



Resiliency influences postoperative outcomes following rotator cuff repair

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Background: The purpose of this retrospective review was to assess the effects of resiliency on postoperative outcome scores and complications following rotator cuff repair (RCR).

Methods: In 2014, 49 consecutive patients underwent arthroscopic RCR for either a partial- or full-thickness tear performed by a single surgeon at a multi-location, single center. In these patients, the following scores were monitored: American Shoulder and Elbow Surgeons (ASES), Simple Shoulder Test (SST), and Life Orientation Test–Revised (LOT-R). Data collected at 4 years postoperatively were statistically analyzed by 1-way analysis of variance tests, Pearson correlations, and multivariate tests of between-subjects effects (multivariate analysis of covariance).

Results: There was a statistically significant difference between cohorts and their scores of resiliency and optimism measured by the LOT-R (function portion of ASES score [ASESf], $P = .048$; pain portion of ASES score [ASESp], $P = .003$; and SST score, $P = .009$) as illustrated by a 1-way analysis of variance. A multivariate analysis of covariance found that LOT-R scores exhibited a significant impact on outcome scores (ASESf score, $P = .043$; ASESp score, $P = .002$; and SST score, $P = .007$). Correlational analysis indicated that LOT-R scores directly correlated with higher ASESp ($P = .003$), ASESf ($P = .029$), and SST ($P = .018$) scores. Regression line analysis provided a positive coefficient of determination value for all outcome scores.

Conclusion: The premise of this study was to look at mental resilience as a potential indicator of long-term outcome scores following RCR. The results of statistical analysis indicated that outcome scores are significantly different based on the degree of optimism; high levels of optimism impact and correlate to higher outcome scores. This study provides a basis for future studies of psychological resilience in the field of orthopedic surgery.

Level of evidence: Basic Science Study; Validation of Outcome Instrument

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Rotator cuff injuries are common and may result in the need for surgical intervention. Outcomes following rotator cuff repair (RCR) surgery depend largely on rotator cuff healing.³ Rotator cuff healing using modern repair techniques is associated with risk factors including age, tear size, Goutallier score, and chronicity.³ Recently, resilience

has been theorized to affect how patients fare following orthopedic surgery.^{6,7,12}

The Life Orientation Test–Revised (LOT-R) has been used to study resiliency in different populations. Anxiety and negative mindset are linked to emotional morbidity with a 3 times higher risk of depression as discovered in a study of patients with a diagnosis of breast cancer,¹⁰ and resiliency has been shown to influence surgical outcomes and play a role in patient’s ability to recover from chronic diseases.^{1,4,7,8,10,12}

In the literature, studies that evaluate the effects of mental resilience on postoperative outcomes in orthopedics are limited and even more so regarding RCR specifically. The purpose of this retrospective review was to assess the effects of resiliency on postoperative outcome scores following RCR.

Materials and methods

Study design and participants

This study was a single-center, multi-location, retrospective data analysis of a consecutive series. Eligible participants were patients aged ≥ 18 years who underwent arthroscopic RCR performed by the principal investigator (R.M.G.) between January 1 and December 31, 2014. Patients who underwent a previous surgical procedure on the same shoulder or were without complete follow-up data were excluded.

The average age was 55 ± 7.9 years (range, 32–67 years). Surgery was performed on the left side in 15 participants (30.6%) and on the right in 34 (69.4%). Of the 49 patients analyzed, 28 (57.1%) were men and 21 (42.9%) were women. Partial- and full-thickness tears were included ($n = 22$ and $n = 27$, respectively).

Surgical details

All patients underwent arthroscopic double-row RCR with suture anchors. Patients underwent the institution’s standard rehabilitation protocol for arthroscopic RCR. The arm was maintained in a sling in the first week after surgery, and passive range of motion daily was encouraged. During weeks 2–6, patients were recommended to begin light active-assisted range of motion with minimal manual resistance. Manual resistance and strengthening were allowed after 10 weeks. Thereafter, depending on activity restrictions, patients’ exercises progressed with increased weight and patients began a functional progression toward sports- and/or activity-specific tasks and isokinetic exercises. After 12 weeks, patients were instructed to continue advancing their exercises and plan for a gradual return to functional activities.

