Aesth Plast Surg (2019) 43:563–568
https://doi.org/10.1007/s00266-019-01324-6

ORIGINAL ARTICLE BREAST SURGERY

Endoscopic Transaxillary Versus Inframammary Approaches for Breast Augmentation Using Shaped Implants: A Matched Case–Control Study

Dong Won Lee[1] · Soo Jung Kim[1] · Hanjo Kim[2]

Received: 7 December 2018 / Accepted: 28 January 2019 / Published online: 25 March 2019

Abstract

Purpose The incision for breast augmentation can be chosen from the transaxillary, inframammary fold, periareolar, or transumbilical approaches. While the inframammary fold approach is commonly used worldwide, the transaxillary approach is more popular in Asia due to the more conservative location of the scar. In this study, we performed augmentation mammoplasty using anatomically shaped implants via the endoscopic transaxillary and inframammary fold incisions and compared the outcomes.

Methods Three hundred sixty-four patients who underwent breast augmentation with shaped implants were enrolled. All were primary and bilateral cases. In total, 728 shaped implants were used. Patients' demographics, incision type, and complications were documented. Complications such as capsular contracture, hematoma, infection, implant malposition, wound problem, and chronic seroma were observed during the average 27 months of follow-up period and analyzed.

Results One hundred ninety-five patients underwent augmentation mammoplasty via the inframammary approach, whereas 169 patients underwent the endoscopic transaxillary approach. Implant type and size were matched between the two groups. Complication rates were 1.8% and 2.7% in the inframammary and transaxillary approach, respectively. There was no significant difference between the two approaches in terms of surgical complications ($p = 0.593$).

Conclusion This study demonstrates that the endoscopic transaxillary approach is not inferior to the inframammary approach when shaped implants are used for augmentation mammoplasty. Therefore, the transaxillary approach may be an alternative method when using shaped implants for augmentation mammoplasty, especially for women who wish to avoid a visible scar on the inframammary fold.

Level of Evidence III This journal requires that authors assign a level of evidence to each article. For a full description of these evidence-based medicine ratings, please refer to the Table of Contents or the online Instructions to Authors www.springer.com/00266.

Keywords Axilla · Breast implant · Inframammary fold · Mammoplasty

Introduction

Patients who undergo augmentation mammoplasty may have naturally small breasts, loss of breast volume after breastfeeding, or other congenital reasons such as pectus excavatum, pectus carinatum, and Poland syndrome. Breast augmentation is the most common aesthetic procedure in the USA and the fastest growing surgery in Asia [1]. Many factors should be considered before augmentation mammoplasty for maximal satisfaction. Many studies have reported breast augmentation according to the incision and pocket plane [2–4]. Ideally, surgeons should decide on the surgical procedure, implant type and size, incision line,

Electronic supplementary material The online version of this article (https://doi.org/10.1007/s00266-019-01324-6) contains supplementary material, which is available to authorized users.

✉ Hanjo Kim
eight.jk@gmail.com

[1] Department of Plastic and Reconstructive Surgery, Institute for Human Tissue Restoration, Yonsei University College of Medicine, Seoul, South Korea

[2] Eight Plastic Surgery, EGI Building 7th Floor, 843 Nonhyun-ro, Gangnam-gu, Seoul 06031, South Korea

plane of dissection, and level of dual plane (in case of a subpectoral dissection) according to the patients' physical profile and demand, following a thorough consultation with the patient.

Popular approaches to access the breast pocket include the inframammary, transaxillary, periareolar, and transumbilical approach. While the inframammary incision is the most popular implant incision site in the Western world, the transaxillary incision using an endoscope is commonly used in the Asian population, as they are prone to hypertrophic and prolonged hyperemic scarring of the inframammary scar [3, 5]. Although the inframammary approach provides for easier manipulation of implants because of wider visual fields, the incision scar is more noticeable than an axillary scar, especially in Asians with thicker skin [6]. In a more conservative environment such as Asia, even a well-managed inframammary scar may be of great concern; thus, the transaxillary approach is relatively popular in this region.

