

Rhinoplasty with Barbed Threads

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Background: Strong strut structures are necessary for nasal tip projection in Asian rhinoplasty. Traditionally, strut structures have been constructed by open skin incisions.

Methods: Barbed threads were implanted for rhinoplasties. The threads have multiple sharp barbs and umbrella-like longitudinal splits at both ends. Autologous micronized fat tissue graft was also simultaneously used when volume replacement was necessary.

Results: Since 2003, barbed threads have been used in approximately 1,200 rhinoplasties for nasal tip projection, dorsal length elongation, and nostril correction. The results of relative length ratios comparing true lateral photographs showed significant increase in tip projection.

Conclusion: The results of long-term observation (> 6 months) indicate that the surgical procedure of lifting the nasal tips with barbed threads is significantly effective for the anterior projection of nasal tip in Asians. (*Plast Reconstr Surg Glob Open* 2018;6:e1967; doi: 10.1097/GOX.0000000000001967; Published online 13 November 2018.)

INTRODUCTION

Barbed threads have a structure in which barbs are attached to monofilament suture threads. The barbs are caught by fibers within tissues and thus can immediately attach. Barbed threads were also used for tendon repairs in 1951.¹ In 1990, Sulamanidze and Sulamanidze² first used barbed threads for performing facelifts. In conventional barbed threads, 2 points within tissues are pulled close to each other, whereas inclined barbs are arranged to face each other from each side with the central part of the thread as the center. These barbs are fixed by being hooked to tissues. This produces an antitension effect that prevents tissues from moving apart again. Although the barbs used in the present study may seem to be similar to the existing ones, their inclinations are arranged in opposite directions; thus, the thread axis has the effect of anticompression rather than antitension (Fig. 1). Another difference is that the barbed threads have radially split ends to minimize thread extrusion under pressure (Fig. 2).

Herein, the threads were implanted at a location away from the skin by inserting a tube-type injection needle, which contains a barbed thread shorter than the needle

inside (Fig. 3), deep into the skin and pushing the thread using a plunger and subsequently pulling out only the needle. Because these threads act as skeletons, areas with an insufficient volume of tissue should be supplemented using a filler injection. We mainly used squeezed fat and fat gel (mechanically micronized fat tissues).³

MATERIALS AND METHODS

Materials

Under local anesthesia, patients were implanted with #2 USP (0.59 mm) absorbable polydioxanone (PDO) threads in 19-G (0.83 mm) needles and barbed #0 USP (0.39 mm) nonabsorbable polypropylene threads in 21-G (0.55 mm) needles of MIS (Medikan, Co., Seoul, Korea; Fig. 3).

Methods

All surgeries were performed in a local clinic. The work described here has been conducted as per the principles of 2013 Declaration of Helsinki for the patient's right to self-determination and the right to make informed decisions regarding participation in research, both initially and during the course of the research. In addition, we have obtained informed consent from all patients included in this study. Finally, 30 patients agreed to the publication of their personal information, including

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Disclosure: The authors are the inventors of MIS, Lipokit, and Filler-Geller, and they are also stockholders of Medikan Co.(Seoul, Korea), which is mentioned in this article. The Article Processing Charge was paid for by the authors.

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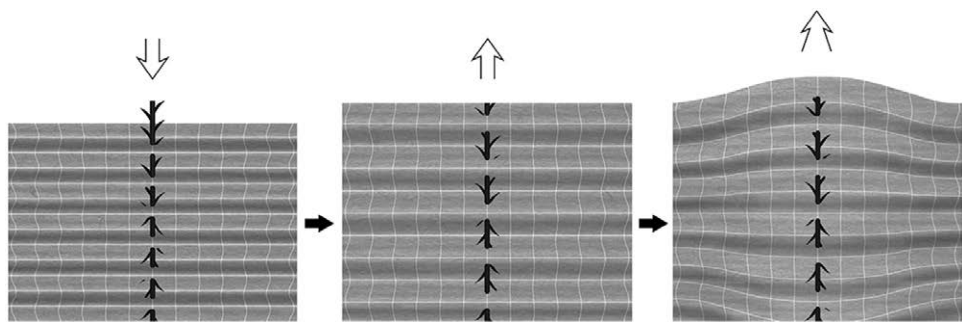


Fig. 1. The mechanism of anticompressive barbs within tissues.

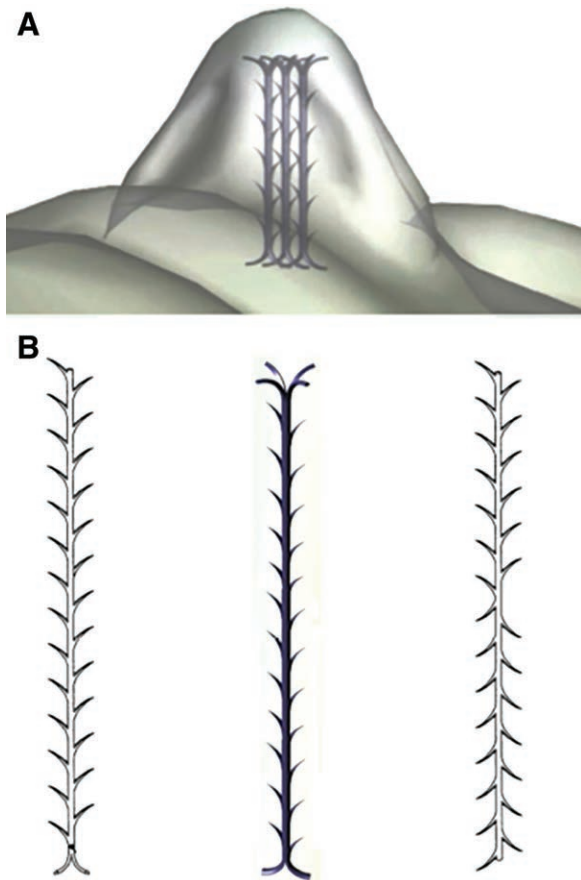


Fig. 2. Anticompressive barbed threads. A, Three threads pushed against each other between nasal tip and maxilla. B, Several types of push-type barbed threads.

photographs. Therefore an institutional review board approval was not necessary.

