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CASE REPORT

The effectiveness of polydioxanone (PDO) thread-embedding acupuncture in adult patients with obesity: Case reports

Irma Nareswari[1,2], Diana Marsha Fredy[1,2], Cindy Notonegoro[1,2], Fieka Meitaqwatiningarum[1,2]

1. *Department of Medical Acupuncture, Dr. Cipto Mangunkusumo Hospital, Jakarta, Indonesia*
2. *Medical Acupuncture Specialist Program, Faculty of Medicine, Universitas Indonesia, Jakarta, Indonesia*

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Abstract

Background: Obesity is a chronic condition defined as excess body fat which is diagnosed based on body mass index, abdominal circumference, and is associated with an increased risk of various diseases. Conservative management is often hard to comply with, unsuccessfully, and expensive, while acupuncture with its variety of modalities can be an option.

Case: A therapy with polydioxanone thread embedding on acupuncture points along with other acupuncture modalities were performed in three cases of obese patients according to their etiology and conditions.

Results: Based on the three cases of obese patients with PDO thread embedding acupuncture alone or combined with cupping, plum blossom and moxibustion modalities are beneficial in decreasing abdominal circumference. The effect after 2 months follow up respectively using abdominal circumference measurement 5 cm above the umbilicus -2 cm (from 110 to 99cm);- 3 cm (from 90 to 87 cm); -8 cm (from 88 to 80 cm), umbilicus to umbilicus -6 cm (from 107 to 101 cm); 10 cm (from 103 to 93 cm); 7 cm (from 93 to 86 cm), 5 cm below umbilicus -1 cm (from 106 to 105 cm); -5 cm (from 107.5 to 102.5 cm); -6 cm (from 104 to 98 cm). No serious side effects occurred in the three cases.

Conclusion: PDO thread embedding can be beneficial in treating obese patients. However, these results require further research.

Keywords: obesity, thread embedding acupuncture, PDO, plum blossom, cupping therapy, moxibustion

Introduction

Obesity is a chronic condition defined as excess body fat that is generally diagnosed based on body mass index (BMI) and is associated with an increased risk of various disease.[1] The World Health Organization (WHO) and the National Heart, Lung, and Blood Institute of the US National Institutes of Health have both stated that obesity is an epidemic.[2] Globally, this condition is reaching crisis proportions: nearly 30% of the population is obese or overweight, and this condition is expected to affect nearly half of the population by 2030.[3] Based on global survey data, the prevalence of obesity in women is greater than in men.[4,5] Thus, obesity is a worldwide epidemic associated with rapidly growing morbidity and mortality that has implications for both individual and public health.[6]

In 1980, Southeast Asia had the lowest prevalence of obesity, with Indonesia at 1.4%, Ethiopia at 1.2%, China and Bangladesh at 0.6% each, and Vietnam at 0.4%. However, in 2015, only Vietnam maintained an obesity prevalence below

Corresponding author:
Diana Marsha Fredy, MD
Email: diana_marsha@hotmail.com

2%, at 1.6%.[7] Based on data from Riskesdas Indonesia, Indonesia's obesity prevalence increased from 10.5% in 2007 to 21.8% in 2015. In 2018, the prevalence of central obesity increased to 31%.[8] At Dr. Cipto Mangunkusumo Jakarta recorded 1,941 cases of obesity in outpatient installations and 369 cases in inpatient care in 2020.[9]

Body mass index is the measurement most often used to diagnose obesity. BMI is defined as mass in kilograms divided by the square of the height in meters.[2] According to the Asia Pacific criteria, a BMI of < 18.5 is underweight, 18.5–22.9 is normal weight, 23–24.9 is overweight, 25–29.9 is classified as obesity grade 1, while ≥ 30 is obesity grade 2.[10] The main cause of obesity is an imbalance between energy output and consumption. This imbalance is caused by several factors, including excessive eating, a sedentary lifestyle, in-utero effects (postpartum weight retention [PPWR] and gestational diabetes), as well as the complex relationship between biological, psychosocial, and behavioral factors, including genetic factors, socioeconomic status, and cultural influences. Increasing age, lack of sleep, endocrine problems, and pharmacological effects also play a part in causing this imbalance.[11,12]