The standard surgical procedure for augmentation mammoplasty using a shaped implant has been through the inframammary approach [7, 8]. This is in part due to the common myth that an anatomically shaped implant is difficult to insert through a transaxillary incision. Since anatomically shaped gel implants were first approved by the Korean Food and Drug Administration in 2012, there were early concerns regarding the use of shaped implants through the transaxillary approach, in terms of malposition or rotation of the implant having a larger pocket than in the inframammary approach. However, Sim et al. [9] reported satisfactory results in a large case study.

In this study, we used anatomical implants inserted through either the endoscopic transaxillary approach or the inframammary fold approach, evaluated outcomes following augmentation mammoplasty by a single plastic surgeon, and compared the results of the inframammary and axillary approaches in terms of complications.

Materials and Methods

Patients

Between April 2013 and August 2017, 364 patients underwent augmentation mammoplasty via the endoscopic transaxillary or inframammary fold approach using Natrelle® 410 type implants (Allergan, Inc., Irvine, California). These were all primary cases, and all patients were older than 20 years. All patients were consulted and operated on by a single surgeon. Reconstructive surgery, secondary or revision surgery, and unilateral augmentation cases were excluded. Informed consent for surgery was obtained after a thorough explanation of the surgical method and complications. Preoperatively, patients' information, including age, sex, history of other surgery, and physical examination of the breast profile were collected. The operation technique, postoperative management, complications, and follow-up time were recorded on the chart postoperatively. Surgical procedure, pocket selection, incision location, implant size, and complications were also charted. The institutional review board of our hospital waived informed consent for this study and approved the design of this retrospective study.

Preoperative Evaluation

Before surgery, patients were consulted regarding their expectations and preference of the size of breast implant with the surgeon. Preoperatively, the following breast measurements were performed: the sternal notch to nipple distance, nipple to inframammary fold distance, as well as the width, height, and projection of the patients' breast. Skin texture and thickness were also evaluated. Preoperative breast photographs were taken from five angles.

Implant and Surgical Techniques

The implants used in this study were textured, anatomically shaped, form-stable gel from Allergan. The average implant size was 314 cc (range, 210–535 cc). Implant size was selected based on skin laxity, breast shape, and patients' preferences. The inframammary fold incision was used in the majority of patients (n = 195), followed by endoscopic transaxillary incision (n = 169). All the breast implants of enrolled patients were placed in the subpectoral pocket.

Under general or sedative anesthesia using propofol infusion, augmentation mammoplasty was performed via the endoscopic transaxillary or inframammary fold approach by a single surgeon. Regardless of incision type, the incision line was designed with a marking pen, and local anesthetic with 1% lidocaine mixed with 1:100,000 epinephrine solution was injected along the incision line, as well as the location of the lateral thoracic nerves. The distal nerve block of the lateral thoracic nerves allows the anesthesiologist to use a lower dosage of inhalation anesthetics or intravenous anesthetics. Through the incision, dissection was performed and the pectoralis major muscle was exposed. A subpectoral pocket was made depending on each incision. (See Video, Supplemental Digital Content 1, which demonstrate subpectoral dissection via the endoscopic transaxillary approach) Pocket irrigation with antibiotics mixed in saline solution was performed. Negative drains were not inserted in any of the cases. The incision was repaired with #4-0 vicryl and #5-0 polydioxanone (PDS) sutures for the axillary incision and #2-0 and

#5-0 PDS sutures for the inframammary incision. The skin was approximated in a subcuticular manner with histoacryl glue. The 14-point plan (except criteria 2, that is 'avoid periareolar/transaxillary incisions' in the case of endoscopic transaxillary approach) was used to minimize postoperative capsular contracture [10].

Postoperative Care

Postoperatively, patients were instructed to wear a specially designed surgical brassier to maintain the breast in the adequate pocket with appropriate axis and to prevent rotation of the implant and hematoma formation. All patients received a prescription for oral first-generation cephalosporin. Patients were advised to rest and avoid raising their arms.

Postoperative Evaluation

For evaluation of the surgical outcome, preoperative and postoperative digital photographs of patients' breasts were taken in the frontal, semiprofile, and bilateral profile views, with the distance between the patient and the photographer consistent. Complications were observed at the outpatient clinic by the operating surgeon during the follow-up period. The rotation axis of shaped implant was evaluated by ultrasonography based on dots in the lower anterior part at the 1-year postsurgery follow-up. Malrotation was defined as implant rotation of more than 10 degrees on ultrasonographic evaluation.

