



Arthroscopic Latarjet procedure does not lead to loss of clinically significant external rotation at 0° and 90° of shoulder abduction



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Background: Several reports have shown that shoulder stabilizing procedures lead to postoperative external rotation (ER) deficits. However, no study on arthroscopic Latarjet procedures has investigated the effect on ER when the arm is abducted at 0° (ER₀) and 90° (ER₉₀). This study examined the relationship between the arthroscopic Latarjet procedure and the subsequent effect on ER₀ and ER₉₀.

Methods: Patients who underwent an arthroscopic Latarjet procedure from December 2015 to April 2021 were retrospectively evaluated. Preoperative ER₀ and ER₉₀ values were obtained from the contralateral shoulder. ER₀ and ER₉₀ values from the operative side were collected at both 3 and 6 months postoperatively. A repeated measures ANOVA was performed to assess the mean preoperative and postoperative values.

Results: Forty-six patients met the inclusion criteria. Mean ER₀ for the 3- and 6-month time frames measured 44.2° and 54.6°, respectively. Mean ER₉₀ for the 3- and 6-month time frames measured 78.4° and 90.4°, respectively. Comparison to the contralateral arm at the 3-month follow-up period showed a deficit of 14.9° ($P = .0001$) and 17.2° ($P = .0001$) for ER₀ and ER₉₀, respectively. At the 6-month follow-up period, patients demonstrated an average decline in ER₀ and ER₉₀ of 4.57° ($P = .063$) and 5.11° ($P = .008$), respectively.

Conclusion: A nominal deficit in ER occurred for both ER₀ and ER₉₀ status post arthroscopic Latarjet procedure. Despite loss of ER₉₀ at 6 months achieving statistical significance, the clinical impact is arguably inconsequential. Such limited loss of ER provides more information regarding bony procedures being a more definitive treatment for glenohumeral instability and the ability to restore native motion.

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The shoulder is a diarthrodial joint involving a complex interplay of counteracting forces performed in concert to provide a wide arc of motion of the upper extremity. When said forces become out of sync due to trauma, failure may present itself in the form of shoulder instability and possibly dislocation. Around 1.7% of the general population incurs some degree of traumatic shoulder instability, with the most common form occurring anteriorly.^{19,8} In cases of recurrent dislocations, failed Bankart repair, and/or significant anterior-inferior glenoid bone loss, bone block procedures, including the Latarjet procedure, offer a favorable solution in treating a patient's symptoms.^{9,22,20} Whether performed open or arthroscopically, the Latarjet technique involves transferring an osteotomized portion of the coracoid process along with the

conjoint tendon (coracobrachialis and short head of the biceps) to the anterior inferior aspect of the glenoid.^{17,18} A recent systematic review and meta-analysis of 896 patients found similar outcomes among open and arthroscopically performed Latarjet procedures when assessing recurrent instability (2.0% vs. 2.4%) and total complication rates (13.8% vs. 11.9%).¹²

Despite favorable outcomes regarding restoring shoulder stability, loss of external rotation (ER) has become a known postoperative sequelae associated with the Latarjet technique as well as with modified procedures adapted by later successors Helfet, May, Mead, and Patte. Prior studies evaluating both open and arthroscopic Latarjet procedures have reported values ranging from 9.9° to 13.0° with regard to mean loss of ER.^{11,23} Furthermore, when comparing open to arthroscopic Latarjet procedures, a systematic review by Griesser et al¹¹ found a significant mean loss in ER of 11.7° vs. 16.0°, respectively. The loss in ER stems from the “sling effect” created by transferring the strap muscles/conjoint tendon, namely the short head of the biceps and coracobrachialis, through the subscapularis and anterior capsule. When attempting to rotate

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the shoulder, the strap muscles impinge upon the subscapularis and anterior capsule, which ultimately inhibits the humerus from achieving full range of motion (ROM). Such a constraint is believed to become even more severe when ER is attempted with the shoulder abducted due to increased tension.²³

In light of the fact that ER at 0° abduction (ER_0) has been proven to decrease after undergoing either an open or arthroscopic Latarjet procedure, no study to our knowledge has evaluated and compared ER at 90° abduction (ER_{90}) to the contralateral extremity in an arthroscopic Latarjet procedure.^{4,11} The purpose of our study was to measure and compare postoperative ER_{90} and ER_0 to the contralateral extremity in patients who underwent an arthroscopic Latarjet procedure. The contralateral shoulder was chosen as our baseline reference for ER measurements because it was non-pathologic and therefore we believed we could obtain the most accurate measurements of ER_0 and ER_{90} without predisposing the patient to further injury (ie, subluxation or dislocation). We hypothesized that the respective differences in both ER_0 and ER_{90} between the operative and nonoperative extremity will be insignificant at the 6-month follow-up visit.