Having a family history of obesity substantially increases a person's likelihood of developing obesity.[2] In particular, PPWR is defined as the body weight difference between pre-pregnancy and certain time periods after delivery. Measurements are usually performed serially at 3, 6, 9, 12, and 18 months postpartum. PPWR is a significant contributor to the risk of obesity in women one year after delivery, even among women who were of normal weight before pregnancy. Several studies have suggested that retention of excess weight one year after delivery is associated with long-term obesity. Postpartum weight retention averages at approximately 0.5–1.0 kg at 12 months, with variations ranging from a loss of 10 kg to an excess of 20 kg. Approximately 75% of women experience weight retention one year postpartum, with 47.4% retained weight of 4.54 kg and 24.4% retained weight more than 9.07 kg.[13-15]

Deposits of excess weight are most often found in central versus peripheral subcutaneous tissue, thus increasing the risk of cardiovascular disease,[13,14 ,15] hypertension, diabetes mellitus, dyslipidemia, glomerulonephritis, cholelithiasis, non-alcoholic fatty liver disease (NAFLD),gastroesophageal reflux disease (GERD), various cancers, obstructive sleep apnea (OSA), and osteoarthritis (OA), as well as increased mood disorders and anxiety.[2,16] Conservative management consists of lifestyle modification, pharmacotherapy, and surgery. However, the treatment of obesity is often difficult, unsuccessful, and expensive.[17] The use of pharmacotherapy has many side effects, while surgical operations require exorbitant costs and carry risks of serious complications.[18] Therefore, a social need exists to seek effective and safe therapy to deal with obesity.

Acupuncture has been widely used to treat various diseases, including obesity. The modalities used vary from manual acupuncture, thread-embedding, pharmaco-puncture, laserpuncture, press needle, cupping, plum blossom, and moxibustion.[19,20] Cupping therapy is a Traditional Chinese Medicine (TCM) therapy developed 2,000 years ago in which a hollow medium is attached to the skin's surface with suction for the purpose of preventing and curing disease. In general, cupping therapy is done on areas with thick muscles while avoiding uneven and hairy locations because the cups can come off easily. Cupping retention generally lasts 5–10 minutes.[21]

Moxibustion is based on the TCM technique of warming acupuncture points with burned moxa wool. Moxibustion is done to treat various diseases, such as fetal malposition, diarrhea, incontinence, fatigue, and problems related to the aging process.[22] Plum blossom is an acupuncture modality that relies on a small hammer with seven sharp, short needles measuring 4–5 mm with a diameter of approximately 0.5 mm. The hammer is lightly tapped on the skin to cause redness, which serves to tighten and strengthen tissues. Mechanical stimulation from plum blossom can induce changes in electrical charges and cause the release of various chemical mediators.[23] This action can also improve blood circulation, lymphatic flow, and cell nutrition.[24] Based on experimental research, plum blossom can reduce

pro-inflammatory cytokines, such as IL-2, IL-1α, IL-1β, TNF-α, and IFN-γ, thereby reducing inflammation and preventing the release of Matrix Metalloproteinases (MMPs) that can degrade the extracellular matrix and inhibit procollagen transcription.[25]