Statistical Analysis

All statistical analyses were performed using SPSS version 20.0 (IBM Corp., Armonk, NY). Descriptive statistics are presented as the mean with standard deviation or as numbers and percentages. To compare the mean of continuous variables (i.e., patient age, implant volume, follow-up period), an independent *t* test was used. The Chi-square test was used to assess any differences between categorical variables (i.e., complications: capsular contracture, hematoma, wound problem, malrotation, infection, and chronic seroma). Two-tailed values of $p < 0.05$ were considered statistically significant.

Results

A total of 364 patients (728 implants) were included in this study, with a mean age of 34.2 (± 7.71) years. The mean follow-up period was 26.5 (± 7.32) months. The overall patient characteristics are presented in Table 1. As shown in Table 1, implant type and size were matched between the two groups, and no statistically significant difference was also noted in other demographic characteristics. Representative results in each group are shown in Figs. 1 and 2.

During the follow-up period, possible complications due to augmentation mammoplasty included capsular contracture (defined as Baker scale grades III and IV), hematoma, wound problem that required a surgical revision, implant malrotation, infection, and chronic seroma. The overall complication rate was 2.2% (16 cases of 728 implants); the complication rate was 2.7% in the transaxillary group and 1.8% in the inframammary group. There was no significant difference in the comparison between the two groups in terms of surgical complications ($p = 0.593$). Capsular contracture rates were 1.8% and 1.0% in the transaxillary group and inframammary group, respectively, with no significant difference ($p = 0.386$). Other complications also exhibited no significant differences between the two groups (Table 2). Implant malrotation occurred in just one case (0.3%) in the transaxillary group. The patient complained of unnatural appearance of the breast, and malrotation was confirmed upon ultrasonographic evaluation (rotated by an angle of 30 degrees). The malrotation was corrected by changing the shaped implant to a smooth round implant bilaterally.

Discussion

When a patient decides to undergo breast surgery, the patient has to make several decisions. The three most important decisions are the selection of the implant shape (round or shaped), size, and the approach through which the implant is to be inserted. These may depend on multiple factors such as the patient's age, cultural background, and the weather conditions of where she may reside. Although breast augmentation is one of the most popular procedures in the field of plastic surgery with the highest satisfaction rate, patient satisfaction may be affected by unexpected circumstances such as hypertrophic scar or keloid of the incision site. To maximize patient satisfaction, it is important to consider the lifestyle of the patient to determine the type and size of implant to use, as well as the most appropriate incision location.

Common incision sites for breast augmentation, in the order of popularity, are the inframammary, periareolar, axillary, and periumbilical approach [11]. In the authors' view, the capsular contracture rate through a periareolar incision would increase in a fairly high-risk surgery, with a continued risk of subclinical infection that may lead to delayed formation of capsular contracture. The periareolar incision may cut through large ducts; this can lead to potential bacterial colonization due to the increase in

Table 1 Patient demographics

	Endoscopic transaxillary approach	Inframammary approach	p value
Patients	169	195	
Number of implants	338	390	
Age (year)	34.4 ± 7.00	33.9 ± 8.29	0.587
Surgery	Primary breast augmentation	Primary breast augmentation	
Implant type	Textured shaped gel (Allergan 410 type)	Textured shaped gel (Allergan 410 type)	
Implant size (cc)	312.0 ± 37.10	315.9 ± 36.77	0.308
Follow-up period (months)	27.0 ± 7.67	26.1 ± 6.99	0.242