Materials and methods

This is a retrospective study of 56 Latarjet procedures performed by a single sports fellowship-trained orthopedic surgeon from December 2015 through April 2021. This study was approved by McLaren Healthcare Institutional Review Board (IRB# 2021-0192). Inclusion criteria necessitated 3- and 6-month minimum follow-up with ER measurements recorded at both 0° and 90° abduction utilizing a goniometer by a single surgeon (Figs. 1 and 2). All of the procedures were primary index procedures that were performed solely arthroscopically. Patients undergoing a revision, concomitant procedure, or who had a prior surgery to the affected shoulder were excluded. Additionally, any patient with prior surgery to the contralateral shoulder was excluded from the study as to prevent jeopardizing our baseline measurements.

Descriptive statistics such as mean and standard deviation were generated. A repeated measures ANOVA was performed to compare the means between the preoperative contralateral extremity measurements and the respective postoperative surgical extremity measurements at the 3-month and 6-month follow-up. The least significant difference test was used for mean separation. IBM SPSS Statistics for Windows, Version 27 (IBM Corp, Armonk, NY, USA) was used to analyze data. Statistical significance was set at a P -value < .05.

Procedure

An example of the Latarjet procedure performed by the study's surgeon can be viewed using the following link: <https://www.vumedi.com/video/complete-footage-of-an-arthroscopic-latarjet-for-an-off-track-lesion-with-anterior-instability/>.

The overall setup and approach for our procedure follow similar principles as that described in a prior report by our surgeon.³ Preoperatively, the patient is provided either single-shot or catheter-infused regional anesthesia to aid in postoperative pain management. The patient is then brought to the operative theater and placed in the modified beach chair position. The head and neck are placed in the neutral position followed by a slight bend toward the contralateral shoulder. An arm positioner (Spider; Smith & Nephew, Andover, MA, USA) is secured at the head of the bed. Once the patient is appropriately positioned, the arm is prepared and draped in a meticulous sterile fashion. Perioperative prophylactic antibiotic is provided intravenously before incision. Arthroscopic Latarjet technique anatomic landmarks are drawn as described by



Figure 1 Demonstration of neutral (0°) shoulder ER_0 . The subject in the photos has provided consent for their use. ER, external rotation.



Figure 2 Demonstration of 90° value of ER_{90} . The subject in the photos has provided consent for their use. ER, external rotation.

Lafosse and Boyle including portal sites A, D, E, H, M, and J.¹⁷ A slightly medialized posterior portal (portal A) is first created in order to conduct a standard diagnostic arthroscopy assessing the 15 points of Snyder.²⁴ The anterior portal (portal E) is created through the rotator interval under direct visualization. After confirmation that the bony Bankart lesion is not viable, the anterior labrum and anterior rim of the glenoid are débrided and skeletonized using a radiofrequency wand (VAPR Suction Electrode; DePuy Synthes, Raynham, MA, USA) and shaver (Omnicut; DePuy Synthes Mitek, Raynham, MA, USA).

Next, the joint capsule is opened and débrided from the posterior surface of the subscapularis using the VAPR device through