Clinical Procedures

Presurgical Photography

Basic photographs obtained before and after surgery (front, side, 3/4, and worm’s eye views) were checked, and those from an eagle’s eye view were included if the nasal bridge and forehead shapes were required to be accurately recorded. For these photographs, the nose, cornea, and ears should be completely exposed, and these parts

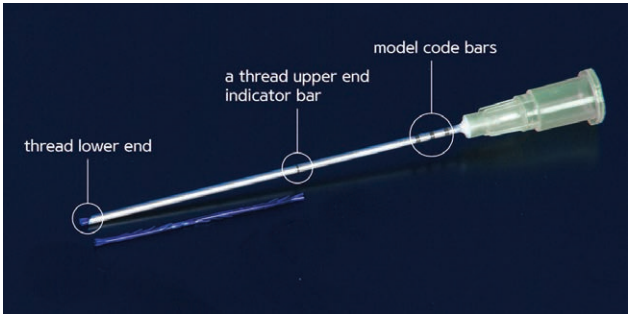


Fig. 3. A barbed thread prefilled needle.

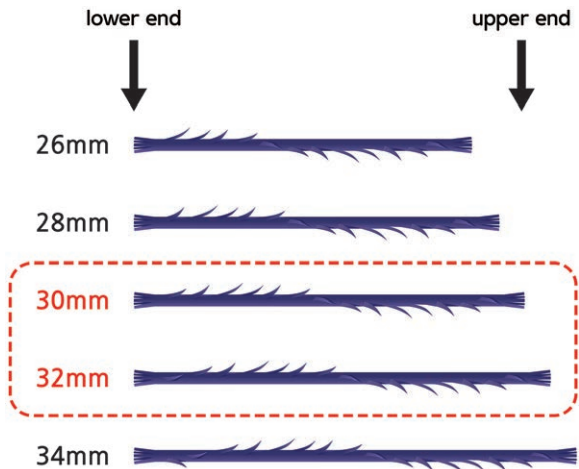


Fig. 4. Anticompressive barbed threads with different lengths.

should not be blurred or obstructed by hair. All conditions, including brightness, background color, lenses, and lights were identical in all photographs.

Surgical Procedures

The entire face was draped and local anesthesia was administered on the nose, including anterior nasal spine (ANS).

Selection of Thread Size and Injector Assembly

After the type and length of a thread were determined, a thread-prefilled needle was combined with the Luer lock of an injector. Various lengths ranging from 26mm to 34mm were used depending on the patient’s features; 30-and 32-mm threads were mainly used (Fig. 4).

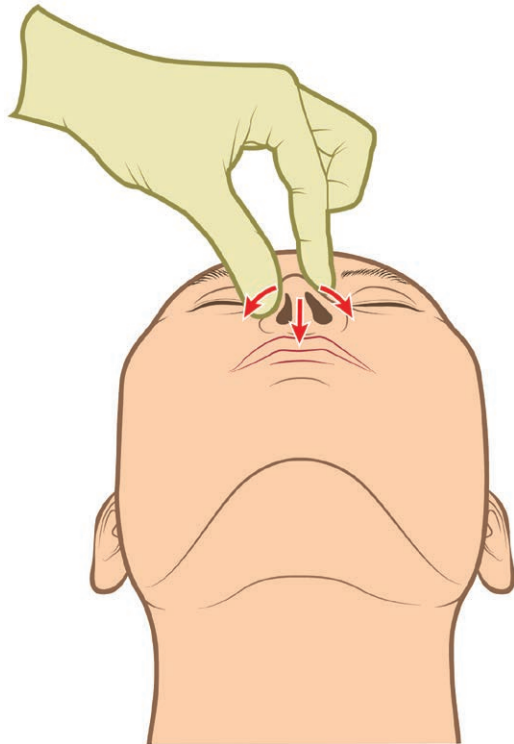


Fig. 5. Directions of preimplantation stretching.

Preimplantation Stretching

The nasal tip was held with 2 fingers and strongly pulled in various directions to predict a possible range of variations in shape and use the immediate effect of skin expansion (Fig. 5; see video, Supplemental Digital Content 1, which displays preimplantation stretching and designing, <http://links.lww.com/PRSGO/A892>).

MIS Needle Insertion

While holding the nasal tip with the fingers, the needle was carefully pushed into the previously marked entry point



Video Graphic 1. See video, Supplemental Digital Content 1, which displays preimplantation stretching and designing. Before the procedure, the operator checks the elasticity of the nose, then makes a design to mark where the holes are going to be made, <http://links.lww.com/PRSGO/A892>.



Video Graphic 2. See video, Supplemental Digital Content 2, which displays MIS needle insertion. After all the designing, the operator makes 2 small holes using the needle, <http://links.lww.com/PRSGO/A893>.

(see video, Supplemental Digital Content 2, which displays MIS needle insertion, <http://links.lww.com/PRSGO/A893>).

Searching Sticky Tissues (Periosteum, Perichondrium, Cartilage, and Scar) and Thread Tucking

While holding the nasal tip with 2 fingers, the needle was carefully moved using the other hand to feel the resistance of tissues against ANS. When the needle came in contact with relatively solid soft tissues, such as the periosteum and perichondrium, the needle tip was able to be inserted approximately 1 mm deeper because although the resistance of soft tissues was strong, it was lesser than that of hard bones. The insertion of the needle was stopped once the tip could be felt by the surface of the fourth fingernail of the hand holding the nasal tip (Fig. 6). Carefully and frequently moving the needle forward helps in detecting the location of the needle (see video, Supplemental Digital Content 3, which displays nose lengthening, <http://links.lww.com/PRSGO/A894>).

Skin Stretching and Skin Advancing over the Thread End Indicator Band

If the needle was felt to be tucked in the periosteum and perichondrium, the needle was fixed and the skin along the needle was moved by strongly pulling the skin. The skin was continuously pulled until it was 5–10 mm

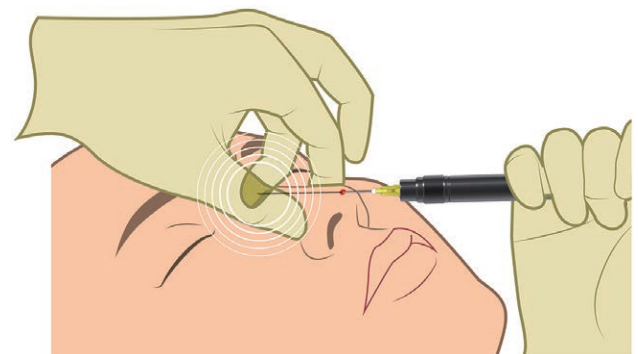


Fig. 6. Thread implantation techniques for dorsal lengthening. The tip of a needle is detected with the help of the fourth finger nail.