Data sources and measurements

The medical history was obtained from the electronic medical record systems from both the clinic and local hospital system where the surgical procedure was performed. Postoperative

patient-reported outcome assessments, including the American Shoulder and Elbow Surgeons (ASES) shoulder test, Simple Shoulder Test (SST), and LOT-R, were collected retrospectively if available in the medical records. Patients who did not return to the clinic were contacted and surveyed via telephone by a designated member of the clinical research staff for collection of patient-reported outcome assessments.

Statistical analyses

Statistical analyses were conducted with SPSS software (IBM, Armonk, NY, USA), with access provided by Northern Kentucky University. Data were analyzed by 1-way analysis of variance (ANOVA) tests, Pearson correlations, and multivariate tests of between-subjects effects (multivariate analysis of covariance).

Results

The LOT-R score was indicated as a statistically significant predictor in terms of outcome scores as a result of a 1-way ANOVA test. LOT-R scores were divided into 4 categories of resilience: low resilience (score of 0–6, $n = 0$), mild resilience (score of 7–12, $n = 5$), moderate resilience (score of 13–18, $n = 25$), and high resilience (score of 19–24, $n = 19$).¹²

Postoperative patient-reported outcomes (ie, function portion of the ASES score [ASESf], pain portion of the ASES score [ASESp], and SST score) were all significantly different among categories by the aforementioned quantification of mental resilience ($P = .048$, $P = .003$, and $P = .009$, respectively). No patients scored in the low-resilience category of LOT-R scores (ie, 0–6). A Duncan post hoc analysis revealed that patients in the mild-resilience category significantly differed from those in the moderate- and high-resilience categories in terms of outcomes. Most patients were in category 3, with scores of moderate resilience (ie, 13–18). There was a significant difference between the categories of resilience in terms of functionality and pain as assessed by the ASESf, ASESp, and SST scores. With increasing categories of LOT-R scores, outcome scores increased on average as well (Table I).

Additionally, a Pearson correlation test found that higher LOT-R scores significantly correlated with higher outcome scores for the ASES and SST assessments (ASESf score, $P = .029$; ASESp score, $P = .003$; ASES score, $P = .005$; and SST score, $P = .018$). Alcohol, tobacco history, and sex did not reduce ASES scores in a statistically significant manner. There is likely an impact of LOT-R scores on outcome scores when compared with trends of resiliency scores by mean \pm standard deviation based on alcohol history, sex, and tobacco history, which attests to a high probability of a causative effect.

Further analysis of the data was performed to investigate the possible causative effect of LOT-R scores on

Table I Resiliency score and prediction of positive influence on outcomes

	Dependent variable			
	ASESf score	ASESp score	ASES score	SST score
LOT-R score category				
1: low optimism	NA	NA	NA	NA
2: mild optimism	34.99 ± 7.87	27.00 ± 6.44	61.99 ± 14.08	6.80 ± 2.08
3: moderate optimism	44.19 ± 1.61	41.6 ± 1.82	85.79 ± 3.04	10.40 ± 0.47
4: high optimism	46.22 ± 1.49	44.47 ± 1.98	90.69 ± 3.12	10.84 ± 0.47
<i>P</i> value	.048*	.003*	.005*	.009*

ASESf, function portion of American Shoulder and Elbow Surgeons score; ASESp, pain portion of American Shoulder and Elbow Surgeons score; ASES, American Shoulder and Elbow Surgeons (function and pain combined); SST, Simple Shoulder Test; LOT-R, Life Orientation Test-Revised; NA, not applicable (no patients in category).

Data are presented as mean ± standard deviation. The means of outcome scores were compared by LOT-R score categories in a 1-way analysis of variance.

* Statistically significant.

the dependent variables. Other independent variables or covariates—tobacco use (past or present), alcohol abuse, and sex—were also added to the test to assess for covariance. One-way ANOVA and multivariate analysis of covariance tests were then run to identify whether the covariates of tobacco, alcohol, and sex would impact resiliency scores. The variables of tobacco use (past or present), alcohol abuse, and sex had no significant impact on the functional outcome scores (Table II). A regression analysis demonstrated a correlation between the SST score, ASESp score, ASESf score, and ASES score and the resiliency score (LOT-R) (Fig. 1).