portal E. The capsule is removed until the subscapularis muscle is seen from the posterior portal. The rotator interval is cleaned out in order to identify the coracoid. The coracoacromial ligament is partially removed. The medial sling of the biceps is preserved in attempt to prevent medial biceps instability. Next, portal D is created 1 cm lateral and inferior to the anterolateral corner of the acromion to offer better visualization of the anterior structures as well as anterosuperior and anteroinferior glenoid bone loss. The anterior and posterior space around the subscapularis is then carefully defined using a radiofrequency ablator and shaver. The axillary nerve is encountered inferior and medial to the coracoid in its predictable position. Once the axillary nerve has been found, dissection can continue, staying lateral to its location. Portals D and E are used until the coracoid is clearly defined. Portals M and J are then developed and used to better define the conjoint tendon and pectoralis minor. The coracoacromial ligament is removed off the coracoid, leaving the conjoint tendon attached. Next, the scope is placed in portal J to view the axis of the coracoid process. A switching stick through portal D is used to retract the superior deltoid and improve visualization of the coracoid. A spinal needle is used to determine the location of portal H over the coracoid. This portal comes down directly over the coracoid. Through this portal, the coracoid drill guide (DePuy Synthes Mitek, Raynham, MA, USA) can be placed. Correct placement of the K-wires must be confirmed. The alpha hole on the coracoid drill guide must be approximately 1 cm proximal to the tip of the coracoid process. The beta hole of the coracoid drill guide is placed appropriately in the center of the coracoid from medial to lateral. The guide can be removed, and the coracoid drill is used over the guidewires in the alpha and beta positions. Next, the subscapularis split is created. A switching stick is placed through the posterior portal across the glenoid face and into the subscapularis to define the appropriate position. The previously made portal A is slightly medialized for this portion of the case. Because of its position, the switching stick lies directly on the glenoid face. The subscapularis split is made at the union between the superior two-thirds and inferior one-third of the tendon into the muscle in the same plane as the future graft site location. The split is made using the radiofrequency ablator until the glenoid is appropriately exposed. Care must be taken to avoid injury to the axillary nerve while completing the split medially. In addition, it is important to carefully dissect the subscapularis split with the radiofrequency ablator to prevent iatrogenic injury to the humeral head cartilage. The conjoint tendon can also be visualized medial to the longitudinal split. The anterior glenoid is then prepared to accept the graft using the shaver and burr (DePuy Synthes Mitek, Raynham, MA, USA). It is important to make sure there is no soft-tissue interposition on the glenoid neck to prevent nonunion of the graft. Care is taken around the inferior glenoid neck to make sure no iatrogenic injury to the axillary nerve occurs. Next, the coracoid osteotomy is performed. The osteotomy is made using straight and curved osteotomes through portal H. It is important to burr circumferentially around the proximal coracoid to serve as a stress riser before making the osteotomy. This prevents the osteotomy from fracturing into the scapular body. Once the osteotomy is completed, 2 coracoid screws are placed into the alpha and beta holes of the postosteotomy coracoid through portal M using a graft handle (DePuy Synthes Mitek, Raynham, MA, USA). Decortication of the inferior coracoid, as well as any bone off the inferior aspect of the proximal coracoid, is performed to allow for a better fit on the glenoid neck. The coracoid is then mobilized through the subscapularis split. The switching stick from the posterior portal is used to widen the split and facilitate mobilization of the graft through the subscapularis until reaching the prepared glenoid neck. The scope is placed back into portal J, and the coracoid is placed in the desired position on the anterior rim of the

glenoid in the 2- to 5-o'clock position. The graft is lined up with the subchondral bone roughly 3 to 4 mm medial to the glenoid cartilage. Once the surgeon is satisfied with the position, a K-wire can be drilled through the cannulated coracoid screw in the alpha hole across the glenoid until it penetrates out the posterior shoulder through the skin, where it is clamped. Clamping the wire prevents retrograde advancement of the wire back into the shoulder. This process is repeated for the beta hole in the same fashion. The coracoid screw is then removed from the alpha hole, and a 3.2-mm drill is used over the wire into the glenoid. Next, the length is measured, and an appropriate-length Latarjet cortical screw (4.5 mm; DePuy Synthes Mitek, Raynham, MA, USA) is placed over the wire into the coracoid and glenoid. This process is repeated for the beta hole. To prevent malpositioning or fracture of the graft, it is important to not completely tighten either screw initially. Once provisional fixation is completed, it is paramount to alternate between the screws until final fixation is completed. Fixation should be assessed through multiple views, along with confirmation of no soft-tissue interposition. Completing the fixation of the graft, the case is complete. No capsular repair is completed as the capsule was removed earlier in the case. The portals are closed with a 3-0 Vicryl in a subcuticular interrupted fashion followed by a 4-0 Monocryl in a subcuticular running fashion. Steri-Strips are used to cover the incisions. A non-adherent bandage is placed over the portals and the arm is placed in a sling with an abduction pillow or bolster. The arm is placed in a neutral position.