Video Graphic 3. See video, Supplemental Digital Content 3, which displays nose lengthening. The needle is then inserted exceeding the indication line on the needle and reaches the periosteum and perichondrium. The operator then checks the presence of periosteum and perichondrium and pushes the skin in an angle while the thread is being inserted using the injector plunger, <http://links.lww.com/PRSGO/A894>.



Video Graphic 4. See video, Supplemental Digital Content 4, which displays nasal tip elevation. Using the same entry point, the MISKO needle is carefully inserted downward. The needle is inserted surpassing the indication line in between the columella, then the operator feels the the ANS to check the presence of the needle, <http://links.lww.com/PRSGO/A895>.

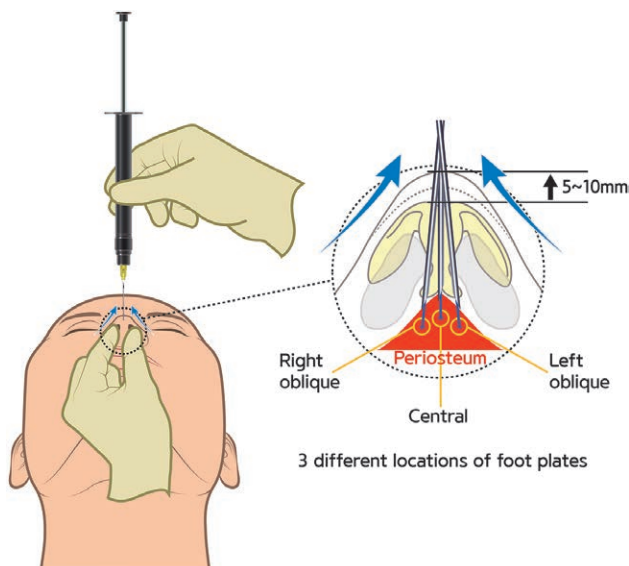


Fig. 7. Thread implantation techniques for tip projection.

beyond the band indicator that marked the upper thread end (Fig. 7; see video, Supplemental Digital Content 4, which displays nasal tip elevation, <http://links.lww.com/PRSGO/A895>).

Thread Implantation

The injector plunger was gently pushed with the thumb holding the injector to the point at which resistance was sensed. Next, the location of the thumb was fixed, and the injector was moved as if it was being pulled backward. The plunger was released when the thread was exposed by approximately 12mm. The state of strongly stretched skin was maintained until the needle was completely removed from the skin (Fig. 8; see video, Supplemental Digital Content 5, which displays more details on nasal tip elevation, <http://links.lww.com/PRSGO/A896>).

Multiple Implanting

It is safe to support the nose with multiple threads even while extending its length in 1 direction. At the same time, for mutual support, having the vectors of pressure created by the threads in various locations as opposed to parallel locations is helpful in obtaining stronger support. The threads were continuously inserted until the desired shape was constructed. For a simultaneous extension of the nasal bridge and columella, approximately 6–8 threads were used for each patient. For expanding the alar rim to reduce the nostril show, 2 threads were used on 1 side. Because the Asian nose often presents problems with respect to nostril exposure after nasal tip projection, approximately 8–12 threads were implanted. In the final phase of surgery, nonabsorbable polypropylene #0 barbed threads were occasionally implanted.

Adjunctive Procedures

In revision surgery or surgery on an excessively small nose, needle dissection and micro-scissors dissection through intranasal stab wounds were occasionally necessary. When volume effects were necessary, autologous fat grafts were used.

Education and Follow-up Period

Unless any specific problem occurred, patients were asked to visit the hospital clinic 5 days after the surgery and were trained to intermittently perform a stretching massage for 2 weeks after the surgery.

Self-stretching Massage

Patients were instructed to perform massages once or twice a day, starting a week after surgery; as part of the massage, they pulled their nasal tip in the direction in which their skin was extended during surgery and maintained this position for approximately 1 minute (Fig. 9). Patients were explained that this massage helps move the overriding tissues forward on the upper end of the threads and helps reduce the possibility of thread exposure by redistributing the excessive tension and pressure applied to a

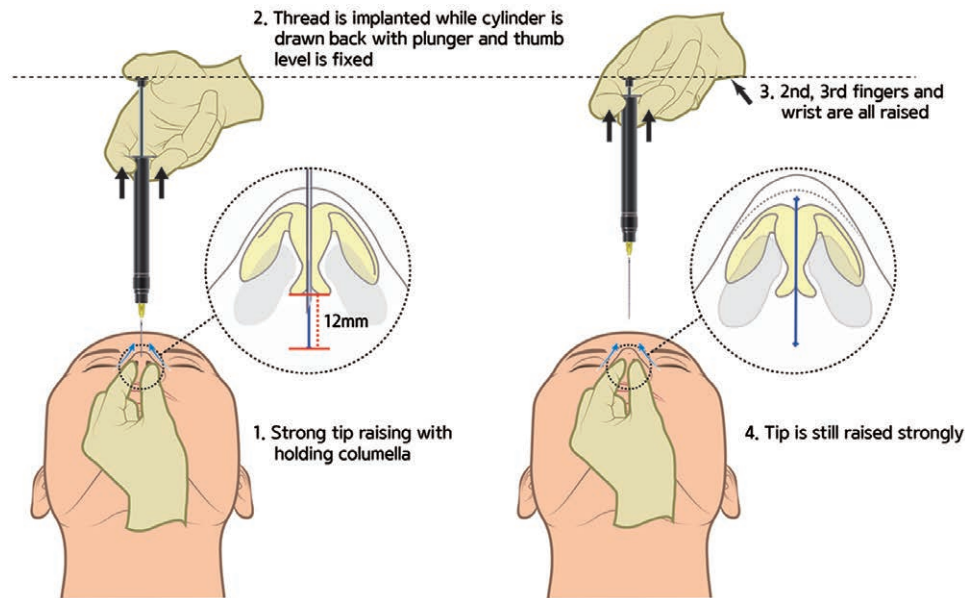


Fig. 8. Skills for using the injector.