Many studies have shown that acupuncture is beneficial in reducing BMI and waist circumference and improving quality of life with minimal side effects. In particular, thread embedding at acupuncture points can induce continuous stimulation of peripheral receptors to the central nervous system and result in a therapeutic mechanism because this type of stimulation lasts longer with more intensive.[26] The materials that can be used for thread-embedding acupuncture are catgut, polylactic acid-glycolic acid (PGLA), PDO and medicinal thread.[27] Polydioxanone is an absorbable polymer from the α-hydroxy acid polymer family. Polymers that are ideal for biomaterial applications should not elicit undesired tissue responses disproportionately to their beneficial effects. Polydioxanone can be metabolized once it has served its purpose. It leaves no trace, is easy to manufacture, and has an acceptable shelf life. It can also be sterilized for in vivo use. The PDO thread-embedding technique can be used with penetrating and perpendicular acupuncture methods. The penetrating method can increase mechanical tensile strength and support the dermis structure.[28] Polydioxanone sutures have been found to degrade over a period of two months and are completely absorbed at 9 to 12 months. In contrast, the effects of collagen can last for more than 12 months.[29,30] The benefits of acupuncture therapy against obesity-related peptide hormones include regulating endocrine systems, such as leptin and ghrelin, improving insulin resistance, improving glucose and lipid metabolism and serum immunoglobulin levels, decreasing appetite,[20] improving digestion, and reducing oxidative stress and inflammatory response.[6]

CASE 1

A 26-year-old woman desired to reduce her abdomen size and lose weight. During a 9-year period (from high school grade 3 to college graduation) her body weight increased from 40 to 74 kg. It was found that the patient's diet was irregular with the consumption of carbohydrates other than rice 2 times a day at undetermined times, light snacks, and infrequent intake of vegetables and fruits. The patient had attempted two types of diets for 2 years at different times and experienced a weight loss of 2 kg in 2 months, but discontinued dieting because of frequent stomachache. The patient had a habit of chewing fast and a tendency to eat snacks when stressed out. She passed stools daily with soft (occasionally hard) consistency. She had a history of regular menstruation with 28–30-day cycles in general. The patient had no trouble sleeping. In addition, she had a history of gastritis for the last 2 years, and the last recurrence was 2 months prior. She had no history of hypercholesterolemia, high blood pressure, or diabetes. In the family history, the patient's mother and sister were also obese. From the patient's physical examination, her body weight was 75.8 kg and height was 155 cm, and her BMI was 31.55. Thus, she was diagnosed with grade 2 obesity. The abdominal circumference was measured with a tape measure horizontally 5 cm above the umbilicus, around the umbilicus and 5 cm below the umbilicus. The measurement is made at the end of normal expiration.

In this case, thread-embedding acupuncture was carried out on the abdomen, hands, and feet with a PDO thread using 27G × 50 mm at CV12 Zhongwan, CV4 Guanyuan, CV6 Qihai, ST25 Tianshu, SP15 Daheng, and ST28 Shuidao with a penetrating technique. Then, the PDO threads 31G × 25 mm were applied at TE6 Zhigou, BL20 Pishu, and ST40 Fenglong bilaterally using the perpendicular technique. Thereafter, a follow-up was implemented once a week. A week later, cupping therapy was added with dry-cupping technique implemented in the lower back area (the BL20 area to the sacrum). Cupping was performed for up to 5 minutes once a week. A week later, moxibustion therapy at the CV12 point was added to the weekly treatment. In addition, the patient was advised to adjust her diet and do physical exercise. After 2 months of follow-up, there was a 2-cm decrease in the diameter above the umbilicus (from 101 to 99 cm), whereas the diameter around the

umbilicus decreased by 6 cm (from 107 to 101 cm), and the diameter 5 cm below the umbilicus decreased by 1 cm (from 106 to 105 cm). However, the body weight increased slowly by 2 kg, from 75.8 to 77.8 kg.

