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Original Article

Timing of corneal stitches removal after extra capsular cataract extraction for control of postoperative astigmatism

Ophthalmology

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ABSTRACT

Background: There are challenges in cataract surgery to predict the postoperative results and correct them. The source of variability is the change in the corneal shape which leads to surgically induced astigmatism.

Objective: To determine the most appropriate time for removal of corneal stitches after extracapsular cataract extraction surgery (ECCE) as regards the stability of refractive status of the eye.

Methodology: An interventional, randomized controlled clinical trial was conducted on 20 eyes of 20 patients who had ECCE surgery and sutures removal 8 weeks after surgery (group I) and 20 eyes of 20 patients who had ECCE surgery and sutures removal 12 weeks after surgery (group II). Visual outcome was assessed before and after suture removal by refraction and keratometry.

Results: Mean surgically induced astigmatism (SIA) in group (I) was -5.09±1.46 diopter (D) postoperative and -2.14±0.86D after 1st suture removal and -1.786±0.66D after all suture removal, there is a statistically significant change of power among group (I). Mean SIA in group (II) was -5.26±1.43D postoperative and -3.82±1.78D after 1st suture removal and -2.818±0.73D after all suture removal, there is a statistically significant change of power among group (II). There is statistically significant higher median power among group II than group I (P=0.001) after 1st suture removal and after full suture removal.

Conclusion: When interrupted 10/0 nylon corneal suture causes a high degree of astigmatism, it is better to be removed at 8 weeks after surgery, not just being as effective in alleviating astigmatism, but safer and more stable in refraction.

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Keywords: ECCE, surgically induced astigmatism, suture removal, timing.

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INTRODUCTION

Cataract surgery is most common single surgery performed all over the world. Cataract surgery rates increased due to improvement of techniques. Nevertheless, cataracts remain the major cause of blindness, responsible for 50 percent of blindness among medium and low-income countries [1]. The principal causes of suture and surgically induced astigmatism (SIA) are wound compression, wound gap and wound misalignment which following cataract surgery [2].

Different studies have clarified the importance of the length of the corneal wound, its distance from the limbus, the prevention of lateral wound shift, and the number of sutures used and their type. In addition, the tension in the suture, a loose or absorbable suture tends to cause wound gap, thus resulting in a horizontal flattening of the cornea which causes against the rule astigmatism (ATR), and non-absorbable suture that causes the wound to be compressed and the corneal to be vertically extended producing with the rule astigmatism (WTR) [3].

Cutting non absorbable sutures is by far the easiest way to eliminate postoperative astigmatism. This will release any compressive effect, which causes its meridian to become steep. The sutures can be cut using a laser or a blade. Though absorbable sutures induce a compression for short time after the surgery, cutting and removal is usually unnecessary because they are naturally absorbed, damaged or extruded [4].

Indications for suture removal include breakage or loosening of sutures, abscess, astigmatism of 4D or

greater, hyperopia of 3D or higher. Contraindications include evidence of insufficient wound healing such as wound gaping, wound dehiscence, or inadequate fibrosis to support the wound or high intraocular pressure [5]. Sometimes sutures are left in place for one or more years if appropriate astigmatism is reached. However, if breaks occur then removal of the suture becomes a must. Furthermore, catastrophic complications related to sutures such as inflammation, infections, vascularization and sub-epithelial and epithelial erosion and ulceration may also occur [6]. Our study aimed to detect the most appropriate time of sutures removal after ECCE for control of postoperative astigmatism.

SUBJECT AND METHODS

Subjects

An interventional, randomized controlled clinical trial included forty eyes of forty patients dividing into 2 groups, twenty eyes of patients had undergone ECCE surgery and sutures were removed at 8 weeks after surgery (Group I), twenty eyes of patients had undergone ECCE surgery and sutures were removed at 12 weeks after surgery (Group II). Sample size was fifty, but ten cases were excluded from the study as they had too tight sutures resulting in high mean cylinder value and the remaining forty cases were statistically reanalyzed. Patient samples were gathered from Ophthalmology department, Al Zahraa University Hospital Clinics, Al-Azhar University from November 2019 to March 2020.