Video Graphic 5. See video, Supplemental Digital Content 5, which displays more details on nasal tip elevation. Then the operator feels the ANS to check the presence of the needle. The operator then pulls the nose upward while the thread is being inserted to have more elevation, <http://links.lww.com/PRSGO/A896>.

specific region; it may be effective in maintaining the surgical effects for a long time. Patients were trained to lightly stretch the nose downward and forward with strong force for over 10s in case of impending extrusion, in which the threads are seen through the skin or sudden pricking pain is experienced.

Methods for Evaluation

Sampling

Regardless of the actual date of surgery, among those who visited the clinic more than 6 months after the operation, 62 patients were selected in the order of the most recent visit date. Among them, 30 patients who agreed to allow at least a partial use of their portrait rights were selected. Their true lateral view images of before and after the surgery were compared. If there was no photograph of

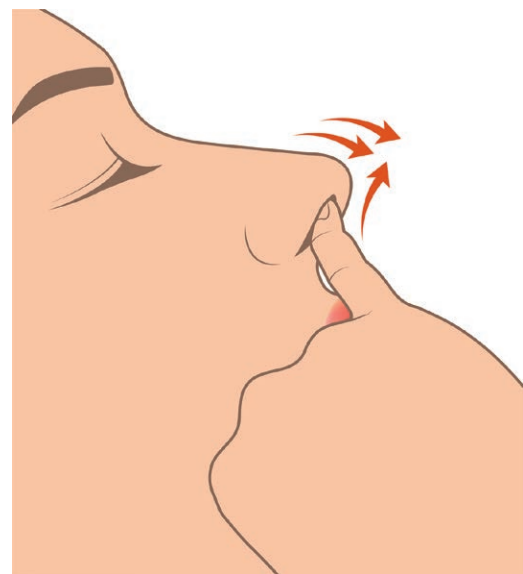


Fig. 9. Postoperative self-stretching massage using 5 fingers.

the same angle before and after the operation due to the axial rotation of the patient's chair or head, we excluded the patient from statistical analysis.

Measurement of the TC/TP Ratio

For 2 points with clear borders on the images, the tragus posterior border (T) and the cornea anterior border (C) were selected as structures that do not change due to surgery, and the distance between the 2 was indicated as TC on the true lateral views (Fig. 10). This distance rarely changed because of rhinoplasty. In contrast, the distance between the tragus posterior border (T) and pronasale (P; anterior border of nasal tip) was indicated as TP, and it increased with nasal tip projection. The distance be-

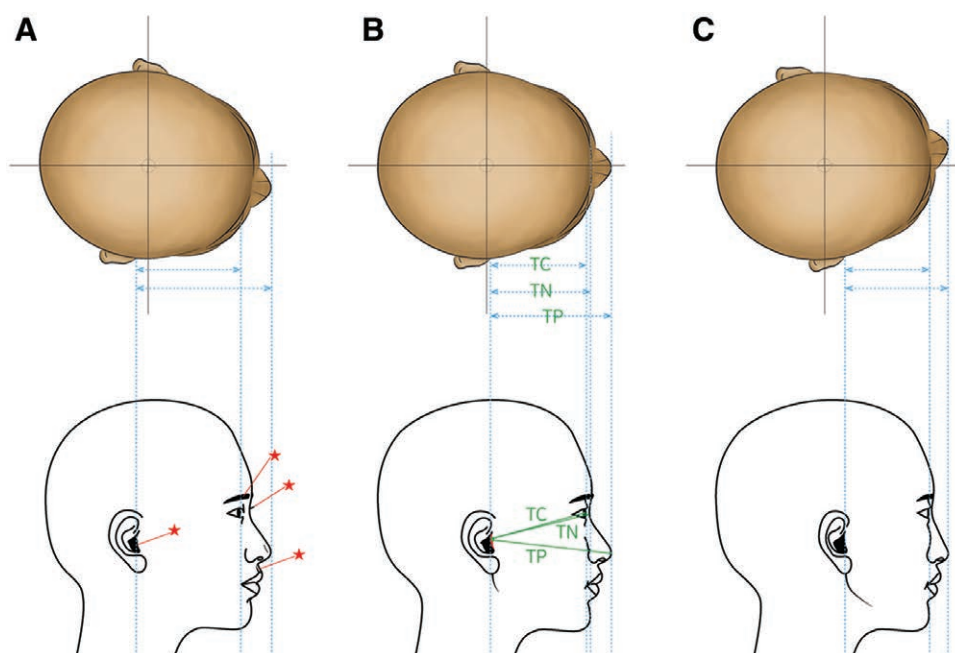


Fig. 10. True lateral photograph for TC/TP ratio measurement. TC, tragus posterior border (T) to corneal anterior border (C). TP, tragus posterior border (T) to pronasale (P; anterior border of nasal tip). TN, tragus posterior border (T) to nasion (N). ★, key structures to decide axial head rotation. External auditory canal, eye brows, eye lashes, Cupid's bow. A, The shape of true lateral view in 10° inward rotation. TC/TP ratio would be increased by 2%. B, The shape of true lateral view in a neutral position. C, The shape of true lateral view in 10° outward axial rotation. TC/TP ratio would be decreased by 2%.

tween T and nasion (N) was TN, and it increased following dorsal augmentation. Because our surgery included nasal tip projection, TN was not indicated. Furthermore, because slight changes in the magnification of a lens or the distance between the camera lens and face makes it impossible to measure actual lengths in images taken using a general camera, only the ratio of 2 lengths (TC and TP) was compared. Using images displayed on a monitor screen, the lengths of TC and TP were indicated using a graphic program, Adobe Illustrator (Adobe Systems Inc., San Jose, Calif.), and the ratio of TP to TC was indicated as a percentage (%).

Even a slight change in axial rotation results in differences in the shapes of exposed external auditory canal entrance and tragus. Hence, views from symmetrical features around the central line such as the eye brows, eye lashes, Cupid's bow of the lips, soft triangle of the nasal tip, chin, and foreheads may result in 1 side being shown more (or less) than the other side, and the degree of such a difference was assessed. Only the images deemed to have an identical angle were selected and compared.

