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An original closed reduction technique for acute shoulder dislocation: The FEAT method

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ABSTRACT

Purpose: The objective of this study was to introduce a novel closed reduction technique, termed the FEAT (Fixation, External rotation, Alignment, Traction) method, for anterior shoulder dislocations and to evaluate its effectiveness, speed, reliability, and safety.
Methods: This prospective study enrolled 30 patients presenting with anterior glenohumeral dislocation at the Emergency or Orthopedics outpatient department of Hubei Provincial Hospital. Closed reduction was performed using the FEAT method without administering analgesics, muscle relaxants, or anesthetics. Only a single reduction attempt was permitted per patient. The time required for successful reduction was recorded, and patient-reported pain intensity during the procedure was assessed using a visual analog scale (VAS) ranging from 0 to 10.
Results: All 30 patients experienced successful reduction on the first attempt. The average time required for successful reduction was 54.3 s, with a mean VAS pain score of 3.67 during the procedure.
Conclusion: The FEAT method is an effective, rapid, and minimally painful technique for anterior shoulder dislocation reduction. Its simplicity and ease of mastery support its widespread clinical adoption.
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1. Introduction

Shoulder dislocation is considered a common type of injury that occurs in various scenarios ranging from sporting activities to everyday life. Anterior dislocations account for 95–98% of all shoulder dislocations [1]. Various ways to reduce shoulder dislocation have been proposed throughout time. Alkaduhimi et al. noted that there were 23 different reduction techniques used and 17 modified reduction techniques, such as the Hippocrates, Chair, Kocher, and FARES methods [2]. The choice of the appropriate reduction technique depends on several variables, including time elapsed since the onset of dislocation, level of pain experienced, spasm in muscles, cooperation of the patient, patient's age, trauma status, among others.

Traditional techniques mainly help in achieving reductions through the use of increased traction forces to counteract resistance offered by muscle contractions. However, over-ttraction increases both pain experienced by patients and chances of developing complications such as fractures and neurovascular injuries.

In this study, the CT and 3D reconstruction helped in the visualization of pathological conditions related to anterior shoulder dislocation, understanding the relationship among structures and the mechanism causing obstructions. It was found that obstructions affecting reduction efforts were caused by various other factors apart from mere muscular contractions and soft tissues. For instance, there are significant obstructions presented by impaction of posterolateral groove of humeral head against anterior glenoid (Fig. 1) as well as muscular entanglement (Fig. 2). Other obstacles include poor scapular immobilization and gradual traction force losses. In light of this, a novel technique of reduction named FEAT (Fixation, External rotation, Alignment, Traction) was developed based on analyses performed.

2. Material and methods

2.1. Study design and setting

This prospective observational study was conducted in the emergency department and orthopedic outpatient clinic of Hubei Provincial

Abbreviations: FEAT, Fixation, External Rotation, Alignment, and Traction; VAS, Visual Analog Scale; CT, Computed Tomography; FARES, Fast, Reliable, and Safe; 3D, Three-Dimensional; ED, Emergency Department; OPD, Orthopedic Outpatient Department.

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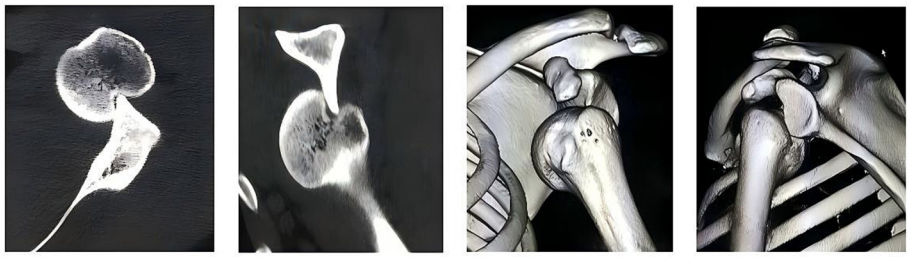


Fig. 1. CT and 3D reconstruction images before reduction.

Hospital of Traditional Chinese Medicine from October 2025 to January 2026. Consecutive patients presenting with acute anterior shoulder dislocation were screened for enrollment. As this was a single-arm feasibility study without a comparator group, no comparative statistical tests were performed. Continuous variables are presented as mean (range), and categorical variables as frequencies and percentages.