CASE 2

A 37-year-old woman wanted to lose weight and slim down after giving birth to her third child 1.5 years ago. Her body weight started to increase from her first pregnancy (11 years ago) and increased from 50 to 62 kg. Then, during her second and third pregnancies, it increased up to 71 kg and, after 18 months (1.5 years), dropped to 70 kg. This patient had PPWR. She had undergone a low-carbohydrate diet and exercised on the treadmill on a regular basis 2–3 times a week for 30 minutes for 4 months (when the child was 9 months old) and her weight dropped to 63 kg, but she discontinued the diet and exercising for 6 months. Her daily diet rarely included breakfast, and even if she had it, she only consumed bread or bananas or milk at 06.30. Her lunch included a portion of rice, vegetables, and side dishes at 12.00. Her dinner was usually at 20.00 or 21.00 with ± 3 tablespoons of rice, non-fried vegetables, and side dishes, ending with fresh fruit such as oranges. Once a week, the patient consumed street food, such as pasta and tofu *martabak*. She had a bowel movement 2 to 3 times a week. As for her sleeping pattern, the patient slept around 01.00 and woke up at 05.00 for the past 2 years. When staying up late, she consumed bitter coffee and snacks. She had regular menstruation. She had no history of taking weight-loss drugs, and there was no history of using hormonal contraception. She had hypercholesterolemia for 6 years and never took medication. She also had a history of lower back pain for 20 years, along with stomach ulcers and diclofenac allergy. The patient's mother, father, and sister were also obese.

Upon physical examination, her vital signs were good; her body shape was that of an apple, and she weighed 70 kg at 151 cm of height, with a BMI 30.7 Kg/m^2. The abdominal circumference was measured with a tape measure horizontally 5 cm above the umbilicus, around the umbilicus and 5 cm below the umbilicus. The measurement is made at the end of normal expiration. Her circumference 5 cm above the umbilicus was 90 cm, while her circumference at the umbilicus was 103 cm and circumference 5 cm below umbilicus was 107.5 cm. The Indonesian version of the Food Craving Questionnaire-Trait-reduced (FCQ-T-r) questionnaire showed a score of 29/90 with a cut-off value >50, indicating food craving. The Pittsburgh Sleep Quality Index Indonesian version (PSQI-I) questionnaire scored 7, which indicated poor quality of sleep. Through examination, the GDS was 88 mg/dl, cholesterol 222 mg/dl 1 week ago, other laboratory results were within normal limits, and lumbosacral magnetic resonance imaging examination revealed the L4-S1 bulging with lumbar spondylosis and lumbar hyperlordosis. Thus, she was diagnosed with obesity grade 2, hypercholesterolemia, spondylosis, and lumbar hyperlordosis.

In this case, a treatment with the PDO threads 29G × 50 mm was carried out at the point CV12 Zhongwan toward CV8 Shenque, ST25 Tianshu toward SP15 Daheng, SP15 Daheng toward GB26 Daimai, CV6 Qihai toward CV4 Guanyuan, ST28 Shuidao toward CV4, and ST28 toward ST30 Qichong with a penetrating technique. Then, the PDO threads 31G × 25 mm were used at the acupuncture points TE6 Zhigou, BL20 Pishu, and ST40 Fenglong bilaterally with perpendicular technique. A week later, 6-cupping therapy was added in the BL20 to BL25 Dachangshu (T11–L4) area using the dry-cupping technique. The cupping lasted up to 5 minutes. The plum blossom therapy was also added and was performed in the front of the abdomen by tapping 10 to 15 times until erythematous occurred in 2 parallel lines right, left, above, and below the umbilicus. This was done once a week. A week later, moxibustion therapy was added to treatment at CV12 for 5–10 minutes until it felt warm and erythematous occurred. This therapy was also conducted once a week. The total thread-embedding therapy was only carried out once; cupping and plum blossom therapy were performed 4 times; moxibustion was performed 3 times. The patient was advised to adjust her diet and do physical exercise.

At the end of the therapy, the patient's body weight decreased by 2 kg (from 70 to 68 kg),

whereas her BMI became 29.8 kg/m^2, diagnosed as obesity grade 1. On the follow-up 1.5 months following thread embedding, it was found that her body weight decreased to 67 kg, and cholesterol levels decreased to 187 mg/dl. A significant decrease also occurred in the patient's abdominal circumference after 2 months of follow-up; the circumference of 5 cm above the umbilicus decreased by 3 cm (from 90 to 87 cm), the circumference at umbilicus decreased by 10 cm (from 103 to 93 cm), and the circumference 5 cm below the umbilicus decreased by 5 cm (from 107.5 to 102.5 cm). Her cholesterol levels also decreased to 162 mg/dl at a 5-month post-therapy follow-up.

