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OPEN ACCESS Case Series

Impact of Khat Chewing on Clinical Outcomes of Autologous Blood Injection in Treating Bilateral TMJ Subluxation: A Case Series

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ABSTRACT

Background: Bilateral temporomandibular joint (TMJ) subluxation causes significant functional impairment, including difficulty chewing, speech problems, and malocclusion.
Objectives: This prospective clinical trial aimed to evaluate the association between khat chewing during treatment and the clinical success of ABI in patients with bilateral TMJ subluxation.
Methods: Forty consecutive patients with radiographically confirmed (orthopantomogram) bilateral TMJ subluxation received standardized ABI therapy (twice weekly for 3 weeks). Patients were categorized based on self-reported khat chewing during treatment. The primary outcome was treatment success, defined as resolution of symptoms (restored mastication, normal speech, and corrected occlusion/deviation) and confirmed return of the joint to normal position on follow-up imaging.
Results: All 20 khat chewers (100%; male, aged 29 or 35 years) experienced treatment failure, exhibiting persistent symptoms and no joint reduction on imaging. In contrast, all 20 non-chewers (100%; female, aged 33 or 42 years) achieved treatment success, demonstrating marked symptomatic improvement and confirmed joint reduction ($p < 0.0001$, Fisher's Exact Test). Khat chewing status showed a perfect negative association with treatment success and was completely confounded with gender and specific age groups in this cohort.
Conclusion: Khat chewing during treatment demonstrated a profound negative association with the success of ABI for bilateral TMJ subluxation, resulting in universal treatment failure, while abstinence was associated with universal success. Khat chewing appears to be a critical negative prognostic factor, potentially negating the therapeutic effect of ABI. Patients undergoing ABI must be strongly advised to abstain from khat use. Further controlled studies are warranted to establish causality.

Keywords: Temporomandibular Joint (TMJ) Subluxation; Autologous Blood Injection (ABI); Khat Chewing; Catha edulis; Treatment Outcome; Treatment Failure; Prognostic Factor; Case Series.

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INTRODUCTION

Bilateral temporomandibular joint (TMJ) subluxation, characterized by pathological condylar hypermobility beyond the articular eminence, impairs critical functions including mastication, speech, and occlusion. It affects 3–8% of the global population, with higher prevalence in younger adults [1]. Autologous blood injection (ABI) is a minimally invasive treatment that promotes intra-articular fibrosis to stabilize the joint, demonstrating 74–94% efficacy in recurrent dislocation cases [2]. However, khat chewing (Catha edulis)—a culturally ingrained habit for more than 20 million people in East Africa and the Arabian Peninsula [3]—may critically compromise ABI outcomes through synergistic pathophysiological mechanisms.

Khat's bioactive alkaloids (cathinone, cathine) induce potent sympathomimetic effects, including vasoconstriction and hypertension [4]. This reduces local perfusion, directly counteracting ABI's mechanism, which relies on inflammatory-mediated fibrosis requiring adequate vascular supply [5]. Concurrently, chronic khat chewing generates destructive biomechanical forces (>5 hours/day of forceful mastication), accelerating TMJ disc degeneration and capsular laxity [6]. Epidemiological studies confirm khat users exhibit 2.3× higher TMJ disorder rates than non-users [7]. Critically, khat-induced xerostomia elevates Clinical Oral Dryness Scores by 48% [8], impairing tissue repair. This aligns with evidence that vasoactive substances (e.g., nicotine) reduce musculoskeletal healing efficacy by 40% [9]. Preliminary clinical data reveal a 100% ABI failure rate in khat-chewing TMJ subluxation patients versus 100% success in abstainers—demonstrating absolute therapeutic antagonism. Despite these mechanistic and observational insights, no studies have prospectively investigated khat's impact on ABI outcomes. This research addresses this gap by analyzing clinical outcomes in 40 bilateral TMJ subluxation patients, providing evidence to guide

METHODOLOGY

Study Design

A prospective case series analysis was conducted on forty consecutive patients diagnosed with bilateral temporomandibular joint (TMJ) subluxation between January 2023 and December 2024.

Study area

This study was conducted at the clinic of Dr. Ghassan A. Abdulwahab for oral & maxillofacial surgery & dental medicine (May/2024-May/2025), in Taiz city, Yemen.

Patient Selection

The inclusion criteria comprised three conditions: first, adults aged ≥18 years with bilateral TMJ subluxation confirmed by orthopantomogram (OPG); second, uniform treatment with autologous blood injection (ABI); and third, availability of complete demographic, habit history, and follow-up records spanning a minimum of three months. Exclusion criteria consisted of 1) prior TMJ surgery, 2) systemic connective tissue disorders such as Ehlers-Danlos syndrome, and 3) concurrent corticosteroid therapy.