2.2. Inclusion criteria

The inclusion criteria required that all subjects must fulfill the following criteria: (1) anterior shoulder dislocation confirmed by radiography or computed tomography (CT); (2) indication for manual reduction; (3) age 25–65 years; (4) no associated injuries (e.g., fractures) identified on routine radiography; (5) time from dislocation to presentation ≤6 h; (6) voluntary participation with written informed consent provided by both patient and family members; and (7) no alcohol or analgesic intake prior to the procedure.

2.3. Exclusion criteria

Patients were excluded for any of the following reasons: (1) failure to meet diagnostic criteria for anterior shoulder dislocation; (2) posterior or inferior dislocation; (3) associated major vascular or neurological injury; (4) pathological shoulder dislocation; (5) open fracture; (6) dislocation with concomitant fracture; (7) history of prior shoulder surgery; (8) psychiatric disorders or other conditions impairing cooperation during manual reduction; (9) pregnancy; (10) allergy to local anesthetics; or (11) refusal of clinical observation and treatment.

2.4. Withdrawal criteria

Patients who failed to comply with the study protocol were withdrawn.

2.5. Patient flow

Consecutive cases of shoulder dislocation during the study period were screened. After applying the inclusion and exclusion criteria, FEAT reduction was performed in 32 patients. Two patients who declined post-reduction radiography were excluded from the study. Reduction was successful in both patients, confirmed by the immediate return of passive range of motion and a negative Dugas test, resulting in a total of 30 patients in the final analysis. Among the 30 patients, 22 (73.3%) initially presented to the ED, whereas 8 (26.7%) initially visited the orthopedic outpatient department. All enrolled patients, regardless of their initial presentation site, were referred to the ED and underwent FEAT reduction in the resuscitation room of the ED under an identical protocol; no reductions were performed in the outpatient setting.

2.6. Analgesia protocol and ethical considerations

This experiment has been cleared by the ethical committee of the hospital (HBZY2025-C102–02). For clarity, no form of anesthesia or sedation—including general anesthesia, intravenous procedural sedation, or intra-articular local anesthetic injection—was administered during any FEAT reduction in this study. The procedure was performed without any anesthesia, sedation, muscle relaxants, or analgesics for three reasons: (1) to avoid complications associated with procedural sedation, to minimize ED observation time, and to conserve monitoring resources; (2) the external-rotation maneuver itself produces muscle relaxation, obviating the need for muscle relaxants; and (3) to test the method's feasibility in settings where sedation and anesthesia resources are unavailable.

Each participant gave informed written consent after receiving instructions that: (1) there would be no painkillers or sedation in the reduction process, and they should refrain from taking analgesics or alcohol before the reduction; (2) if they experienced intolerable pain, they could withdraw from the study at any point, and the reduction would then be completed under analgesia—either an intra-articular injection of local anesthetic (e.g., lidocaine) or intravenous analgesia with procedural sedation; and (3) in the event that the first reduction attempt proved unsuccessful, intra-articular lidocaine injection or intravenous analgesia/sedation would be offered before a second attempt.

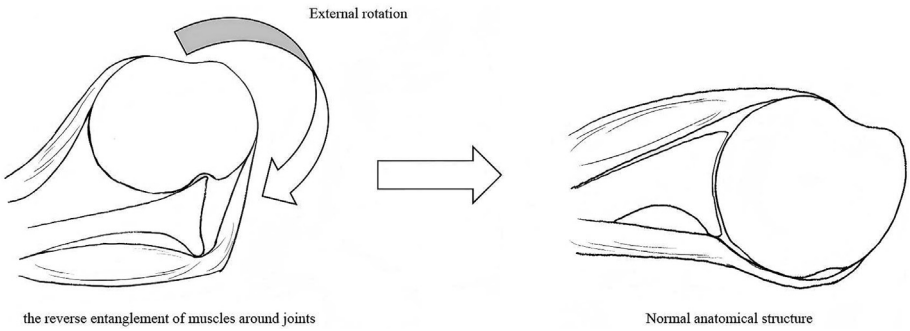


Fig. 2. Schematic illustration demonstrating the reverse tendon wrap and external rotation “unlocking” mechanism in anterior shoulder dislocation.

2.7. No patient discontinued the procedure due to pain

2.7.1. Definition of a single reduction attempt

A single reduction attempt was defined as one continuous maneuver from the initiation of external rotation to the completion of traction, without releasing the traction hand, returning the limb to neutral, or changing operators. Minor adjustments to the position of the scapular fixation hand were permitted. Timing started at the initiation of external rotation and stopped upon confirmation of reduction (palpable clunk and restoration of passive range of motion).