The ethical review board of Al-Azhar University approved this study and conducted according to Declaration of Helsinki. All the necessary approvals for carrying out the research were obtained. After explaining the study purpose and prior to participating in the study, each participant gave an informed oral consent. Complete confidentiality was ensured for all patients, and they had the rights to refuse to participate without affection of the care given to him/her.

Exclusion criteria: The research had excluded eyes with preoperative corneal scarring, pterygium, corneal degenerative changes, corneal opacities, raised intraocular pressure. Eyes in which the preoperative cylindrical refraction was more than (+/-) 3 diopters .Those in which previous surgery or corneal irregularities disallowed accurate refraction and keratometry, Intraoperative complications like vitreous loss. Postoperative complications like wound leak, raised IOP, Infection, too tight (causing more than 10 D cylinder) and too loose sutures.

Methods

Study tools and procedures: History taking (name, sex, age, occupation, past ophthalmic history, medical history). Complete ophthalmic examination including, Landolts visual acuity and converted to decimal. Refractive status using autorefractokeratometere (Nidek ARK 500A Maehama, Hiroishi Gamagori, Aichi 443-0038, Japan). Best corrected visual acuity (BCVA). Slit-lamp microscopic examination, full examination of the anterior segment performed for cornea, sclera, anterior chamber, iris, pupil and lens. Fundus examination by slit-lamp bio microscopy using + 90 D noncontact lens. Ophthalmic biometry using A/B scan Mentor (Minneapolis, Minnesota, USA) ultrasound. Intraocular lens (IOL) power calculation aimed at -0.50 D refraction postoperative. All patients had undergone routine ECCE 8-10 mm in length. We performed ECCE through a partial thickness groove incision (about 10 mm length) at peripheral clear cornea; the incision was made perpendicular to tissues, approximately two-thirds thickness deep. The anterior chamber was entered with a microsurgical knife and then viscoelastic was injected into anterior chamber. A 360 degree can- opener anterior capsulotomy was created with a cystotome. The wound was extended with corneoscleral scissors angling blades at 45 degrees to tissue to create a biplane incision. The nucleus was expressed by applying careful pressure at 6 and 12 o'clock. The cortical material was removed with manual irrigation/aspiration. Viscoelastic was injected into the anterior chamber and capsular bag, and then a single piece PMMA PCIOL was implanted. The wound was carefully closed using 4-5 interrupted 10-0 nylon sutures, which were removed 8-12 weeks postoperatively. Steroid eye drops; Prednisolone acetate 1% (Allergan, Irvine, United States) every 2 hours, the dose was progressively decreased after 2 weeks) and antibiotic eye drops, Moxifloxacin hydrochloride 0.5% (Alcon, Geneva, Switzerland) were obtained. Post-operatively After 8 weeks, if there were more than 2.5-cylinder diopters through keratometry and refraction (Fig. 1**)**, patients were randomly assigned to one of two groups after describing the purpose of the procedure and receiving consent.

Figure (1): Case with interrupted sutures producing wound compression in the same meridian as the steep keratometry readings.

All surgeries were performed by two experienced surgeons at El Zahraa University Hospital. At 8 and 12 weeks postoperatively, selective single suture removal using blade was done with the removal of the second suture, after 1 hour, in the steepest axis if necessary. If the astigmatism was still 2.5 or higher, a further suture was cut following the same protocol, which was continued based on residual astigmatism a third and a fourth time if necessary. The results were analyzed to

determine the correct timing after ECCE surgery for suture removal. The prescription of glasses should be delayed 1 week following removal of the final suture.

Statistical Methods

Data were fed to the computer and analyzed using IBM SPSS Corp. Released 2013. IBM SPSS Statistics for Windows, Version 22.0. Armonk, NY: IBM Corp. Qualitative data were described using number and percent. Quantitative data were described using median (minimum and maximum) for non-parametric data and mean standard deviation for parametric data after testing normality using Shapiro–Wilk test. All P-values were based on two-side tests and considered statistically significant when < 0.05.

Qualitative data

Chi-Square test for comparison of 2 or more groups. Monte Carlo test for comparison of categorical variables when 2 cells or more have count less than 5.

Quantitative data between groups

- Student t-test was used to compare 2 independent groups.
- Mann-Whitney U test was used to compare 2 groups of non-parametric variables.
- Kruskal Wallis test was used to compare more than 2 independent groups with Mann Whitney U test to detect pair-wise comparison.