Discussion

This study is the first of its kind demonstrating that patients with high resiliency appear to have an association with improved postoperative outcome scores following RCR and patients with lower resiliency scores have worse postoperative scores than individuals with average resiliency. The LOT-R quantifies resiliency by reliably assigning a value to optimism or pessimism—2 independent traits, not simply 1 bipolar trait.⁵ Optimism correlates directly with resiliency, which is defined as “the ability to bounce back from stress.”⁹ Scores range from 0 to 24, with higher scores being indicative of resiliency. In a control population, individuals aged > 70 years scored an average of 11.6 and those aged 41-50 years scored an average of 20.5, as found in a study conducted in 2012.⁵ The overall average for women aged > 18 years was a total score of 15.0, and that for men aged > 18 years was 15.3.⁵

The LOT-R score was used as a categorical variable to better compare the continuous quantitative outcome scores (ie, ASESp, ASESf, and SST scores) with resilience as was modeled in a prior study by Tokish et al.¹² The quantitative nature of the variable reflects a meaningful qualitative

difference between patient groups. Additionally, the authors credited for the scale listed the interpretation of the data values based on their optimism category.² The only discrepancy between the authors’ original categories and the categories used in our study is the addition of “mild resilience” as a category. This was done because of the lack of data points in the low-resilience category (scores of 0-6).

Whereas our study demonstrated that resiliency predicts the outcome of a surgical procedure, another study indicated that the LOT-R score predicts satisfaction rather than surgical outcomes.⁶ Similar to our study findings, resilience also proved to be predictive of positive outcomes following total knee and total shoulder arthroplasty.^{7,10} The results of Magaldi et al⁷ and Markovitz et al⁸ both further testified to the effect that resilience acts as a protective factor in times of elevated anxiety such as surgery.

Hope and mental resilience are highlighted as possible “protective factors” for patients’ emotional stability and quality of life and appear to transcend surgical specialties.⁴ A recent retrospective study of neurosurgery patients found supporting evidence for the impact of mental resilience on surgical outcomes.⁴ High levels of resilience correlate with positivity, openness, and optimism, which allow patients to combat the stresses of a diagnosis or surgical procedure such as RCR. In a study on total shoulder arthroplasty, Tokish et al¹² demonstrated improved outcomes following total shoulder arthroplasty in patients with high levels of resilience. In our study, unlike in the study by Tokish et al, the postoperative time scale was controlled, with all patients being at the 4-year postoperative time point. Our study on RCR and the study by Tokish et al demonstrate the predictive value of mindset and resilience on postoperative orthopedic outcomes.

It may be reasonable to determine the mental resilience of a patient preoperatively to assist with patient counseling. For example, patients who lack resilience should be counseled prior to RCR so that appropriate goals and

Table II Multivariate tests of between-subjects effects

Source	Dependent variable			
	ASESf score	ASESp score	ASES score	SST score
Alcohol	.513	.098	.204	.773
Sex	.248	.078	.111	.270
Tobacco history	.959	.095	.367	.409
LOT-R categories	.043*	.002*	.004*	.007*
Error†	79.596	82.062	270.880	6.482

ASESf, function portion of American Shoulder and Elbow Surgeons score; ASESp, pain portion of American Shoulder and Elbow Surgeons score; ASES, American Shoulder and Elbow Surgeons (function and pain combined); SST, Simple Shoulder Test; LOT-R, Life Orientation Test–Revised.

* Statistically significant.

† Data are represented with mean square values as significance or *P* values do not exist for error values.

