesity and associated lifestyle behaviours in Iran: findings from the first national non-communicable disease risk factor surveillance survey. *Public Health Nutr.* 2008;11:246-251.
2. Bray GA. Complications of obesity. *Ann Intern Med.* 1985;103:1052-1062.
3. Raffaelli M, Sessa L, Mingrone G, Bellantone R. Assessing the obese diabetic patient for bariatric surgery: which candidate do I choose?. *Diabetes Metab Syndr Obes: Targets Ther.* 2015;8:255-262.
4. Cram P, Lu X, Kates SL, Singh JA, Li Y, et al. Total knee arthroplasty volume, utilization, and outcomes among Medicare beneficiaries, 1991-2010. *JAMA.* 2012;308:1227-1236.
5. Brown NM, Sheth NP, Davis K, Berend ME, Lombardi AV, et al. Total knee arthroplasty has higher postoperative morbidity than unicompartmental knee arthroplasty: a multicenter analysis. *J Arthroplasty.* 2012;27:86-90.
6. Post WR, Dye SF. Patellofemoral pain: an enigma explained by homeostasis and common sense. *Am J Orthop.* 2017;46:92-100.
7. Hong E, Kraft MC. Evaluating anterior knee pain. *Med Clin.* 2014;98:697-717.
8. Jibri Z, Jamieson P, Rakhra KS, Sampaio ML, Dervin G. Patellar maltracking: an update on the diagnosis and treatment strategies. *Insights Imaging.* 2019;10:1-11.
9. Heuts EA, de Jong LD, Hazebroek EJ, Wagener M, Somford MP. The influence of bariatric surgery on hip and knee joint pain: a systematic review. *Surg Obes Relat Dis.* 2021;17:1637-1653.
10. Hamdi A, Albaghdadi AT, Ghalimah B, Alnowiser A, Ahmad A, et al. Bariatric surgery improves knee function and not knee pain in the early postoperative period. *J Orthop Surg Res.* 2018;13:1-6.
11. Rasouli D, Norouzi A, Ramezani G, Hashemi A. A psychometric evaluation of inter-professional education competency tool in nursing and medicine students. *BMC Med Educ.* 2024;24:110.
12. Dowsey MM, Brown WA, Cochrane A, Burton PR, Liew D, et al. Effect of bariatric surgery on risk of complications after total knee arthroplasty: a randomized clinical trial. *JAMA Netw Open.* 2022;5:e226722.
13. Edwards C, Rogers A, Lynch S, Pylawka T, Silvis M, et al. The effects of bariatric surgery weight loss on knee pain in patients with osteoarthritis of the knee. *Arthritis.* 2012:1-8.
14. Ansari H, Abassi M, Nourozadeh R. Health-related quality of life among nurses in Zahedan University of Medical Sciences hospitals. *Cabi digit lib.* 2015;14:47-55.
15. Widmyer MR, Utturkar GM, Leddy HA, Coleman JL, Spritzer CE, et al. High body mass index is associated with increased diurnal strains in the articular cartilage of the knee. *Arthritis Rheum.* 2013;65:2615-2622.
16. Gunardi AJ, Brennan SL, Wang Y, Cicuttini FM, Pasco JA, et al. Associations between measures of adiposity over 10 years and patella cartilage in population-based asymptomatic women. *Int J Obes.* 2013;37:1586-1589.
17. McAlindon T, Zhang Y, Hannan M, Naimark A, Weissman B, et al. Are risk factors for patellofemoral and tibiofemoral knee osteoarthritis different?. *J Rheumatol.* 1996;23:332-337.
18. Niromand E, Mansoori MS, Ramezani G, Khazaei MR. Design, implementation and evaluation of e-learning program for common diseases to smartphone-based medical students: at a developing university. *BMC Med Educ.* 2024;24:52.
19. Vincent HK, Vincent KR, Seay AN, Hurley RW. Functional impairment in obesity: a focus on knee and back pain. *Pain Manag.* 2011;1:427-439.
20. Abu-Abeid S, Wishnitzer N, Szold A, Liebergall M. The influence of surgically-induced weight loss on the knee joint. *Obesity Surg.* 2005;15:1437-1442.
21. Li JS, Tsai TY, Clancy MM, Li G, Lewis CL, et al. Weight loss changed gait kinematics in individuals with obesity and knee pain. *Gait Posture.* 2019;68:461-465.
22. Groen VA, Van de Graaf VA, Scholtes VA, Sprague S, van Wagenveld BA, et al. Effects of bariatric surgery for knee complaints in (morbidly) obese adult patients: a systematic review. *Obes Rev.* 2015;16:161-170.
23. Vincent HK, Heywood K, Connelly J, Hurley RW. Obesity and weight loss in the treatment and prevention of osteoarthritis. *PM&R.* 2012;4:59-67.
24. Ramezani G, Norouzi A, Moradi E, Pourbairamian G, Aalaa M, et al. Comparing peer education with TBL workshop in (EBM) teaching. *Med J Islam Repub Iran.* 2020;34:70.
25. Thomas AC. Effect of nutritional counseling on weight loss and food consumption in elderly women with knee osteoarthritis [master's thesis]. *Curitiba: UFPR.* 2017.
26. Trofa D, Smith EL, Shah V, Shikora S. Total weight loss associated with increased physical activity after bariatric surgery may increase the need for total joint arthroplasty. *Surg Obes Relat Dis.* 2014;10:335-339.
27. Üstün I, Solmaz A, Gülçiçek OB, Kara S, Albayrak R. Effects of bariatric surgery on knee osteoarthritis, knee pain and quality of life in female patients. *J Musculoskelet Neuronal Interact.* 2019;19:465-471.