2.7.2. Outcome assessment

The clinical diagnosis of dislocation was confirmed by radiography and physical examination. Physical and neurological examinations were performed before and after reduction. Post-reduction radiography was obtained to assess glenohumeral alignment and to document neurovascular injuries or iatrogenic fractures resulting from reduction. Two investigators independently recorded all data.

Previous CT with 3D reconstruction had been used to analyze the anatomical structures, pathology, and obstruction mechanisms associated with anterior shoulder dislocation, informing the development of the FEAT method. For this clinical efficacy study, routine post-reduction CT was not obtained, as plain radiography was sufficient to confirm successful reduction, thereby avoiding unnecessary radiation exposure and cost.

2.7.3. Reduction technique

All reduction procedures were performed by two attending physicians working collaboratively: one orthopedic surgeon (Chief Physician) and one emergency medicine physician (Attending Physician). No reductions were performed independently by a single operator: one physician was dedicated solely to scapular fixation, while the other performed the external rotation, alignment, and traction steps. The patient lies in the supine position. Fixation: One physician stabilizes the patient's acromion with the thumb while pressing on the inferior angle of the scapula with a clenched fist. This ensures complete scapular immobilization, preventing translation or rotation, and thereby eliminating any loss of traction force due to scapular movement (Fig. 3a). External Rotation: The assistant immobilizes the wrist of the patient while applying external rotation to the shoulder joint; this will cause relaxation of the three muscles called the supraspinatus, infraspinatus, and teres minor muscles, which are tense when there is dislocation. As a result, the articulation of the anterior lip of the glenoid fossa and the posterosuperior groove of the humeral head will be separated (Fig. 3b). Alignment: Subsequently, the shoulder is abducted at an angle of 90 degrees, thus making the alignment of the articular surfaces of the scapula and humeral head parallel (Fig. 3c). Traction: Finally, the assistant grasps the patient's wrist and gradually increases traction force. Reduction is successful once the humeral head glides into the joint cavity (Fig. 3d).

3. Results

3.1. Baseline characteristics

Of the 30 patients, 18 (60%) were male and 12 (40%) were female. The mean age was 45.5 years (range, 25–65 years). The right shoulder was affected in 21 patients (70%), and the left shoulder in 9 (30%). Twenty-six patients (87%) had primary dislocations, while 4 (13%) had recurrent dislocations. The mechanisms of injury included falls in 14 patients (46.7%), sports injuries in 12 (40.0%), traffic accidents in 2 (6.7%), and other causes in 2 (6.7%). The mean duration from dislocation to reduction was 1.88 h (range, 0.5–5 h).

3.2. Reduction outcomes

All 30 patients achieved successful reduction on the first attempt (100% success rate). The mean reduction time was 54.3 s (range, 38–75 s), with a mean procedural pain score of 3.67 on a 10-point visual analog scale (range, 2–5). No patients experienced post-reduction fractures or neurovascular complications (Table 1, Fig. 4, and Video 1).

4. Discussion

We believe that the ideal reduction method should be quick, efficient, safe, relatively painless, easy to learn and teach, and achievable with minimal medication and equipment. We acknowledge that the FEAT method requires two operators and therefore does not fulfill the criterion of single-operator application; however, the second operator's role—scapular fixation—is simple and can be performed by non-physician personnel such as a nurse.

Based on the results of CT scans with three-dimensional modeling and comparison between several reduction techniques, the following conclusions can be formulated: 1. Transmission of traction forces: With previously described reduction techniques, the lack of sufficient stabilization or incorrect fixation of the scapula led to insufficient transfer of traction forces, with traction forces being transmitted to the thoracic wall because of scapular rotation or scapular lateralization [3]. With the FEAT technique, scapular fixation is ensured through proper fixation of both the acromion and the inferior angle of the scapula, thus allowing for effective traction forces delivery to the glenohumeral joint. 2. In shoulder dislocations, the translation of the humeral head causes stretching of the supraspinatus, infraspinatus, and teres minor muscles, and this stretches the humerus against the glenoid cavity. Internal rotation of the shoulder leads to additional stretching of the muscles that prevents separation of the humeral head from the glenoid cavity [4]. The FEAT procedure makes use of external rotation, which helps to relax the muscles around the shoulder joint and thus facilitates the disengagement of the humeral head from the glenoid socket, minimizes muscle spasm, and alleviates pain [4,5]. 3. The relationship between the humeral