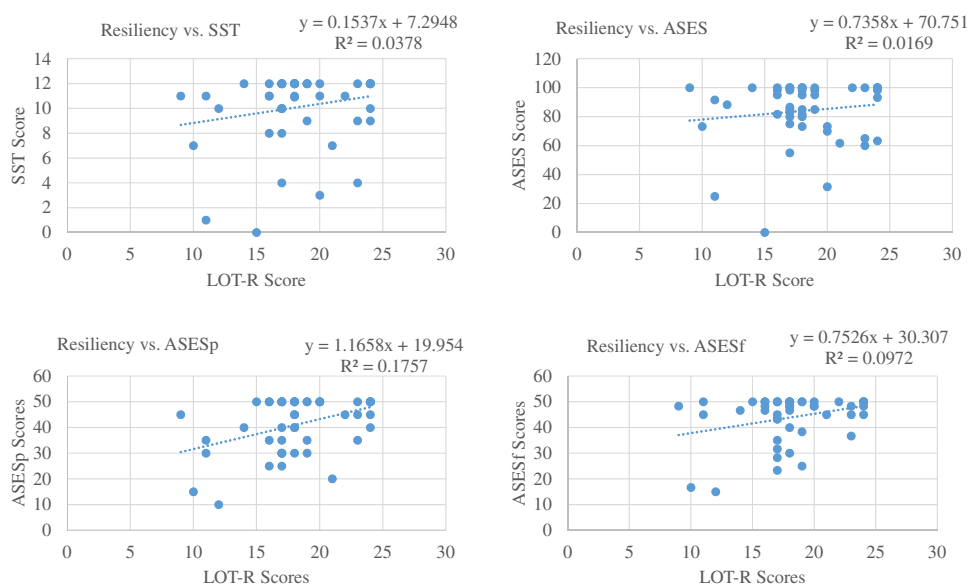


Figure 1 Four scatter plots of Life Orientation Test–Revised (*LOT-R*) scores as independent variable and outcome scores as dependent variable. Equations and values showing tightness of fit to the regression line (coefficient of determination, or R^2) (*dotted line*) have been added to each graph. *SST*, Simple Shoulder Test score; *ASES*, American Shoulder and Elbow Surgeons score (function and pain combined); *ASESp*, pain portion of American Shoulder and Elbow Surgeons score; *ASESf*, function portion of American Shoulder and Elbow Surgeons score.

expectations are made following surgery given a predictive equation model like that illustrated by linear regression analysis (Fig. 1). Despite the study findings regarding RCR, total knee arthroplasty, and total shoulder arthroplasty, it is still unclear whether lack of mental resiliency drives poor outcomes in other types of orthopedic surgery. Further research should be entertained to identify those procedures that require resiliency for improved outcomes.

Study limitations

Inherent to the retrospective design, the limitations of the study are the small sample size; heterogeneity of the data,

which included both full- and partial-thickness tears ($n = 27$ and $n = 22$, respectively); and retrospective collection of the *LOT-R* score, which has not been validated in post-operative patients. Typically, scores are collected preoperatively to assess the resiliency of the patient prior to surgery; this allows for extrapolation on patient mindset about the procedure. However, as illustrated in prior studies, mindset is independent of adversity and, therefore, post-procedural resiliency scores are valid.⁸ Nonetheless, patients were instructed to answer the *LOT-R* questions in a general manner rather than based on a momentary feeling to control for this limitation. The validity of post-procedural resiliency scores is further supported by a

2008 study that assessed resilience scores in women who faced adversity (eg, widowhood).⁹ The scores of the women in the study returned to baseline after 1 year following the event, which attested to the conclusion that resilience score fluctuation is temporary, and thus, the validity of a 4-year postoperative time point assessment of resilience is fair.⁹ Additionally, the validity of this post-procedural data collection is supported by a 2017 study of active-duty military patients undergoing arthroscopic Bankart repair for instability.¹¹ Resilience scores (Brief Resilience Scale scores) did not change between the preoperative and postoperative assessment time points in these patients, which further speaks to the reliability and validity of the postoperative data collection of resilience scores.¹¹

Conclusion

We found resilience to be associated with better postoperative RCR outcomes, which provides evidence of its potential use as a viable and reliable predictor of postoperative RCR outcomes. Prospective examination of resilience and optimism could provide aid to surgeons considering surgical candidates and assessing quality-of-life outcomes. Further investigation of poor outcome risk assessment would better prepare physicians and patients and allow patients to be properly matched with personalized support to improve postoperative quality of life. For this reason, we recommend that physicians adopt the practice of resiliency assessment in their patients. Furthermore, this study provides a basis for future studies in the field of orthopedic surgery regarding mental resilience. Examining these factors prospectively with a larger sample size, both preoperatively and postoperatively, would expand these findings and provide more supportive evidence for the practice of resilience measurement prior to surgical procedures.

Disclaimer

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