RESULTS

In group (I) the mean age was 55.32±3.46 years (range 50 – 60). This group included 11 males (55%) and 9 females (45%). In group (II) the mean age was 56.60±3.49 years (range 50 – 60). This group included 13 males (65%) and 7 females (35%). There was no statistically significant difference between the two groups regarding age and sex (table 1).

Correlation between keratometric and refractive astigmatism

There is statistically significant strong positive correlation between keratometric and refractive astigmatism among studied cases (r= 0.985, p<0.001). This indicates that changes in corneal curvature caused the observed refraction. (Fig. 2)

Types of astigmatism present in each group at 8 weeks

Overall, 34 cases had with-the-rule (WTR), 2 cases against the rule (ATR), and 4 cases oblique astigmatism. Group I include 18 WTR cases (90.0%), 1 ATR (5.0%) and 1 oblique (5.0%) Group II include 16 WTR cases (80.0), 1 ATR (05.0%) and 3 oblique cases (15.0%) (table 2). For this research purposes, With the rule astigmatism is that subtype which is corrected at 90 ° ± 30 ° by a plus cylinder while against the rule astigmatism is that which is corrected at 180 ° ± 30 ° by a plus cylinder, the remainder 60 ° considered oblique astigmatism. (Fig. 3).

Changes in postoperative cylindrical power among and between groups

In group (I), the mean value of cylindrical power by keratometry was -5.09±1.46D postoperative, -2.14±0.86 after 1st suture removal and -1.786±0.66 D after all suture removal, there is a statistically significant change of power among group (I) p1<0.001, p2<0.001, p3<0.001). In group (II), the mean value of cylindrical power by keratometry was -5.26±1.43D postoperative and -3.82±1.78D after 1st suture removal and -2.818±0.73D after all suture removal, there is there is a statistically significant change of power among group (II) p1<0.001, p2<0.001,p3<0.001 There is statistically significant higher median power among group II than group I after 1st suture removal and after full suture removal (P=0.001). There is no statistically significant difference between studied groups regarding median postoperative power P=0.654.

The percentage change in power, Axis and BCVA between studied groups

Power: The mean percent change in group (I) was 0.612±0.20% and in group (II) was -0.45±0.12%. There is a statistically significant difference between studied groups regarding median power change (P=0.009) (table 4) **Axis:** The mean percent change in group (I) was 9.42±12.11 % while in group (II) was 6.29±12.11 %. There is no statistically significant difference between studied groups regarding mean axis change P=0.142. **BCVA:** The mean percent of change of change in BCVA in group (I) was 1.08±0.57 %, while in group (II) was 0.964±0.628%. There is no statistically significant difference between studied groups regarding mean BCVA change P=0.38 (table 4)

Change in power percent according to the initial type of postoperative astigmatism

In group (I): The mean percent of change in power in cases of WTR astigmatism was 0.528±0.22 % while in cases of ATR astigmatism, it was 0. 547±0.0 % and in cases of oblique astigmatism it was 0.684±0.0%. There is no statistically significant difference of percent of change in power between different types of astigmatism (p=0.425). In group (II): The mean percent of change in power in cases of WTR astigmatism was 0.479±0.131 % while in cases of ATR astigmatism, it was 0.808±0.0% and in cases of oblique astigmatism it was 0.615±0.0 %. there is no statistically significant difference of percent of change in power between different types of astigmatism (p=273) (table 5). Between group I and II: There is a statistically significant higher mean percent of power change among group I than group II for WTR astigmatism (p=0.049) and for oblique astigmatism (p=0.46). While for cases of ATR astigmatism There is a statistically significant higher mean percent of power change among group (II) than group (I) p=0.046 (table 5)