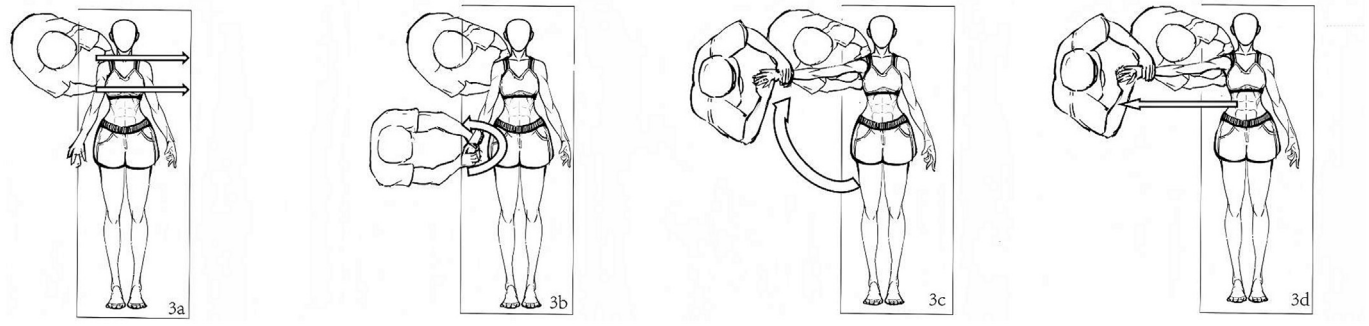


Fig. 3. Detailed steps of the FEAT method.

Table 1
Baseline characteristics of patients managed with the FEAT method.

Characteristics	Data
Patients, n	30
Age, y, mean (range)	45.5 (25–65)
Sex, n (%)	
Men	18 (60)
Women	12 (40)
Side of dislocations, n (%)	
Right	21 (70)
Left	9 (30)
Number of dislocations, n (%)	
Primary	26 (87)
Recurrent	4 (13)
Fracture-dislocation, n (%)	
No fracture	30 (100)
Fracture	0 (0)
Visual Analog Scale, mean (range)	3.67 (2–5)
No sedation	30 (100)
Sedation	0
Reduction result, n (%)	
Success	30 (100)
Failure	0
Reduction time, seconds, mean (range)	54.3 (38–75)
Trauma mechanism,n (%)	
Sports injury	12 (40)
Traffic accident	2 (6.7)
Fall injury	14 (46.7)
Other	2 (6.7)
Time interval, h, mean (range) Sedation, n (%)	1.88 (0.5–5)

posterolateral sulcus and the anterior rim of the glenoid constitutes a bony mechanical blockage preventing proper reduction after dislocation. Anterior dislocations lead to a posterolateral deformity of the humerus, which causes a tight lock-up of the humerus against the inferior anterior glenoid. Internal rotation movements may complicate this locking further [6–8]. In the FEAT technique, external rotation releases this mechanical lockup, thus allowing for proper reduction. 4. With the abduction of the shoulder joint to 90°, traction runs along the axis of the joint, resulting in less stress on the shoulder and increasing the effect of the traction process. The chance of fracture complications also drops considerably [5,9]. After all of the above measures have been taken, very little traction is needed to perform a successful reduction. Thus, the suggested technique greatly reduces patient discomfort and physical strain on clinicians.

The use of the Hippocratic technique needs strong traction, often achieved by placing one's foot inside the axilla, which increases neurovascular risk [10]. Likewise, the Kocher technique applies strong shear forces because of leverage and can cause fractures, damage to the axillary vein, and rotator cuff injury [11]. The chair method similarly involves axillary compression, posing persistent neurovascular risks despite the use of padding [12].

Among other techniques recommended currently are the Davos self-reduction, Milch, FARES, shoulder manipulation, and Stimson techniques. The Davos (Boss-Holzach-Matter) method includes the patient's sitting position with hips and knees bent as much as possible while holding the knees to create traction by bending backward [13]. Reported success rates range from 60% to 86% [13,14]; the method can be taught to patients with recurrent dislocations for self-administration [13]. Pain scores are moderate (maximum VAS of 4.18) [15]. However, substantial patient cooperation is required, and the method is contraindicated in cases of obesity or lower extremity pathology [13]. The FEAT method does not depend on patient cooperation and may be particularly useful for obese patients and elderly individuals.