Postoperative period

The immediate postoperative protocol consists of pendulum exercises and biceps isometrics for 2 weeks. After 2 weeks, formal physical therapy is initiated with passive ROM, advancing to active-assisted ROM and then active ROM. A follow-up computed tomography scan is performed at 3 months to evaluate for a healed graft to the anterior glenoid. If both are present, the patient is allowed to return to sport/daily activities with no restrictions at 3 months postoperatively.³

Results

A total of 46 out of our original 56 patients met the inclusion criteria. The average age was 28.8 years old with a range from 15 to 54 years old. There were 38 males (82.6%) compared to 8 females (17.4%). Comorbidities measured included diabetes ($n = 1$; 2.2%), hypertension ($n = 4$; 8.7%), smoking ($n = 5$; 10.9%), and other (epilepsy and Ehlers Danlos) ($n = 5$; 10.9%).

Mean ER values at 0° and 90° abduction of the preoperative contralateral extremity, as well as the 3- and 6-month postoperative values of the operative extremity are shown in Table 1. A charted comparison of the mean values is demonstrated in Fig. 3. Overall, ER values over time were statistically significant at 0° ($P = .0001$) and 90° ($P = .0001$) abduction. An average decrease in ER₀ and ER₉₀ measured at the 3-month follow-up visit equated to 14.9° ($P = .0001$) and 17.2° ($P = .0001$), respectively. Decreased ER₀ and ER₉₀ was once again found at the 6-month follow-up measuring 4.6° ($P = .063$) and 5.1° ($P = .008$), respectively.

Discussion

Our hypothesis that there would be no statistical difference between the preoperative and postoperative ER values held true for ER₀ but not for ER₉₀.

The 3-month follow-up visit status post arthroscopic Latarjet procedure for anterior shoulder instability demonstrated an average deficit in both ER₀ and ER₉₀ of 14.9° and 17.2°, respectively.

Table 1
Mean and standard deviation of external rotation at 0° and 90° abduction.

Time period	Mean	Standard deviation	95% CI	SEM	Δ from contralateral	P value
ER at 0°						
Contralateral ER _{0°} ABD	59.1	15.1	54.6-63.6	2.2	Δ ER ₀	
Operative ER _{0°} 3-month	44.2	20.8	38.1-50.4	3.1	14.9	.0001
Operative ER _{0°} 6-month	54.6	13.4	50.6-58.6	2.0	4.6	
ER at 90°						
Contralateral ER _{90°} ABD	95.5	9.4	92.7-98.3	1.4	Δ ER ₉₀	
Operative ER _{90°} 3-month	78.4	12.4	74.6-82.2	1.9	17.2	.0001
Operative ER _{90°} 6-month	90.4	10.2	87.4-93.5	1.5	5.1	

CI, confidence interval; ER, external rotation.

Patient compliance with physical therapy exercises over the following 3 months led to continued improvement in shoulder ROM, allowing them to gain nearly equivalent values to the contralateral limb by 6 months.

At the 6-month follow-up visit, we found an insignificant loss of ER₀ at 4.6° and a significant loss of ER₉₀ at 5.1°. Such results have disproved a portion of our hypothesis that claimed the deficit to ER₉₀ would not be statistically significant. However, we feel that such limited loss of shoulder ROM would likely be clinically insignificant in the general population and should further support the efficacy of the Latarjet procedure for anterior shoulder instability.

The Latarjet procedure has become a reputable surgery and a viable option in treating recurrent anterior shoulder instability. A metaanalysis of shoulder stabilization procedures has shown that surgeons have achieved as high as a 73% rate of return to play (RTP) at the same level of sport after undergoing a Latarjet procedure.¹³ Davey et al⁷ delved a bit further when investigating RTP in terms of the patients' history of instability and reasoning for undergoing an open Latarjet surgery. They compared patients with primary instability (first dislocation), recurrent instability, and recurrent instability after failure of a prior stabilization procedure. Their results showed improved outcomes with RTP and RTP at the same or higher level after an open Latarjet for those with primary or recurrent instability as opposed to patients who underwent revision of a previously failed stability procedure.⁷ Furthermore, Buckup et al⁶ demonstrated similar results as Davey et al⁷ with a RTP of 89.4%, which was achieved at an average of 4.6 ± 2.0 months. However, the patients in Buckup et al⁶ study were able to accomplish a higher rate of RTP at the same level, with 89.4% of subjects accomplishing this goal. Lastly, functional outcomes as measured by the ROWE questionnaire found the Latarjet procedure to score significantly more favorable than a Bankart procedure in treatment of glenohumeral instability.¹ Despite such success, it is known that ER₀ values diminish compared to preoperative levels after undergoing this method of shoulder stabilization. Although the same can also be said for soft tissue stabilizing procedures, our study called into question the severity of motion loss at ER₀ and ER₉₀ as both of these positions are necessary for functional use of ER in our daily lives.