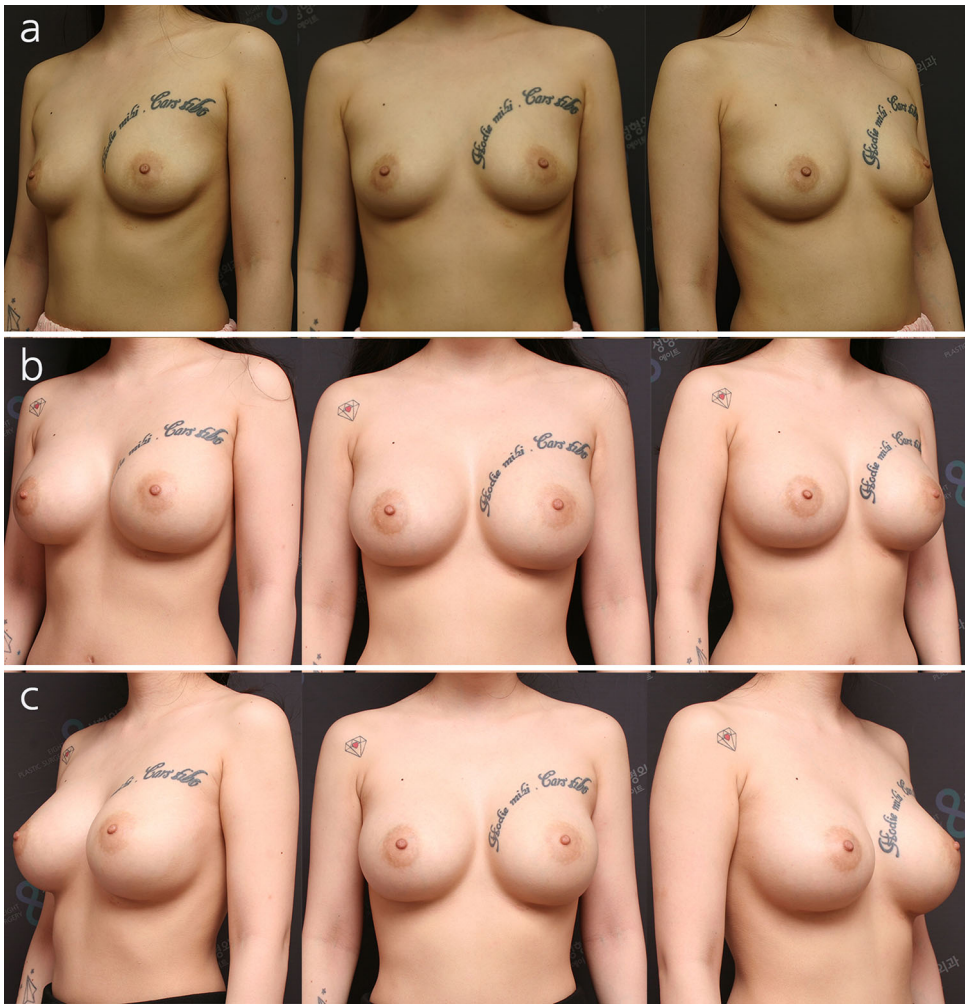

Fig. 1 A 25-year-old female patient with Allergan 410 MF 335 implants through the inframammary approach. a Preoperative view. b Postoperative 3-month view. c Postoperative 2-year view

chance of contracting large amounts of bacteria resident in the ducts [12, 13]. In a meta-analysis with a random effect model, Li et al. [14] reported a higher rate of capsular contracture in the periareolar group than in the non-periareolar group (7.2% vs. 3.1%, p = 0.03). It is technically very difficult to insert an anatomical implant through a periumbilical incision due to a high risk of implant gel fracture during insertion. The only logical incision site in the authors' view is either from an inframammary approach or from a transaxillary approach.

Although breast augmentation via the axillary approach was first described by Hoehler in 1973, it is not as popular in the Western world as it is in the more conservative Asian region [15]. Previous transaxillary approach methods included blind surgery, where an exact dual plane dissection was not possible with blunt instruments. However,