Case 3

A 40-year-old woman faced difficulty losing weight. She gained 4 kg during the last 2 years. Her weight before pregnancy 19 years ago was around 44 kg; however, it increased to 54 kg after her first pregnancy (18 years ago). She had 58 kg (16 years ago) during her second pregnancy, and during her third pregnancy (8 years ago), her weight increased to 60 kg and was 70.6 kg by the time of consultation. The patient had never tried any diet program before. She walked 30 minutes once a week but irregularly. Her daily morning diet routine included carbohydrates and coffee with 1 cup of milk. During the day, the patient ate 1 portion of rice with vegetables, *tempeh*, and tofu. At 17.00, she would eat chicken porridge/green bean porridge. Occasionally, she ate snacks 2–3 times a day (pudding/banana/bread/fruit). She had no sleep disturbances. She had regular bowel movements every morning. Her menstrual cycle was regular with a 28-day cycle. There were no symptoms leaning toward diabetes mellitus, asthma, hypertension, PCOS, sleep apnea, knee pain, urinary tract infection, dyspepsia, depression, and anxiety.

As seen from the patient's physical examination, her vital signs were good, her body shape was pear, and she had 70.6 kg at 152 cm, while her BMI was 30.55 kg/m^2, categorized as the obesity grade 2. The abdominal circumference was measured with a tape measure horizontally 5 cm above the umbilicus, around the umbilicus and 5 cm below the umbilicus. The measurement is made at the end of normal expiration. The circumference 5 cm above the umbilicus was 88 cm, the circumference as high as umbilicus was 93 cm, and the circumference 5 cm below the umbilicus was 104 cm. The Indonesian Version of the FCQ-T-r Questionnaire had a score of 37/90, indicating no food craving. Thread-embedding therapy in this case was carried out 1 time using the PDO threads 25G × 90 mm at the acupuncture points of ST25 Tianshu to SP15 Daheng bilaterally, SP15 Daheng to GB26 Daimaixue bilaterally, KI15 Zhongzhuxue to ST27 Daju bilaterally, PDO threads 27G × 60 mm at CV9 Shuifen to CV12 Zhongwan, ST24 Huaroumen toward mid SP16 Fuai and SP15 bilaterally, CV6 Qihai to CV4 Guanyuan, KI14 Siman to ST28 Shuidao bilaterally, using PDO 31G × 25 mm at BL20 Pishu and ST40 Fenglong bilaterally with perpendicular technique. The patient was advised to adjust her diet and do physical exercise.

The follow-up was carried out once a week, and it was found that the patient's body weight decreased with its highest peak at 4 weeks post-therapy, 5.4 kg less from the previous (70.6 to 65.2 kg), then it increased again. At 2 months of follow-up, her body weight was 68.2 kg. The circumference 5 cm above the umbilicus decreased by 8 cm (from 88 to 80 cm), the circumference as high as umbilicus decreased by 7 cm (from 93 to 86 cm), and the circumference 5 cm below umbilicus decreased by 6 cm (from 104 to 98 cm).

At 26 weeks of follow-up, there was a 3.4 kg (67.2 kg) decrease in body weight, and her BMI declined to 29.08, categorized as obesity grade I. There was still a decrease of abdominal circumference 5 cm above the umbilicus, umbilicus to umbilicus, 5 cm below the umbilicus by 4 cm (from 88 to 84 cm), 6 cm (from 93 to 87 cm), and 7 cm (from 104 to 97 cm). Laboratory results showed that there was a reduction in triglycerides before and after by 48 mg/dL (157 to 109 mg/dL), and HDL improved by 6 mg/dL (45 to 51 mg/dL).