RESULTS

Clinical Cases and Measuring Samples

Statistical Analysis

Among patients under long-term observations, 62 patients were initially selected randomly according to their latest clinic visit dates regardless of surgery timing. Among

them, all 30 patients who agreed to allow at least a partial use of their portrait rights were finally selected. Twenty-two patients received fat graft, and 8 received only thread implantation.

We divided the photographs into 3 groups: control group, experimental group 1, and experimental group 2; the control group included presurgical photographs, experimental group 1 included photographs taken immediately before 1 month, and experimental group 2 included photographs taken in the long-term over 6 months (Figs. 11–14).

TP measured in the lateral images taken from the same angle was divided by TC, and the resulting value was indicated in percentage (%). The mean ratio was 125.28% in the control group and 132.34% in experimental group 1. The mean ratio in experimental group 2 was 127%, which showed a 3.43% increase as a long-term result after the surgery and was statistically significant at a confidence level of 99%. The SD of the increased rates of the mean values was 0.06%. Compared with the value immediately after surgery, the long-term result showed a 5% decline and was statistically significant at a confidence level of 99% (Tables 1–9; Fig. 15).

For empirical analysis, *t* test, which assesses mean differences, and 1-way analysis of variance (ANOVA) were conducted to examine mean differences among different groups.⁴ The target value was obtained by dividing TP by TC. Herein, both lengths were indicated by a program in the same image on the monitor, and the target value was



Fig. 11. Barbed threads tip implantation; 29-year-old woman. TC/TP was increased by 5% of the original ratio.

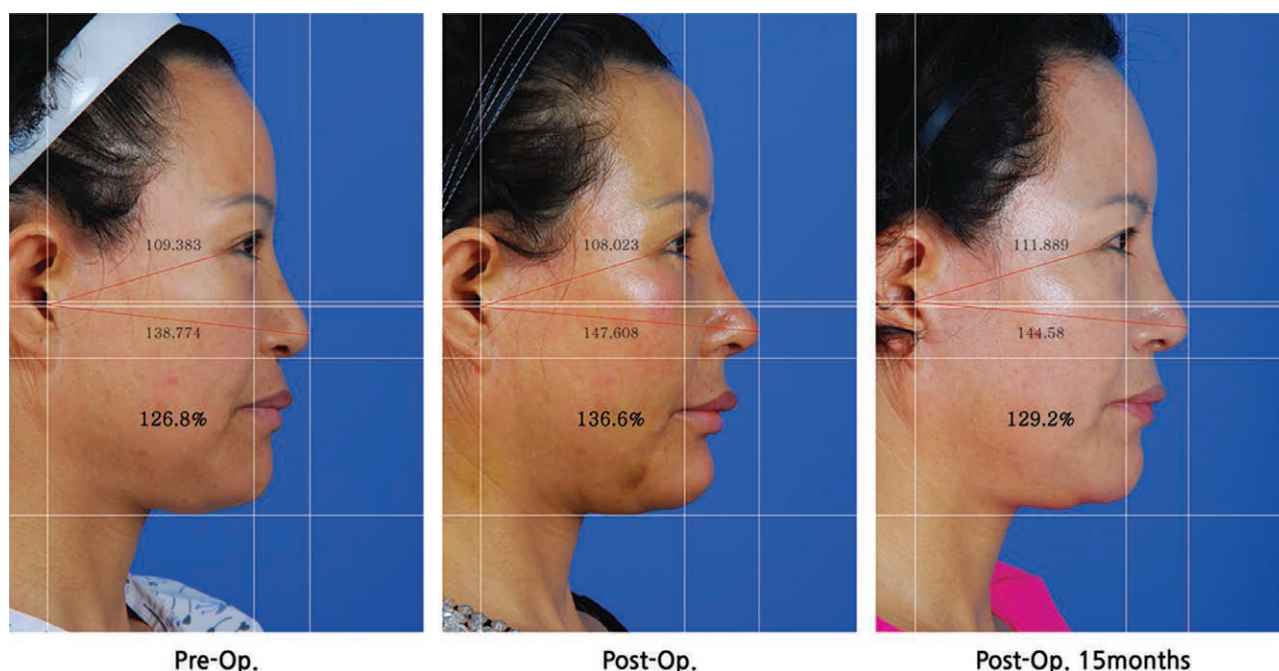


Fig. 12. Barbed threads tip implantation and autologous micronized fat graft; 62-year-old woman. TC/TP was increased by 3.6% of the original ratio.

indicated in percentage (%) ($TP/TC \times 100$). For all empirical analyses, P values of < 0.05 were considered to be statistically significant, and the statistics program SPSS WIN 22.0 (SPSS Inc., Chicago, Ill.) was used for statistical analysis. The mean was significantly higher in the experimental group 1 (132.34) than in the control group (125.28); t test showed a statistically significant difference at $t = 18.94$ ($P < 0.001$), implying that the mean increased immediate-

ly after the surgery. The mean was significantly higher in experimental group 2 (128.70) than in the control group (125.28); t test showed a statistically significant difference at $t = 10.598$ ($P < 0.001$). This result indicated that in the long-term observation, the mean for the experimental group 2 increased compared with that for the control group.

The mean was significantly higher in experimental group 1 (132.34) than in experimental group 2 (128.70);