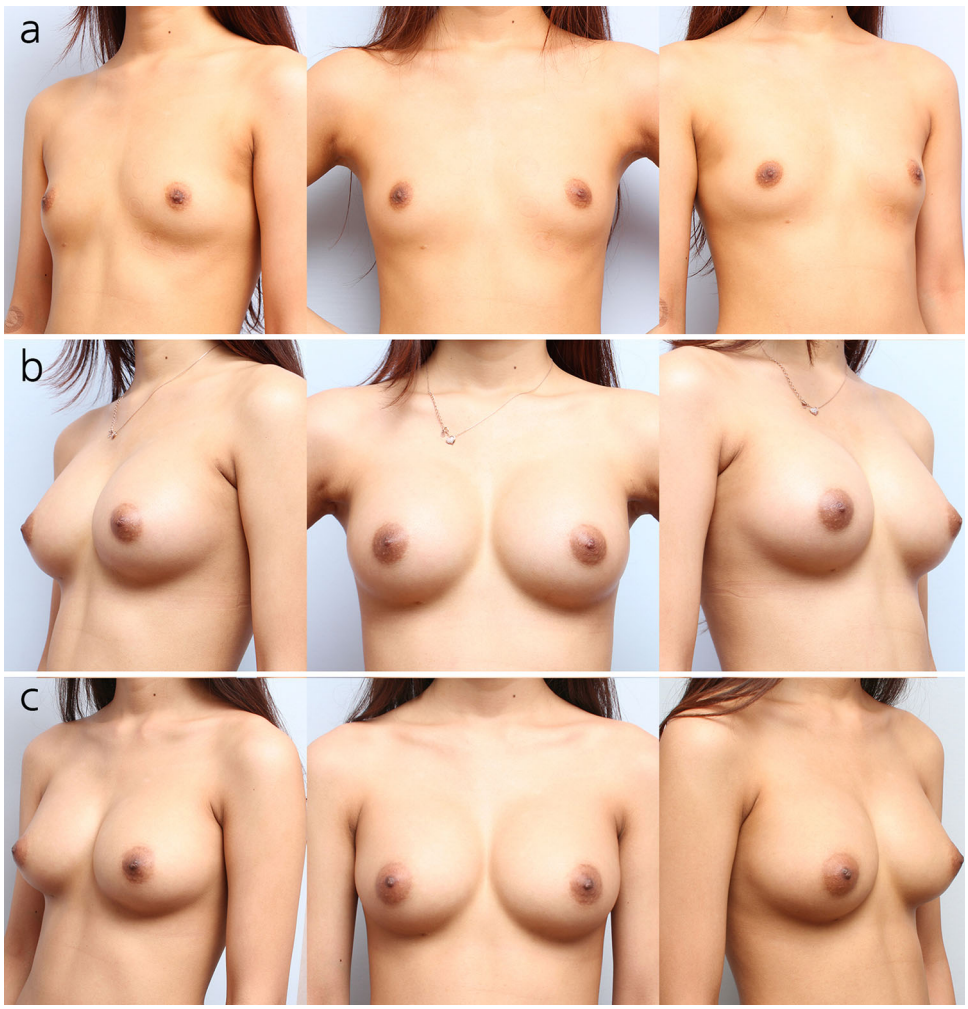

Fig. 2 A 32-year-old female patient with Allergan 410 MF 335 implants through the transaxillary approach. a Preoperative view. b Postoperative 3-month view. c Postoperative 2-year view

Table 2 Complications after the endoscopic transaxillary and inframammary approaches for breast augmentation

	Endoscopic transaxillary approach	Inframammary approach	p value
Patients	169	195	
Number of implants	338	390	
Capsular contracture	6 (1.78%)	4 (1.03%)	0.386
Hematoma	2 (0.59%)	2 (0.51%)	0.886
Wound problem that requires surgical revision	0	1 (0.26%)	0.352
Malrotation	1 (0.30%)	0	0.282
Infection	0	0	
Chronic seroma	0	0	
Total	9 (2.66%)	7 (1.78%)	0.593

with advances in medicine, endoscopes are now used with the axillary approach; therefore, it should be considered from a different perspective than the previously blind approach. Sim et al. [9] reported a capsular contracture rate of 2.6% in a series of 116 patients which is far less than previous reports [16]. It is true that the endoscopic transaxillary approach has a steeper learning curve than the inframammary approach in which surgery is performed under direct vision of the surgical field. However, with experience, the capsular contracture rate may be similar to that of the inframammary approach. As described, these techniques enable the surgeon to minimize tissue trauma

during the endoscopic transaxillary approach for a lower capsular contracture rate. If conducted correctly, capsular contracture is not a problem.

Furthermore, there are prominent cautions with the inframammary approach. The inframammary incision is made in a dependent position; therefore, precise design of the new inframammary fold and accurate wound repair are essential for satisfactory results. Otherwise, it may lead to inappropriate location of the new inframammary fold, hypertrophic scars, and problems with the wound, eventually producing aesthetically poor results. The axilla incision has relatively less postoperative wound problems, because the incisional wound is distant from the implant pocket and is independent of the gravity of an implant. In the current study, none of the patients in the axillary group sustained major wound problems. When other complications such as hematoma, seroma, bottoming out, double bubble deformity, and/or capsular contracture occur, the correction of each approach may be a little different. In practice, the inframammary approach allows a wider visual field than the axillary approach, thus allowing for easier correction of complications. In the setting of reoperation on a previously axillary-approached patient, many surgeons would recommend an additional incision on the inframammary fold to manage the complications. However, experienced surgeons could address the above complications without adding an inframammary fold incision. We believe that the endoscopic transaxillary approach is a good alternative to the inframammary incision. In addition, a patient's scar location preference should be considered for maximum satisfaction.