Much of the ER functional demand on the shoulder occurs with the extremity in abduction. Despite our results demonstrating a statistically significant decrease in ER₉₀ compared to the contralateral extremity, one must further investigate the clinical meaning of an average deficit of 5.11°. Namdari et al²¹ evaluated several shoulder functional outcome assessment tools including the American Shoulder and Elbow Surgeon, Simple Shoulder Test, and U-Penn Shoulder Score. Their findings indicated that patients are capable of completing functional overhead tasks requiring shoulder ER₉₀ if they are able to attain an average of 60° ER₉₀.²¹ When looking at our gross data, all patients at the 6-month mark had achieved 60° or greater of ER with an average of 95.5° when the

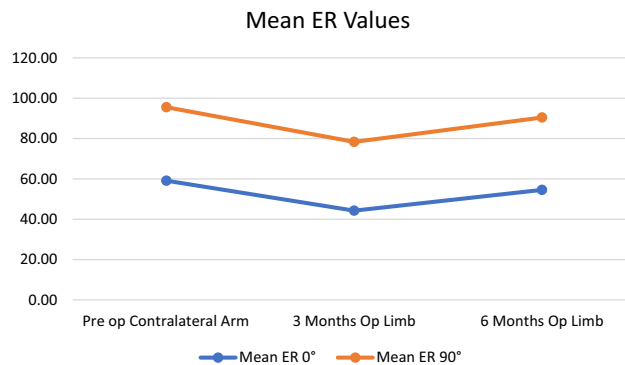


Figure 3 Comparison of ER₀ and ER₉₀ values. The preoperative value was obtained from the uninjured, contralateral extremity. Values at both 3 and 6 months post-operatively were measured using the operative extremity. ER, external rotation.

shoulder was in the 90° abducted position. Additionally, Namdari et al²¹ highlighted the fact that none of the functional shoulder outcome measurement tools specifically called for testing the shoulder's ER ability when held at 0° abduction. One may infer from this finding that much of the daily functional demand of the shoulder occurs with some level of combined abduction. From these findings, we may then question the clinical significance of prior studies reporting an average loss of shoulder ER₀ of 16.0° status post arthroscopic Latarjet procedure.¹¹

In scenarios where patients suffer from recurrent instability episodes secondary to borderline glenoid bone loss (15%-20%), surgeons may consider performing a Bankart repair instead of a Latarjet procedure. Jeon et al assessed such scenarios and reported a postoperative deficit of 13.3° and 11.6° in ER₀ and ER₉₀ with arthroscopic Bankart repairs compared to 7.3° and 10.3° in open Latarjet procedures, respectively. Their study ultimately found that the Latarjet procedure resulted in significantly less recurrent instability episodes as well as less of a postoperative deficit in ER compared to arthroscopic Bankart repair.¹⁵ The degree of ER loss in our study further supports their findings of improved ER deficit with the Latarjet procedure. However, our results would argue that the loss of ER₉₀ is not as severe in arthroscopic Latarjet cases. A possible explanation for said difference may be due to the handling of soft tissues, specifically the capsule and subscapularis. In the Jeon et al¹⁵ study, the Latarjet procedure was performed open with a vertical as opposed to horizontal capsulotomy. The significance of a vertical capsulotomy was highlighted in a study by Itoi et al¹⁴ who showed that such an incision lead to greater ER₉₀ loss when compared to horizontal capsulotomies. The reasoning is due to excessive imbrication during the repair of vertically based incisions leading to a tightened capsule and subsequent loss of motion. Despite Jeon et al not repairing their vertical capsulotomy at the end of surgery, it is possible that scarring of the vertical arthroto

site lead to subsequent contracture of the capsule, thus limiting them from achieving max ER. Our surgeon's method involved a partial capsulectomy of the anterior capsule followed by a horizontal subscapularis split at the junction of the superior two-thirds and inferior one-third of the muscle belly.