Table 1 Summary of the cases

	Case 1	Case 2	Case 3
Age	26 years old	37 years old	40 years old
Etiology	Stress related obesity	PPWR	PPWR
Treatment	PDO threads with penetrating technique: • CV12 toward CV8, • ST25 toward SP15, • SP15 toward GB26, • CV6 toward CV4 • ST28 toward CV4, • ST28 toward ST30 PDO threads with perpendicular technique: • TE6, BL20, and ST40		PDO threads with penetrating technique : • ST25 toward SP15 • SP15 toward GB26 • KI15 toward ST27 • CV9 toward CV12 • ST24 toward mid SP16 and SP15 • CV6 toward CV4 • KI14 toward ST28, PDO with perpendicular technique : • BL20 and ST40
Additional treatment	• Cupping therapy at BL20 area to the sacrum • Moxibustion therapy at the CV12	• Cupping therapy at BL20 to BL25 • Plum blossom in the front of the abdomen • Moxibustion therapy at CV12	-
Result after 2 months follow up	**Abdominal circumference 5 cm above the umbilicus**		
	2 cm (from 101 to 99 cm)	3 cm (from 90 to 87 cm)	8 cm (from 88 to 80 cm)
	Abdominal circumference umbilicus to umbilicus		
	6 cm (from 107 to 101 cm)	10 cm (from 103 to 93 cm)	7 cm (from 93 to 86 cm)
	Abdominal circumference 5 cm below the umbilicus		
	1 cm (from 106 to 105 cm)	5 cm (from 107.5 to 102.5 cm)	6 cm (from 104 to 98 cm)
	Body weight		
	+2 kg (75.8 to 77.8 kg). Body weight tends to increase by 2 kg, the decrease in abdominal circumference occurs gradually and lasts up to 2 months.	2 kg (70 to 68 kg) Body weight lasts 1.5 months, abdominal circumference up to 2 months.	2.4 (70.6 to 68.2 kg) Body weight and abdominal circumference persisted up to 26 weeks post-therapy.

Discussion

Obesity is defined as excessive body fat, and fat distribution plays an important role in obesity. Several studies have found that fat in the middle or top of the body (apple-shaped obesity) is most closely associated with health risks such as insulin resistance in case of diabetes mellitus, hypertension, dyslipidemia, and cardiovascular disease. This risk is possible even when BMI does not increase sharply. In addition to BMI, waist circumference is a frequently used anthropometric measurement and is considered superior as a reflection of central obesity.[31] Postpartum usually causes approximately 6 kg of weight loss, including fluids and products of conception. From day 3, the body weight will decrease by about 0.3 kg/day until day 10. It will remain stable at week 10 about 2.3 kg of pre-pregnancy weight or 0.7 kg

in women who are breastfeeding. At 6–18 months following delivery, 1–2 kg of body weight will be retained, but one in five women can maintain 5 kg or more.[32] In PPWR, these excess weight deposits are found at the center of the abdomen (apple-shaped obesity), which can increase the risk of long-term obesity and cardiovascular disease. Postpartum conditions also contribute to the sagging of abdominal skin.

According to TCM, obesity can occur due to heat in the stomach and intestines, deficiency of the spleen and stomach, and renal insufficiency. Thus, acupoints BL20–BL25 can be used as Back Shu points of the spleen, stomach, kidneys, and intestines.[33] Obesity due to damp stagnation in the middle jiao, acupuncture can be performed on the back area as high as T7–L2.[23] One of the rapidly developing non-pharmacological obesity therapies is acupuncture with various modalities. Thus, PDO threads embedding acupuncture has recently become widely used because of their comparable effectiveness and fewer side effects compared to catgut suture.[34] Thread embedding using penetrating method also increases the mechanical tensile strength of tissues and supports the structure of the dermis and extracellular matrix, increasing the collagen and elastin components.[28]