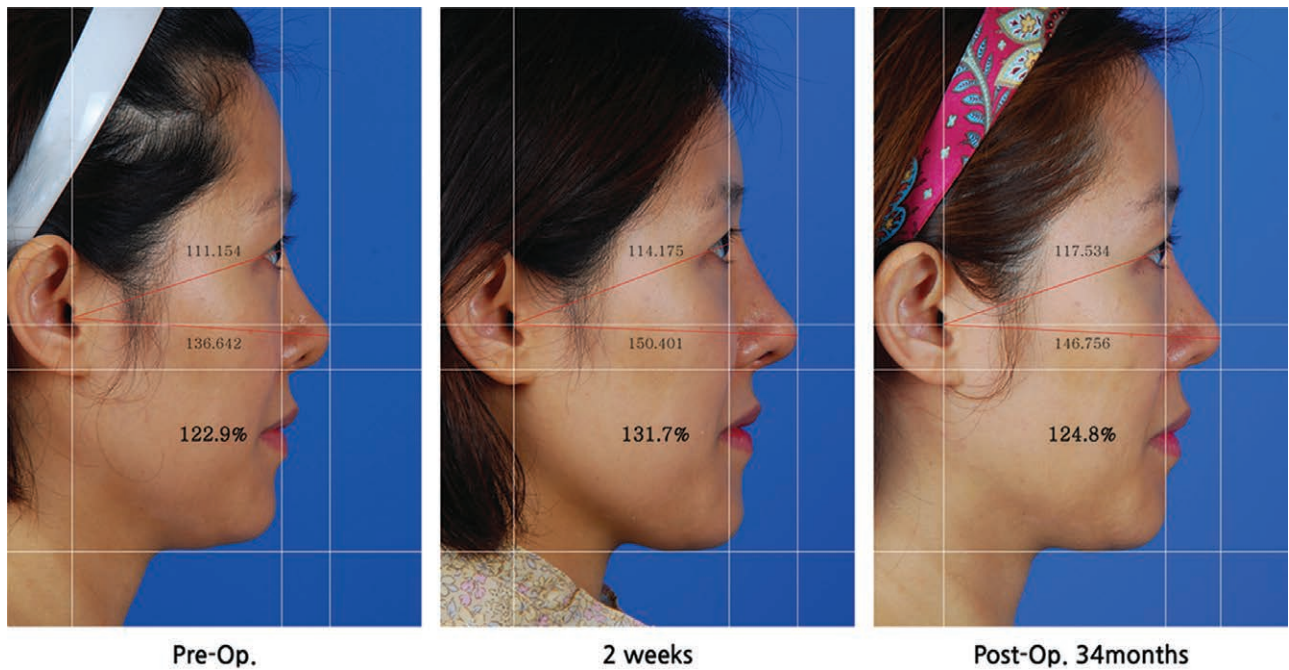


Fig. 13. Barbed thread tip implantation and autologous micronized fat graft; 41-year-old woman. TC/TP was increased by 1.9% of the original ratio.

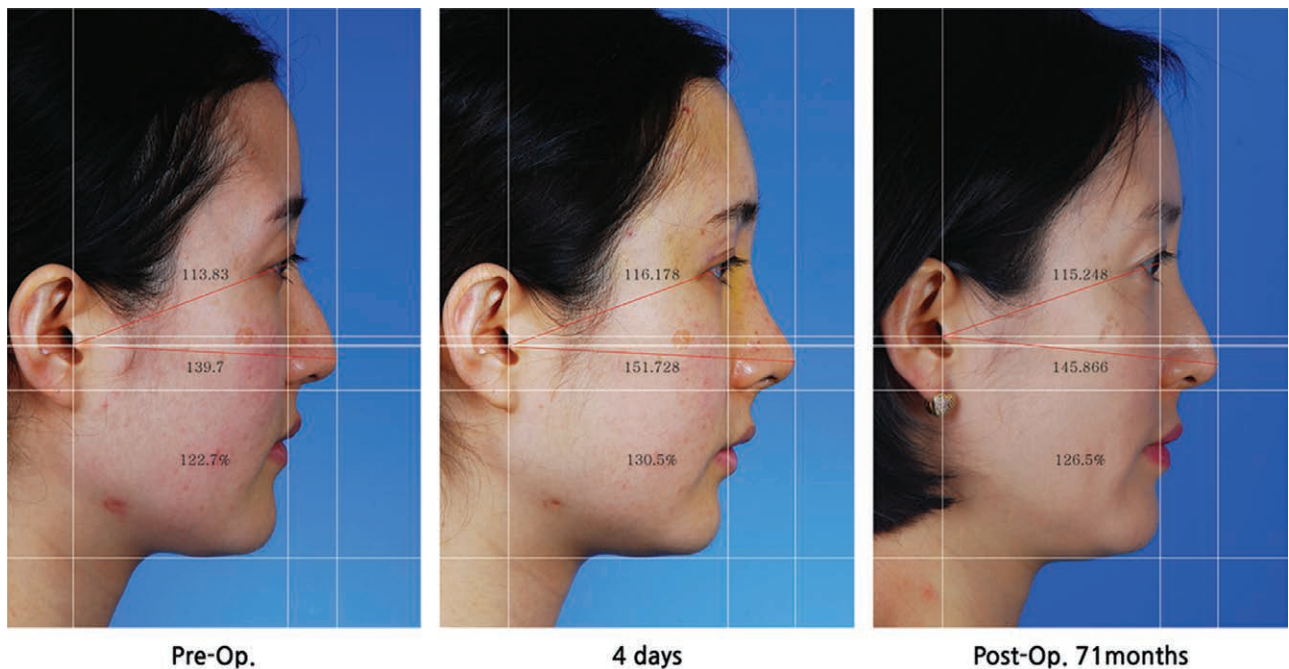


Fig. 14. Barbed threads tip implantation and autologous micronized fat graft; 32-year-old woman. TC/TP was increased by 3.8% of original ratio.

t test showed a statistically significant difference at $t = 8.41$ ($P < 0.001$). This result indicates that the mean immediately after surgery was higher than that after long-term observation.

Repeated-measure ANOVA was performed to compare the mean among the control group, experimental group 1, and experimental group 2. The results revealed the highest value of 132.34 in experimental group 1, followed by 128.71

in experimental group 2, and 125.28 in control group. The *F*-value was statistically significant at 112.32 ($P < 0.001$).

Complications

Adverse effects that could theoretically occur because of the surgery included thread extrusion, infection, foreign body reaction, granuloma, hematoma, bruising, and sensory nerve stimulation in the maxilla. Some adverse

Table 1. Comparison of Mean Values between Control Group and Experimental Groups 1 and 2

Number	Unit (%)		
	Preoperative (Control Group)	Experimental Group 1 (Immediately Postoperatively)	Experimental Group 2 (Long-term Observation)
1	126.8	130.1	130.0
2	131.9	136.9	136.0
3	123.1	132.5	127.2
4	115.0	123.1	119.8
5	126.6	135.8	129.8
6	126.8	136.6	129.2
7	128.2	137.1	129.4
8	121.5	127.3	122.8
9	122.9	131.7	124.8
10	131.0	134.7	132.6
11	116.8	123.7	118.7
12	125.7	133.7	129.7
13	124.8	129.7	129.6
14	125.9	135.4	130.6
15	127.4	135.0	131.9
16	121.8	127.2	122.2
17	134.9	141.2	137.0
18	127.6	133.0	130.1
19	122.7	130.5	126.5
20	125.8	130.3	127.5
21	122.6	127.2	127.6
22	124.8	133.1	129.8
23	123.0	131.5	128.1
24	118.0	127.5	123.0
25	121.7	129.5	128.3
26	132.1	135.8	134.3
27	126.2	135.8	131.4
28	125.8	132.9	125.8
29	126.4	135.2	129.8
30	130.7	136.2	137.7