Table (1): demographic characteristics among studied cases

items		Group I (n=20)	Group II (n=20)	Stat. Tests	p value
Age: Mean ± SD Range		55.32±3.46 (50.0-60.0)	56.60±3.49 (50.0-60.0)	t=1.30	0.199
Sex	Male Female	11(55.0) 9(45.0)	13(65.0) 7(35.0)	χ^2=0.739	0.390
Side	Right Left	16(80.0) 4(20.0)	12(60.0) 8(40.0)	χ^2=0.739	0.390

t: Student t test χ^2=Chi-Square test

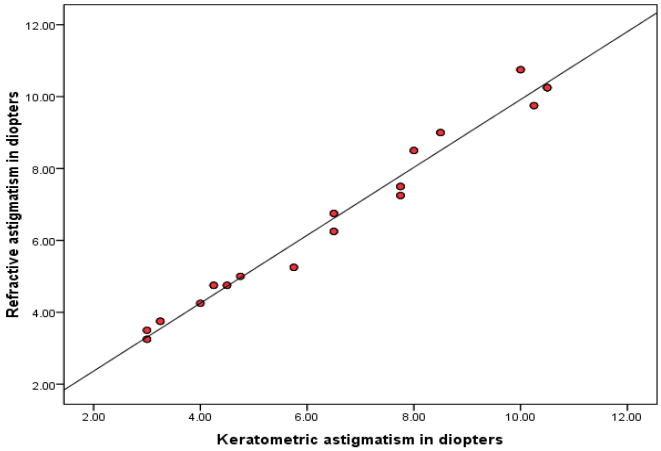

Fig. (2) Scatter diagram representing correlation of degrees of astigmatism as measured by keratometry and refraction

Table (2): Comparison of initial type of postoperative astigmatism between studied groups at 8 Weeks.

Groups		Initial type of astigmatism			Total	test of significance
		WTR	ATR	Oblique		
Group I	No. (%)	18 (90.0%)	1 (5.0%)	1 (05.0%)	20 (50.0%)	MC p=0.295
Group II	No. (%)	16 (80.0%)	1 (05.0%)	3 (15.0%)	20 (50.0%)	
Total	No. (%)	34 (85.0%)	2 (05.0%)	4 (10.0%)	40 (100 %)	

MC: Monte Carlo test

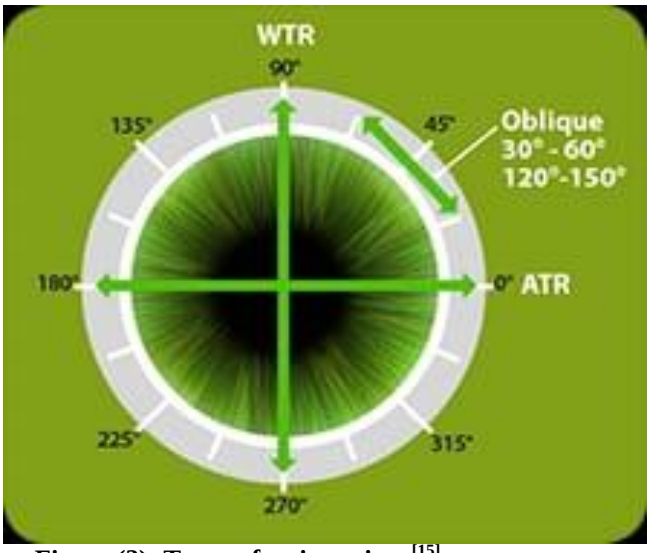

Figure (3): Types of astigmatism [15]

Table (3): Comparison of cylindrical power mean values between studied groups

Power in Dioptre		Group I (n=20)	Group II (n=20)	Test of significance	P value
Pre suture removal	Mean ±SD Median Range	-5.09±1.46 -5.75 (-3.0 - -6.5)	-5.26±1.43 -5.5 (-3.0 - -6.5)	Z=0.449	0.654
after 1st suture removal	Mean ±SD Median Range	-2.14±0.86 -2.25 (-1.0 - -3.0)	-3.82±1.78 -2.75 (-2.25 - -5.0)	Z=3.28	0.001*
Final	Mean ±SD Median Range	-1.786±0.66 -1.75 (-0.75 - -2.9)	-2.818±0.73 -2.5 (-3.75 - -2.0)	Z=3.91	0.001*
Within group significance		p1<0.001* p2<0.001* p3<0.001*	p1<0.001* p2<0.001* p3<0.001*		

Z: Mann Whitney U test *statistically significant, P1 : difference between cylindrical power mean values presuture removal and after 1st suture removal, P2: difference between cylindrical power mean values presuture removal and final suture removal, P3: difference between cylindrical power mean values after 1st suture removal and after final suture removal, *: p value< 0.05.