Several studies have exemplified the superiority of the Latarjet procedure over arthroscopic Bankart repair in terms of preventing recurrent instability episodes. Zimmermann et al²⁵ reported continued dislocation, subluxation and/or apprehension in 41.7% of patients who underwent arthroscopic Bankart repair as opposed to 11% of patients in the Latarjet group ($P = .0001$) at mean follow-up of 10 years. Bessiere et al demonstrated similar results in their study despite the Latarjet group incurring a greater number of preoperative instability episodes. With a 4-year minimum follow-up, Bessiere et al² found 10% of the Latarjet group and 20% of the arthroscopic Bankart repair group to have sustained a recurrent instability (subluxation or dislocation) episode ($P = .026$). Another noteworthy finding that both Zimmermann and Bessiere's studies shared was that Bankart repairs tended to have worse survivorship rates when assessing for late recurrent instability episodes. Both studies showed that the Latarjet population exemplified better tolerance to wear as time progressed compared to Bankart repair.^{2,25} If a patient were to incur late failure of a Bankart repair, they potentially may be offered a Latarjet procedure as an alternative. Flinkkilä et al⁹ compared patients undergoing a primary Latarjet procedure to those receiving a revision for failed arthroscopic Bankart repair. Inferior results were seen in the revised Bankart group receiving a Latarjet when comparing clinical outcomes measured by the Western Ontario Shoulder Instability Index (76 vs. 85; $P = .02$) and the Subjective Shoulder Value (80 vs. 88; $P = .03$). Additionally, the revision group also portrayed higher recurrence rates in terms of subluxations or sense of instability (25% vs. 9%; $P = .03$).¹⁰ Such established outcomes from the studies mentioned above call into question the utility of an arthroscopic Bankart repair vs. Latarjet procedure. One may reconsider the value of an arthroscopic Bankart repair in treating anterior inferior shoulder instability after taking into account our findings of limited ER₀ and ER₉₀ loss combined with the previously well published improved stability of the Latarjet procedure. Personalization of the procedure based on activities the patient wants to return to is very important to appropriately treat patients with shoulder instability. It may be prudent to opt for the Latarjet procedure rather than Bankart repair in high-risk patients such as those involved in contact sports and repetitive overhead activity.

Finally, it should be noted that our study found values for ER₀ loss to be lower than that previously reported for arthroscopic Latarjet procedures. Boileau et al⁵ reported a mean ER₀ deficit of 17° at an average follow-up of 16 months. Similarly, Lafosse et al¹⁶ found a mean deficit of 18° at 26 months. These values are substantially greater than our 6-month average loss of ER₀ equating to 4.57°. It is possible that surgeon technique, patient characteristics, and/or arthroscopic advancements may have attributed to our improved results.

Limitations

Limitations of our study include it being a retrospective study with a relatively short follow-up period. However, one would expect only continued improvement in ROM as subjects progress to the 1-year mark. Additionally, preoperative ER₀ and ER₉₀ values from the operative extremity were not obtainable due to the patient presenting after incurring their injury. Any values obtained at the preoperative visit from the operative limb would have been a misrepresentation of their normal ROM due to the boney Bankart injury limiting their motion. Lastly, the patients are from a single

surgeon's work and therefore the results achieved may not be applicable to the majority.

Conclusion

The arthroscopic Latarjet procedure has proven itself a viable surgery for treating anterior glenohumeral instability. We found the difference between the operative and nonoperative extremities to be minimal with regard to the loss of ER₀ and ER₉₀ at 6 months. The numerical value of ER₉₀ loss at 6 months proved to be statistically significant, yet unlikely to carry any notable clinical impact. Such limited loss of ER at both 0° and 90° abduction further supports the utility of the arthroscopic Latarjet procedure in providing an acceptable outcome for anterior shoulder instability. Despite achieving such favorable results with regard to ER₀ and ER₉₀, more studies are needed to confirm similar results before applying such expectations to the majority.

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