Intervention Protocol

The autologous blood injection (ABI) procedure followed a standardized protocol. Venous blood (2 mL) was first drawn aseptically from the antecubital fossa. Subsequently, bilateral intra-articular injections were administered via a posterior lateral approach under strict aseptic technique, with 1 mL injected per joint. The treatment protocol consisted of twice-weekly sessions over a three-week period, totaling six sessions. Post-procedure care included adherence to a soft diet for two weeks and avoidance of mouth opening exceeding 30 mm (Figure 1).

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Figure 1: (ABI) procedure followed a standardized protocol.

Exposure Variable: Khat Chewing

Khat chewing was operationally defined as self-reported consumption of fresh Catha edulis leaves for ≥1 hour daily throughout the three-week treatment period. Exposure assessment was validated using a structured questionnaire documenting daily frequency (sessions per day), duration per session (hours), and total chewing days during treatment. Patients were stratified into two groups: Group A (Khat+, n=20) comprised active chewers during treatment, while Group B (Khat-, n=20) consisted of non-chewers.

Outcome Measures

The primary outcome, treatment success, was defined as a composite endpoint requiring both resolution of functional symptoms (normal mastication, speech, and occlusion) and radiographic confirmation of joint reduction on follow-up OPG. Secondary outcomes included time to symptomatic improvement (measured in days) and incidence of minor complications (pain, swelling, and infection).

Data Collection

Data collection encompassed four variable categories: demographic parameters (age, gender, occupation) extracted from electronic health records; clinical parameters (symptom duration, maximal mouth opening in millimeters, joint noise) assessed through pre-treatment clinical examination; imaging parameters (condylar position, articular eminence morphology) evaluated via OPG (Kodak 8000C); and habit history (khat use patterns, tobacco/alcohol co-use) documented through structured interviews.

Statistical Analysis

Statistical analyses were performed using SPSS version 28 (α=0.05). Descriptive statistics characterized categorical variables as frequencies and percentages, while continuous variables were expressed as mean ± standard deviation or median with interquartile range. Comparative analysis for the primary outcome employed Fisher's Exact Test to evaluate the association between khat exposure status (Khat+ versus Khat-) and treatment outcome

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(success versus failure). Subgroup analyses stratified by age and gender utilized the Mantel-Haenszel test. Association strength was quantified through relative risk (RR) with corresponding 95% confidence intervals.

Quality Control

Methodological rigor was ensured through three principal measures: first, OPG interpretations were independently validated by two maxillofacial radiologists, demonstrating excellent inter-rater reliability (κ=0.92); second, a randomly selected 20% sample underwent comprehensive data auditing to verify coding accuracy; and third, all ABI procedures were performed by two senior surgeons using identical techniques to minimize operator-dependent variability.

Ethical Considerations

These prospective case series were conducted at the clinic of Dr. Ghassan A. Abdulwahab for oral & maxillofacial surgery & dental medicine. Informed consent was taken as it is the prospective nature of data collection. All procedures adhered to the Declaration of Helsinki guidelines for ethical medical research. This study was approved by Medical Research Ethics Committee at University of Science and Technology, Aden, Yemen (MEC /AD0117).

RESULTS

Participant Flow and Baseline Characteristics

The study cohort comprised 40 consecutive patients with bilateral temporomandibular joint (TMJ) subluxation, equally distributed by gender (20 males, 20 females) with discrete age clustering: males exclusively aged 29 years (n=10) or 35 years (n=10), and females aged 33 years (n=10) or 42 years (n=10). All participants completed the standardized autologous blood injection (ABI) protocol and minimum 3-month follow-up, with no attrition. Baseline clinical characteristics were homogeneous across groups, presenting uniform symptomatology: 100% exhibited impaired mastication (Figure 2), speech difficulties, mandibular deviation, and malocclusion. Radiographic confirmation via orthopantomogram demonstrated bilateral condylar displacement beyond the articular eminence in all cases.

Figure 2: Impaired mastication.

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Primary Outcome: Treatment Efficacy

A perfect dichotomy in treatment outcomes emerged based on khat exposure status. In the khat-chewing cohort (Khat+, n=20; all males aged 29/35 years), universal treatment failure (0% success) was observed. These patients exhibited persistent functional limitations, with a mean mouth opening improvement of only 2.4 ± 1.7 mm (p=0.32 vs. baseline), unresolved malocclusion, and no radiographic evidence of condylar reduction on follow-up imaging. Conversely, the non-chewing cohort (Khat-, n=20; all females aged 33/42 years) achieved 100% treatment success, demonstrating complete symptomatic resolution: normal mastication function (mean mouth opening: 44.8 ± 2.5 mm; p<0.001 vs. baseline), restored speech, corrected occlusion, and radiographically confirmed joint repositioning. Fisher's Exact Test confirmed this absolute divergence as statistically significant (p<0.0001). The relative risk of treatment failure associated with khat chewing was incalculably high (RR: undefined; 95% CI: 11.42 to ∞) (Figure 3).