Table 2. Comparison of Mean Values of Control Group and Experimental Group 1 (Immediately Postoperatively)

Group	Mean	N	SD	Standard Error of the Mean
Preoperative (control group)	125.2833	30	4.44375	0.81131
Experimental group 1 (immediately postoperatively)	132.3400	30	4.21292	0.76917

Table 3. Comparison of Mean Values of Control Group and Experimental Group 2 (Long-term Observation)

Group	Mean	N	SD	Standard Error of the Mean
Preoperative (control group)	125.2833	30	4.44375	0.81131
Experimental group 2 (long-term observation)	128.7067	30	4.56130	0.83278

effects such as thread extrusion and granuloma were observed, but no apparent infections were observed. Among 62 patients examined in this study, one experienced thread extrusion; however, no serious problems occurred while pulling and removing the thread out of the skin. Thread extrusion could be the most frequent complication if the operator is unable to optimally use an injector.

Table 4. Comparison of Mean Values of Experimental Group 1 (Immediately Postoperatively) and Experimental Group 2 (Long-term Observation)

Group	Mean	N	SD	Standard Error of the Mean
Experimental group 1 (immediately postoperatively)	132.3400	30	4.21292	0.76917
Experimental group 2 (long-term observation)	128.7067	30	4.56130	0.83278

Table 5. Descriptive Statistics of Preoperative, Experimental Group 1 (Immediately Postoperatively), and Experimental Group 2 (Long-term Observation)

Group	Mean	SD	N
Preoperative (control group)	125.2833	4.44375	30
Experimental group 1 (immediately postoperatively)	132.3400	4.21292	30
Experimental group 2 (long-term observation)	128.7067	4.56130	30

DISCUSSION

Since 1997, we have been performing minimally invasive fat grafting for nasal tip projection. Given that only fat grafting cannot produce sufficient forward projection of the nasal tip, in 2003, we started to use absorbable barbed PDO suture threads. Biopsy results obtained in the study showed that in case of using only absorbable # 2 PDO, even after an absorption period of 3–4 months, scarred tissues, into which the material was already absorbed, still exhibited a tendency to maintain their prior condition (Fig. 16).

To maintain the initial effect at most, patients were recommended to undergo an additional treatment that could facilitate the wound healing process under their surgery-induced modified conditions. When fat grafting from another region was attempted, we used procedures such as grafting of fat that was concentrated with stromal cells and extra cellular matrix (ECM) by squeezing or using a micro-cutter (Filler-Geller)^{4,5} and cell-assisted lipotransfer, in which stromal vascular fraction was added.⁶

Among the types of tip projection surgery, the surgery using autologous fat graft is a nonincisional method with minimized tissue damage and thus has the advantage of flexible surgery timing. The greatest advantage perceived by us was that even if foreign substances were exposed, they could be simply treated unlike existing implants. Hence, a certain level of internal pressure, which could be risky for existing solid implants, could be applied, and the immediate effect of skin expansion could be observed during surgery. The immediate stretching and fixation techniques employed by this surgery can cause immediate modification by sufficient force of only a single hand of an operator and can fix the respective location within a short time. It is important to select an insertion tool that can enable operators to sense delicate changes.

Table 6. Comparative t Test of Control Group and Experimental Group 1

Group	Mean	SD	Standard Error of the Mean	95% Confidence Interval of Difference		t	P
				Lower Limit	Upper Limit		
Preoperative (control group)—experimental group 1 (immediately postoperatively)	-7.05667	2.04006	0.37246	-7.81844	-6.29490	-18.946***	0.000

* $P < 0.05$; ** $P < 0.01$; *** $P < 0.001$

Table 7. Comparative t Test of Control Group and Experimental Group 2

Group	Mean	SD	Standard Error of the Mean	95% Confidence Interval of Difference		t	P
				Lower limit	Upper limit		
Preoperative (control group)—experimental group 2 (long-term observation)	-3.42333	1.76922	0.32301	-4.08397	-2.76270	-10.598***	0.000

* $P < 0.05$; ** $P < 0.01$; *** $P < 0.001$

Table 8. Comparative t Test of Experimental Group 1 (Immediately Postoperatively) and Experimental Group 2 (Long-term Observation)

Group	Mean	SD	Standard Error of the Mean	95% Confidence Interval of Difference		t	P
				Lower Limit	Upper Limit		
Experimental group 1 (immediately postoperatively)—experimental group 2 (long-term observation)	3.63333	2.36619	0.43201	2.74978	4.51688	8.410*	0.000

* $P < 0.05$; ** $P < 0.01$; *** $P < 0.001$

Table 9. Comparative Repeated Measure ANOVA on Preoperative, Experimental Group 1 (Immediately Postoperatively), and Experimental Group 2 (Long-term Observation)

Source	Type III Sum of Squares	Degree of Freedom	Mean Square	F	P
Among individuals					
Intercept	1492508.689	1	1492508.689	27636.914***	0.000
Error	1566.121	29	54.004		
In-group					
Group	175.788	1	175.788	112.320***	0.000
Error (group)	45.387	29	1.565		

* $P < 0.05$; ** $P < 0.01$; *** $P < 0.001$

Our suggested evaluation method has the advantage of using only photographs. However, proper lateral images for comparison at similar angles often cannot be obtained, making measurement impossible. Small differences may arise due to facial postures, and axial rotations can cause bigger differences than expected. Therefore, it would be better to use devices for conventional cephalometry with fixing tools for positioning the head such as 2 ear rods and a mouth piece or to use modern 3D measurement methods. However, despite this handicap, photometry, as suggested by us, could be used for objective analysis in cosmetic surgeries, including rhinoplasty.

Because this study verified the ratios from the same view and angle, the absence of actual numerical values was deemed not to affect the verification. This measurement method was first attempted, owing to the absence of other

methods for the authors' retrograde research. Therefore, despite the presence of numerous reasons for which we could be convinced of the study results, multiple discussions and comparative analyses are additionally required, and some standards should be prepared for relevant photography techniques. Fortunately, because our surgical results only showed differences that would not hinder statistical analysis, this method is considered feasible. However, more detailed studies are required to apply this method to surgical procedures that require the verification of other important differences.