Table (4): Comparison of percentage of change in power, axis and BCVA mean values between studied groups.

Percent of change		Group I (n=20)	Group II (n=20)	Test of significance	p value
Power	Mean ±SD Median Range	0.612±0.20 0.79 (0.81- 0.23)	0.45±0.12 0.46 (0.62 - 0.24)	Z=2.58	0.009*
Axis	Mean ± SD Median Range	9.42±12.11 4.80 (0.49 - 32.33)	6.29±12.11 0.104 (0.95- 34.0)	Z=1.46	0.142
BCVA	Mean ± SD Median Range	1.08±0.57 1.03 (0.34 - 1.94)	0.964±0.628 1.0 (0.34 - 1.94)	Z=0.878	0.38

Z: Mann Whitney U test, *: p value< 0.05.

Table (5): Comparison of Percent of Change in cylindrical power according to initial type of postoperative astigmatism among studied groups.

Groups		Change in power			test of significance
		WTR	ATR	Oblique	
Group I	Mean ±SD	0.528±0.22	0. 547±0.0	0.684±0.0	KW, p=0.425
Group II	Mean ±SD	0.479±0.131	0.808±0.0	0.615±0.0	KW, p=273
Comparison between 2 groups		z=1.99, p=0.049*	z=2.0, p=0.046*	z=2.0, p=0.046*	

KW: Krauskal Wallis test Z: Mann Whitney U test

DISCUSSION

In ophthalmology, perhaps no other surgery has undergone such rapid and drastic revolutionary change in the past four decade, as has cataract surgery. The transition from intracapsular cataract extraction (ICCE) to ECCE to phacoemulsification has really been a breakthrough in cataract extraction. [7] One of the most important causes of delayed visual rehabilitation is the surgically induced astigmatism. Therefore, one of the key objectives of current surgical methods is to eliminate surgically induced astigmatism [8].

Although the considerable articles on how to avoid, correct or minimize postoperative astigmatism, the question of the most correct time to remove sutures has only been discussed anecdotally. [9] In cases with a high grade of astigmatism, it is mandatory to balance between early removal when the greatest reduction of astigmatism may be expected but corneal wound healing may not be complete, especially if the patient is still treated with topical steroids, and late removal where wound healing is achieved but a permanent high cylinder may be a risk. [10] Donders, 1864, who declared against the rule astigmatism (ATR) following surgery, first noticed alteration in the shape of the cornea after cataract extraction. This change has been more and more recognized since then, although with modem suture material, the change is typically with the rule. [11]

In our study, 40 eyes which had undergone ECCE in which sutures are removed at 8 and 12 weeks respectively, are included, 24 male patients were (60%) and 16 female patients were (40%); with mean age of the studied groups was 55.32 and 56.6 for group

I and II respectively. The results of refraction and keratometry shows a statisticaly strong correlation, this means that the observed astigmatism was due to changes in the corneal shape rather than other structures, and this confirms the findings of Kawahara and Takayanag [12] which found that refractive astigmatism and keratometric astigmatism after cataract surgery were strongly correlated.

The results of our study have demonstrated that interrupted nylon sutures typically induced almost with the rule astigmatism 90% in group I and 80 % in group II. This was in agreement with Elkadim, et al. [13] They found that the most common orientation for postoperative astigmatism was WTR astigmatism. The theory of wound compression in the early postoperative period can clarify this.

According to our results, early selective suture removal has great role in reducing high postoperative WTR astigmatism and giving better visual outcome, this agrees with Sapre and Radadia. [14] and Satitpitakul et al. [5] they found that selective suture cutting on the same day (SSSC) would help patients achieve adequate vision faster and reduce the amount of follow-up visits required after surgery. The type of resulting postoperative astigmatism affects the degree of change in power. In which WTR astigmatism shows a significant decrease when done early while ATR becomes worse if suture removed early as this result in more gaping of the wound. This agrees with Sapre and Radadia. [14]; they observed that patients with against the rule astigmatism shows significantly less improvement than other types of patients.

According to our study, eyes with postoperative WTR astigmatism changed to ATR astigmatism and eyes with postoperative ATR become more ATR astigmatism, this agrees with Feizi et al. [4]. They noticed that early suture cutting can over time transform WTR astigmatism into undesirable ATR astigmatism.