Conclusion

This study demonstrates that the endoscopic transaxillary approach is not inferior to the inframammary approach when shaped implants are used in augmentation mammoplasty. It is known that the transaxillary incision is more likely to result in malrotation of the implant. However, in this study, the transaxillary approach was associated with fewer complications; in fact, the observed complication rate was low. We conclude that it is a good alternative when using anatomically shaped implants in augmentation mammoplasty, especially for women who wish to avoid a visible scar on their chest.

Acknowledgements This paper has been presented at Aesthetica Supersymposium (March 2017) in New Orleans.

Compliance with Ethical Standards

Conflict of interest Dr. Hanjo Kim is an Allergan Korea consultant for speaking events and marketing strategy.

Human and Animal Rights All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki Declaration and its later amendments or comparable ethical standards.

Informed Consent Informed consent form was signed for all the patients who underwent surgery.

References

1. Heidekrueger PI, Sinno S, Hidalgo DA, Colombo M, Broer PN (2018) Current trends in breast augmentation: an international analysis. Aesthet Surg J 38:133–148
2. Stutman RL, Codner M, Mahoney A, Amei A (2012) Comparison of breast augmentation incisions and common complications. Aesthet Plast Surg 36:1096–1104
3. Zelken J, Cheng MH (2015) Asian breast augmentation: a systematic review. Plast Reconstr Surg Glob Open 3:e555
4. Somogyi RB, Brown MH (2015) Outcomes in primary breast augmentation: a single surgeon's review of 1539 consecutive cases. Plast Reconstr Surg 135:87–97
5. Hidalgo DA, Spector JA (2014) Breast augmentation. Plast Reconstr Surg 133:567e–583e
6. Ince B, Dadaci M, Oltulu P, Altuntas Z, Bilgen F (2015) Effect of dermal thickness on scars in women with type III–IV Fitzpatrick skin. Aesthet Plast Surg 39:318–324
7. Adams WP Jr, Mallucci P (2012) Breast augmentation. Plast Reconstr Surg 130:597e–611e
8. Schwartz MR (2014) Algorithm and techniques for using Sientra's silicone gel shaped implants in primary and revision breast augmentation. Plast Reconstr Surg 134:18S–27S
9. Sim HB, Sun SH (2015) Transaxillary endoscopic breast augmentation with shaped gel implants. Aesthet Surg J 35:952–961
10. Adams WP Jr, Culbertson EJ, Deva AK, Magnusson M, Layt C, Jewell ML, Mallucci P, Hedén P (2017) Macrotextured breast implants with defined steps to minimize bacterial contamination around the device: experience in 42,000 implants. Plast Reconstr Surg 140:427–431
11. Hidalgo DA, Sinno S (2016) Current trends and controversies in breast augmentation. Plast Reconstr Surg 137:1142–1150
12. Chong SJ, Deva AK (2015) Understanding the etiology and prevention of capsular contracture: translating science into practice. Clin Plast Surg 42:427–436
13. Maxwell GP, Van Natta BW, Bengtson BP, Murphy DK (2015) Ten-year results from the Natrelle 410 anatomical form-stable silicone breast implant core study. Aesthet Surg J 35:145–155
14. Li S, Chen L, Liu W, Mu D, Luan J (2018) Capsular contracture rate after breast augmentation with periareolar versus other two (inframammary and transaxillary) incisions: a meta-analysis. Aesthet Plast Surg 42:32–37
15. Tebbetts JB (2006) Axillary endoscopic breast augmentation: processes derived from a 28-year experience to optimize outcomes. Plast Reconstr Surg 118:53S–80S
16. Jacobson JM, Gatti ME, Schaffner AD, Hill LM, Spear SL (2012) Effect of incision choice on outcomes in primary breast augmentation. Aesthet Surg J 32:456–462