The reason behind selecting these acupuncture points in our cases is because it has been proven by evidence-based medicine that acupuncture at point CV12 is used for regulating gastrointestinal function and gastric acid secretion according to the morphology in spinal ganglion T7–L2.[35] CV6 and ST25 regulate the sympathetic and parasympathetic nervous systems. Sympathetic nerve fibers inhibit gastric emptying, while parasympathetic nerve fibers increase intestinal peristalsis to reduce food absorption, thereby regulating gastrointestinal motility and suppressing perilipin expression via MAPK p44/42 and JNK. Decreased expression of perilipin causes increased lipolysis, facilitation of defecation,[36] reduction of abdominal distension, increase of intestinal peristalsis, and stimulation of gastrointestinal smooth muscle contraction. [35,37,38] ST25 and BL20 also have the function to increase PPARγ-mRNA and decrease total cholesterol, LDL, lipoprotein lipase liver, and triglyceride levels.[39] ST25, CV12, CV4, CV6, BL20, and SP15 regulate the endocrine system; increase gastric and small intestinal absorption; reduce oxidative stress; increase lipid metabolism by lowering total cholesterol and triglycerides; improve insulin thereby increasing PPAR-γ; reduce TNF-α in the blood; improve leptin resistance that leads to the reduction of NPY secretion, suppression of appetite, inhibition of fat synthesis, and increase of energy expenditure.[6,40] The BL20 point together with ST36 and ST25, can regulate lipid metabolism by increasing the expression of PPAR-γ mRNA in adipose tissue; activating lipoprotein lipase and hepatic lipase; and reducing total cholesterol and LDL cholesterol serum.[41] CV6, CV9, ST28, ST36, and KI14 can reduce body weight, waist and hip circumference, and triglycerides by improving leptin resistance.[40] ST40 is effective in regulating blood lipids and has proven to reduce IL-17, total cholesterol, triglycerides, and LDL, and increase HDL, stimulating an increase in the PPARγ activity, which will stimulate adipose tissue to secrete adiponectin, thereby activating PPARα in the liver that plays a role in fat metabolism. PPARα will upregulate apoA-I and apoA-II genes, and downregulate ApoC-III, resulting in increased catabolism by lipoprotein lipase.[42-44] GB26, KI15, ST24, and ST27 have proven to reduce body weight, BMI, hip circumference, waist circumference, waist-to-hip ratio, waist-to-height ratio, abdominal subcutaneous fat tissue thickness with a significant decrease in blood pressure, glycemia, LDL, uric acid as well as TNF α and IL-1β, and improve HDL significantly.[45] TE6 has been shown as effective in alleviating symptoms of ileus, abdominal pain, and distension, and increasing intestinal peristalsis. In this case, stimulation of the TE6 point can help maintain the bowel movement.[37] The PDO suture embedding has several advantages over chromic catgut sutures because it absorbs at a slower rate, so its stimulation in acupuncture points is longer and is superior to manual acupuncture or electroacupuncture in terms of the effectiveness in reducing BMI, waist circumference, and weight; hence, it reduces the frequency and duration of therapy, shows better ease of use, and has clinical benefits, and is faster than diet and exercise only.[46]

Thread-embedding acupuncture has proven as beneficial in treating obesity with minimal side effects. [26,35,46,47]

Furthermore, the cupping therapy on the BL meridian in the back combined with thread embedding can significantly reduce body weight, BMI, and waist and hip circumferences.[48] This can be caused by the improved subcutaneous blood circulation that stimulates the autonomic nervous system to further regulate fat metabolism and glucose in the blood associated with organs according to their dermatome, such as pancreas, stomach, intestines, and liver through the cutaneous-visceral reflex.[49,50] The use of thread-embedding acupuncture accompanied by cupping therapy in the BL area has a greater average therapeutic effectiveness of up to 90% in reducing weight, BMI, and waist and hip circumferences.[48] Furthermore, the plum blossom modality helps tightening the skin of the abdomen, and plum blossom is tapped on 2 lines right and left, above and below the umbilicus about 10–15 times until erythematous occurs. This action can release various chemical mediators,[23] increase blood circulation, improve lymphatic flow, and enhance cell nutrition.[24] Furthermore, it can prevent the release of MMP so that the extracellular matrix degradation process can be inhibited, and fibroblasts can be stimulated, resulting in the occurrence of procollagen transcription.[25] Moxibustion with 43°C–45°C temperature at point CV12 according to an experimental study conducted by Yang-Shuai et al. (2014) can inhibit gastric motility through the role of TRPV1.[51] The combination of several acupuncture therapy modalities can provide a greater effect than using only one modality.