This study has some limitation such as visual acuity was done using Landolt's Brocken C chart and converted to decimal. Refraction was done using Keratometry and auto refractometry only and not by corneal topography. Astigmatism was calculated be arithmetic method not by vector analysis. Surgeries were done by more than one surgeon; this limitation could introduce bias from the operator, to minimize this bias and to ensure a non-biased study, we strictly defined the study protocol as described in the methods section.

The results of this study recommend that, in the case of interrupted 10/0 nylon corneal suture which caused high with the rule astigmatism, it should be removed 8 weeks after surgery, not only to alleviate the effect of induced astigmatism, but also to be safer and refraction is more stable. We also recommend that glasses better to be prescribed after 4 weeks of final sutures removal, particularly when done in 8 weeks.

CONCLUSION

At 8 weeks post-operative, selective single suture removal can be performed safely with removal of the second suture in the steepest axis, if necessary, after 1 hour. The prescription for glasses should be postponed for 1 week after removal of the final suture. Early suture cutting can over time transform WTR astigmatism into undesirable ATR astigmatism. ATR astigmatism is better to delay sutures removal to prevent more gaping of the wound. ATR astigmatism is best to postpone the removal of sutures in order to avoid further wound gaping.

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الملخص العربي

توقيت إزالة الغرز بعد جراحات المياه البيضاء للسيطرة علي لانقطية ما بعد الجراحة

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ملخص البحث

الخلفية: هناك تحديات في جراحات استخراج المياه البيضاء للتنبؤ بنتائج ما بعد الجراحة وتصحيحها. مصدر التباين هو التغيير في شكل القرنية الذي يؤدي إلى اللابؤرية الناتجة عن الجراحة.

الهدف: تهدف هذه الدراسة الي تحديد أنسب وقت لإزالة غرز القرنية بعد جراحة استخراج المياه البيضاء خارج المحفظة فيما يتعلق باستقرار الحالة الانكسارية للعين.

الطرق: تم إجراء تجربة سريرية تداخليه عشوائية مضبوطة على 20 عينًا من 20 مريضًا خضعوا لجراحة استخراج المياه البيضاء خارج المحفظة وإزالة الغرز بعد 8 أسابيع من الجراحة (المجموعة الأولى) و 20 عينًا من 20 مريضًا خضعوا لجراحة استخراج المياه البيضاء خارج المحفظة وإزالة الغرز بعد 12 أسبوعًا من الجراحة (المجموعة الثانية). تم تقييم النتائج البصرية قبل وبعد إزالة الخيوط عن طريق الانكسار وقياس تحدب القرنية.

النتائج: كان متوسط الاستجماتيزم الناتج جراحياً في المجموعة الأولي هو -5.09 ± 1.46 ديوبتر بعد الجراحة و - 2.14 ± 0.86 ديوبتر بعد إزالة أول غرزة و -1.786 ± 0.66 ديوبتر بعد إزالة كل الغرز ، يوجد تغير إحصائي ذو دلالة إحصائية في القوة بين المجموعة الأولي. متوسط الاستجماتيزم الناتج جراحياً في المجموعة الثانية كان -5.26 ± 1.43 ديوبتر بعد الجراحة و -3.82 ± 1.78 ديوبتر بعد إزالة أول غرزة و -2.818 ± 0.73 ديوبتر بعد إزالة كل الغرز ، يوجد تغير إحصائي ذو دلالة إحصائية في القوة بين المجموعة الثانية. توجد قوة وسيطة ذات دلالة إحصائية بين المجموعة الثانية أعلى من المجموعة الأولى بعد إزالة أول غرزة وبعد إزالة كل الغرز.

الاستنتاجات: عندما تتسبب خياطة القرنية المتقطعة 0/10 في درجة عالية من الاستجماتيزم ، فمن الأفضل إزالتها في غضون 8 أسابيع بعد الجراحة ، ليس فقط كونها فعالة في التخفيف من الاستجماتيزم ، ولكن أكثر أمانًا وثباتًا في الانكسار.

الكلمات المفتاحية: :اللابؤرية المستحثة جراحيًا، ازالة الغرز، توقيت، جراحة استخراج المياه البيضاء خارج المحفظة.

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