Thread extrusion and irritation could be the most frequent complication when the operator is less experienced. We have been instructed to excessively use a sponge block or a thick towel before a clinical trial so that threads can be removed with just pulling, even after several weeks.

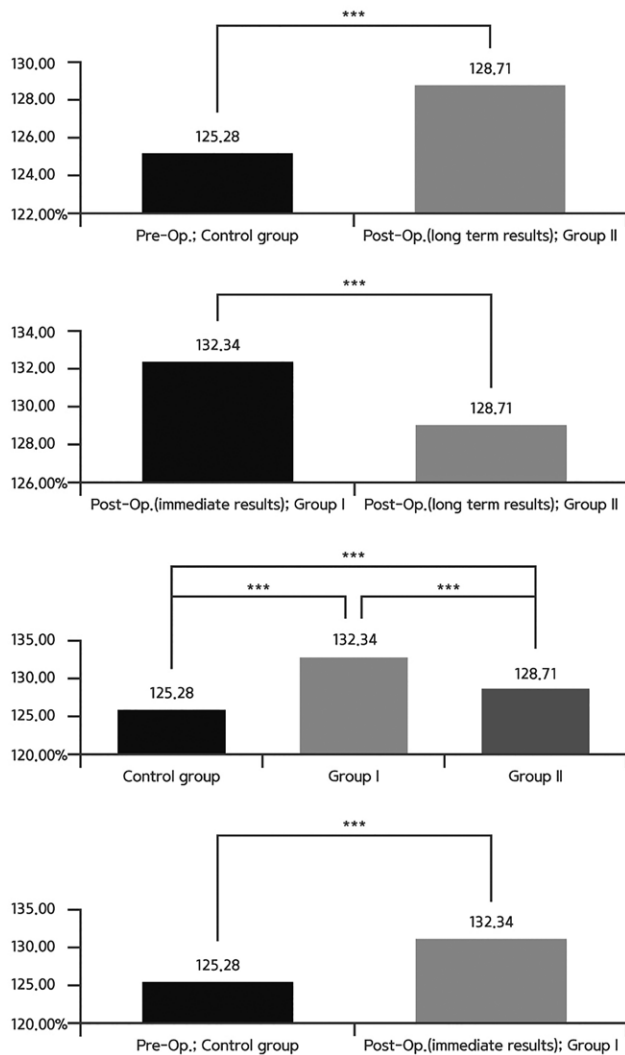


Fig. 15. Comparative t test between the control group and experimental groups.

Barbed threads with split ends are effective implants that endure pressure even during dorsal length extension and alar rim expansion. Adjunctive filler of fat injections may show better results. Artificial fillers could be used for dorsal

nasal augmentation but not for tip projection. Filler injection within caudal border of septal cartilage may sometimes show dramatic results, but if the injected volume spreads to adjacent areas due to internal pressure, the initial strut effects could disappear in a week, particularly in Asians with small noses. Therefore, strut structures should not be constructed with filler only. In summary, we believe barbed threads and autologous fat gel graft would give the best results for the trial of anterior projection of a nasal tip and dorsal lengthening. When patients want minimally invasive procedures, artificial filler and threads should be recommended. Artificial filler only for anterior nasal tip projection is not recommended. Threads were occasionally recommended to be implanted, that is, only when there were enough tissues in the nose. Without a solid structure, liquid form materials like fillers or fat grafts make a flat plane or a sphere shape by tissue pressure distribution rather than longitudinal struts, so we could presume these have rare strut effects. However, when solid struts exist, liquid creates a longitudinal form and then creates tissue remodeling along the struts. Especially in the aspect of long-term effects of liquid forms, threads help to have greater projection effects. As a result, we believe liquid and solid form have strong synergies not only for volume effects but for tip projection effects.

CONCLUSIONS

In rhinoplasty performed on Asians, the results of long-term observations indicated that the surgical procedure of lifting the nasal tip with barbed threads was effective. Although a maximum of ≥ 10 -mm projection could be attempted, its effects are reduced in long-term results, and thus, the nasal tip is located in the mid-point between the presurgical and maximum projection points. Although an analysis was not performed to assess the differences in the patients' satisfaction between the simultaneous procedures of fat grafting and nasal tip projection and nasal projection only, more cases require fillers or fat grafting to maintain a natural sense of volume. There may be differences in the frequency of adverse effects and the degree of satisfaction depending on the surgeon's experience and presurgery explanation. Irreversible adverse effects were almost absent. Although there may be some unsatisfactory results because doctors are gradually becoming familiar

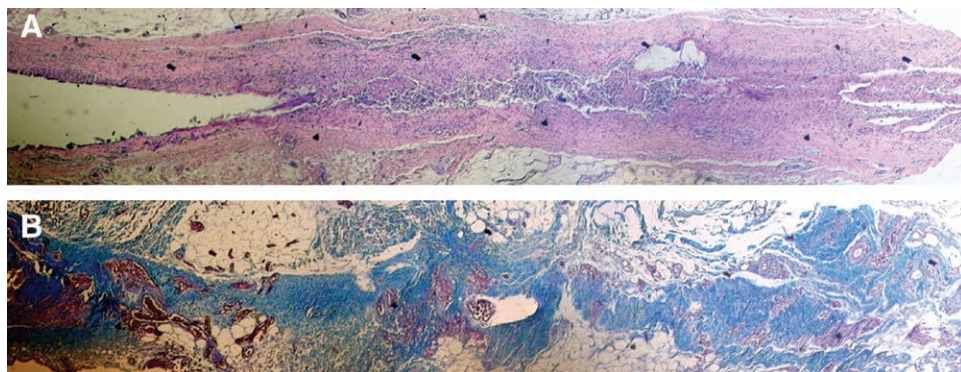


Fig. 16. Histology of tissue biopsy samples; 4 months after using PDO threads. A, Hematoxylin eosin staining for infiltrated cells; small dots with navy color. B, Masson trichrome staining for collagen; cobble stone matrix with blue color.

with the surgical procedure, there is less incidence of re-touching because the procedure is minimally invasive.

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