An analysis of the three cases indicated that the effect of PDO thread embedding varies. In the first case, where the PDO with cupping and moxibustion were performed, there was only a reduction of abdominal circumference without being followed by weight loss. This can happen due to several possibilities. First, the acupuncture intervention is not synergized with advised dietary routine and physical exercise. The patients do not limit their food intake, so it is possible that the number of calories taken is still greater than their energy expenditure. Patients also tend to refuse any kind of physical exercise with the excuse of being busy and not having enough time. Meanwhile, in a systematic review by Kim et al. (2018), it is said that in general, acupuncture therapy combined with lifestyle modification has a high success rate. Namely, acupuncture therapy with various modalities is generally combined with diet and physical exercise to reach success.[20] Second, a stressed/depressed mind can affect the patients' diet. Patients tend to eat more snacks when they are under stress or pressure. It is argued that stress-related obesity is the result of an imbalanced interaction between cognitive factors (self-control), habits (diet, sleep, physical activity), physiology (HPA axis), and biochemical (leptin, ghrelin, and NPY).[52] Third, there is an effect related to the mechanism in PDO thread embedding in stimulating collagen formation, proliferation of myofibroblasts, and increasing fibrous tissue so as to strengthen subcutaneous fat tissue, improve tissue circulation, and localize denaturation of adipocyte cells in the abdominal area. Thus, the abdomen tightens along with the reduction of waist circumference.[30]

In the second case, the use of the PDO thread embedding modality combined with cupping, plum blossom, and moxibustion resulted in weight loss. According to the minimum clinically important difference, there was a weight loss of 2 kg, although it fluctuated afterwards due to irregular diet and exercise. Abdominal circumference (5 cm above, as high as and 5 cm below the umbilicus) showed a significant decrease of 3, 10, and 5 cm in 2 months, respectively. After 2 months, the patient's abdominal circumference began to increase. The effect of weight loss can last up to 1.5 months after the first therapy, while the effect of abdominal circumference can last up to 2 months after the first therapy. This may be caused by the tensile strength of PDO threads, which decreased to 25% after 6 weeks.[34]

The embedding of PDO threads alone was performed in the third case. The peak of weight loss was 5.4 kg at the 4th week of therapy, and it continued to increase afterwards. At the 26th week of follow-up, there was still a weight loss of 3.4 kg from before therapy and the abdominal

circumference 5 cm above, as high as and 5 cm below the umbilicus by 4, 6, and 7 cm, respectively. There was also an improvement in triglyceride results and an increase in HDL. The weight loss was then followed by weight gain because the patient did not regularly exercise and maintain the recommended diet, thus affecting the therapy results. This shows that PDO also had a shaping effect even though the increase in body weight was followed by a decrease in abdominal circumference. The PDO starts to degrade in about 60 days with complete degradation in 9–12 months.[29] In all three cases, there were no serious side effects other than pain in the right hand at the TE6 point implantation area on the same day of the procedure, which disappeared the next day, as well as soreness and tightness in the abdominal region on the 3rd day after the procedure, lasting till day 6. Afterward, no other complaints were reported.

Conclusion

This manuscript is a case report of obese patients using PDO thread embedding acupuncture. The original technique of thread embedding acupuncture is to use catgut thread, which has a higher risk of allergies. Not much research has been done using PDO thread embedding acupuncture, one of the advantages of this case report is the combination with various acupuncture modalities (cupping, plum blossom, and moxibustion) that provide benefits to the patient in reducing abdominal circumference due to biochemical and mechanical effects of PDO and no serious side effects occurred in the three cases examined. However, these results require further research.

Conflict of Interest

Authors declared no conflict of interest regarding this article.

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