The Milch technique positions the patient supine with the affected limb abducted and externally rotated to 90° ("zero-position"), minimizing muscle resistance before applying longitudinal traction [16,17]. It avoids adduction and internal rotation, eliminating shear forces, and achieves an 82.8% success rate without sedation [17]. However, the traction mechanism is somewhat weakened by the action of the scapula, requiring adjustments by the provider, and obesity can restrict abduction among patients [17]. The FEAT technique follows the principles of zero-positioning but reduces the effects of traction loss caused by scapula movement.

The FARES technique uses traction along the long axis of the humerus combined with anterior-posterior oscillations at approximately 2 Hz, incrementally increasing abduction up to 120°-150° with a success rate of 92% [2]. This procedure involves active participation by the patients and due to the high frequency of oscillations, carries a higher risk for those suffering from fractures and the elderly with osteoporosis [18]. In the FEAT method, oscillation is replaced by gradual traction, maintaining efficacy (average time required reduced by 54.3 s) while decreasing the chances of complications for osteoporotic patients. FARES technique requires knowledge of oscillation frequency, oscillation amplitude, and abduction velocity, which leads to a steep learning curve [18]. On the other hand, the FEAT technique breaks down reduction into four steps, helping avoid the learning curve.

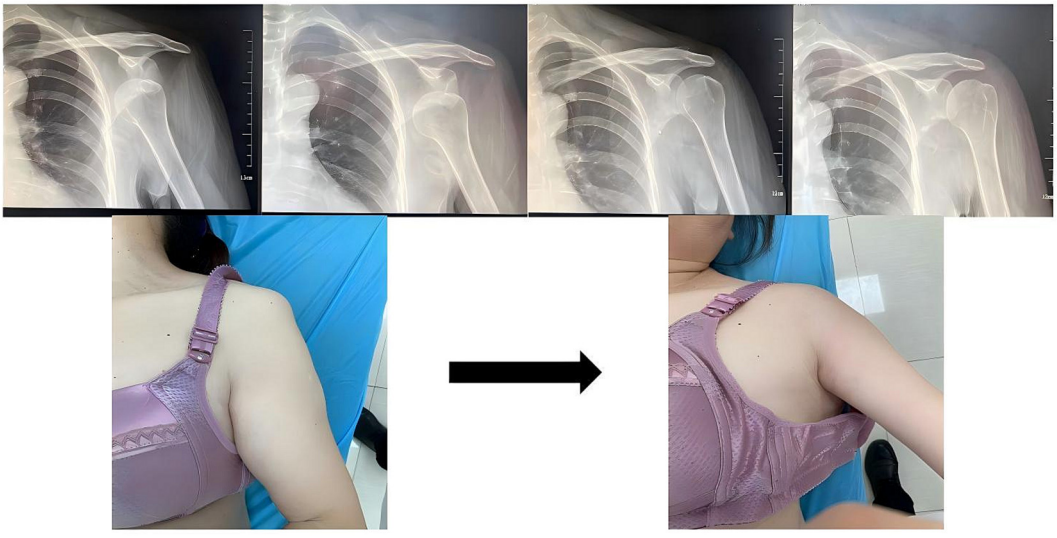


Fig. 4. Successful reduction achieved using the FEAT method.

Scapular manipulation consists of traction that is performed by the assistant while the practitioner maintains stability of the superolateral edge of the scapula and performs internal rotation of the inferior angle so that the glenoid faces the humeral head [19]. Success rates range from 79% to 96% [19,20]. It is a quick procedure and does not cause significant pain; nonetheless, palpation of the edges of the scapula can be difficult in overweight patients [21]. The FEAT technique reverses the procedure as it includes stabilization of the glenoid and traction of the humerus, avoiding any traction loss and making it easier to use in overweight individuals.

The Stimson technique consists of hanging the affected extremity with 5- to 10-pound weights in a prone patient for 10 to 20 min [22]. However, this method is non-invasive, does not require external aid, but has an increased duration of reduction and low success rate without sedation (28%) [17]. Besides, traction might lead to an increase in spasm and pain [17]. On the other hand, the FEAT method substitutes passive gravitational traction with active progression of traction and thus dramatically decreases average reduction time from 10 to 20 min to 54.3 s, using active external rotation instead of muscle fatigue.

In Cunningham's method, muscle relaxation is achieved by means of traction and massage of the trapezius, deltoid, and biceps brachii muscles without any medication [23]. However, this approach has rather low efficacy and significantly depends on patient cooperation, particularly among obese patients and those with well-developed muscles [24,25]. Similarly, in the case of the FEAT method, muscle relaxation occurs due to external rotation without dissipation of traction through scapula fixation. Supine positioning is more suitable for use in the emergency room.

In this study, the mean reduction time was 54.3 s, and the mean procedural pain score was 3.67 on a 10-point visual analog scale. The FEAT method eliminates axillary compression and avoids shear forces, resulting in very low rates of fracture and neurovascular complications. The four-step approach, Fixation, External rotation, Alignment, and Traction, is sufficient for successful reduction. The FEAT method offers the following advantages: no requirement for specialized equipment, pharmaceuticals, or monitoring resources; simple operation with a high success rate that aligns with shoulder biomechanics; gentle traction reducing pain and procedure duration; minimal shear force on the proximal humerus; avoidance of axillary compression to prevent fractures and neurovascular injury; applicability to uncomplicated anterior shoulder dislocations, including challenging reductions and elderly osteoporotic patients; and substantially reduced post-reduction complications through the avoidance of excessive traction force.

Analgesia is commonly employed during reduction procedures, typically involving an intra-articular injection of local anesthetic (e.g., lidocaine) or intravenous analgesia with procedural sedation [26]. Analgesia during reduction decreases both procedural pain and duration. Intra-articular local anesthetic injection exhibits comparable efficacy to intravenous analgesia with sedation, with potentially superior safety [27,28]. We acknowledge that the complete absence of pharmacological analgesia in this study deviates significantly from standard emergency practice. Although a mean VAS pain score of 3.67 suggests that the FEAT method's gentle traction and muscle relaxation contribute to reduced procedural pain, this finding may reflect selection bias. We intend to evaluate the FEAT method combined with intra-articular local anesthetic injection in subsequent studies, aiming to further minimize pain while maintaining rapid reduction capability.

4.1. Limitations

There are certain limitations associated with the present study. To begin with, the number of subjects studied is not large enough, and the follow-up time frame was short. Secondly, as no control group was used, it does not enable any conclusive judgment about whether the FEAT technique proves superior or inferior compared to other methodologies that exist. Thirdly, the total lack of use of any drug therapy for pain relief deviates markedly from standard practice; even though the procedure gained ethical approval and patient's consent, its generalization seems rather dubious. Fourthly, the FEAT technique as studied requires two operators—both attending physicians in this study, one an orthopedic surgeon—and the present design cannot establish whether emergency medicine providers can perform it independently. However, the second operator's sole task is scapular fixation, which can be performed by a nurse or patient care technician after brief training; future studies will evaluate the technique performed by a single physician with such assistance. Fifthly, posterior shoulder dislocation is rare in clinical practice, and the FEAT methodology has not yet been tested for this situation. Sixthly, the inclusion of 4 recurrent dislocations (13%) may limit generalizability to primary dislocations, as recurrent cases may present with less muscle spasm due to tissue laxity.

5. Conclusion

The FEAT method is a rapid, reliable, and safe technique for reducing anterior shoulder dislocations. Its four standardized steps align with glenohumeral biomechanics and can be readily mastered. This single-center feasibility study was conducted by experienced physicians; thus, these preliminary findings must be validated by randomized controlled trials comparing FEAT with existing techniques prior to recommending widespread clinical adoption.

Supplementary data to this article can be found online at https://doi.org/10.1016/j.ajem.2026.09.036.

CRediT authorship contribution statement

Haoyi Guan: Writing – review & editing, Writing – original draft, Investigation, Formal analysis, Data curation, Conceptualization. **Lin Li:** Writing – review & editing, Writing – original draft, Project administration, Investigation, Conceptualization. **Bang Hu:** Writing – review & editing, Writing – original draft, Investigation, Formal analysis, Data curation, Conceptualization. **Feng Li:** Writing – review & editing, Supervision, Resources, Investigation, Funding acquisition, Conceptualization.

Compliance with ethical standards

This study was approved by the ethics commitee of Hubei Provincial Hospital of TCM (approval HBZY2025-C102–02) and consent was obtained from all participants and from a parent and/or legal guardian. No patient identifer was included in this manuscript. Data were de-identifed before conducting data analysis. This study was performed in accordance with the ethical standards as laid down in the 1964 Declaration of Helsinki and itslater amendments or comparable ethical standards.

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Declaration of competing interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Data availability statement

The datasets used and/or analyzed during the current study are available from the corresponding author on reasonable request.

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