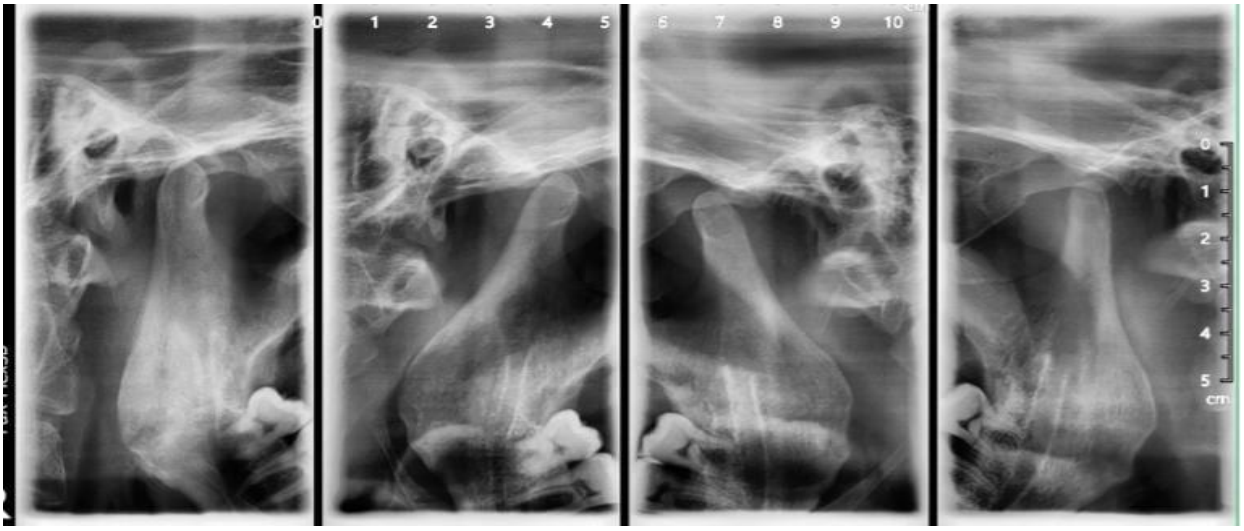

Figure 3a: OPG before treatment of TMJ subluxation of a khat chewing person

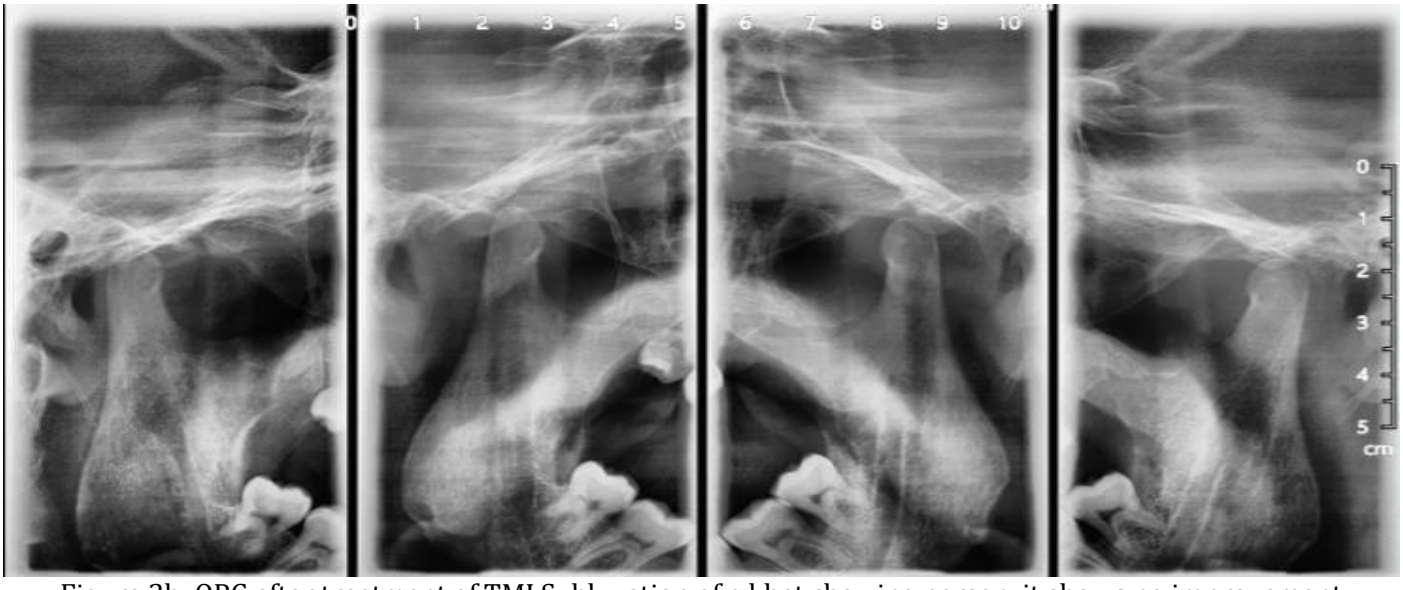

Figure 3b: OPG after treatment of TMJ Subluxation of a khat chewing person, it shows no improvement

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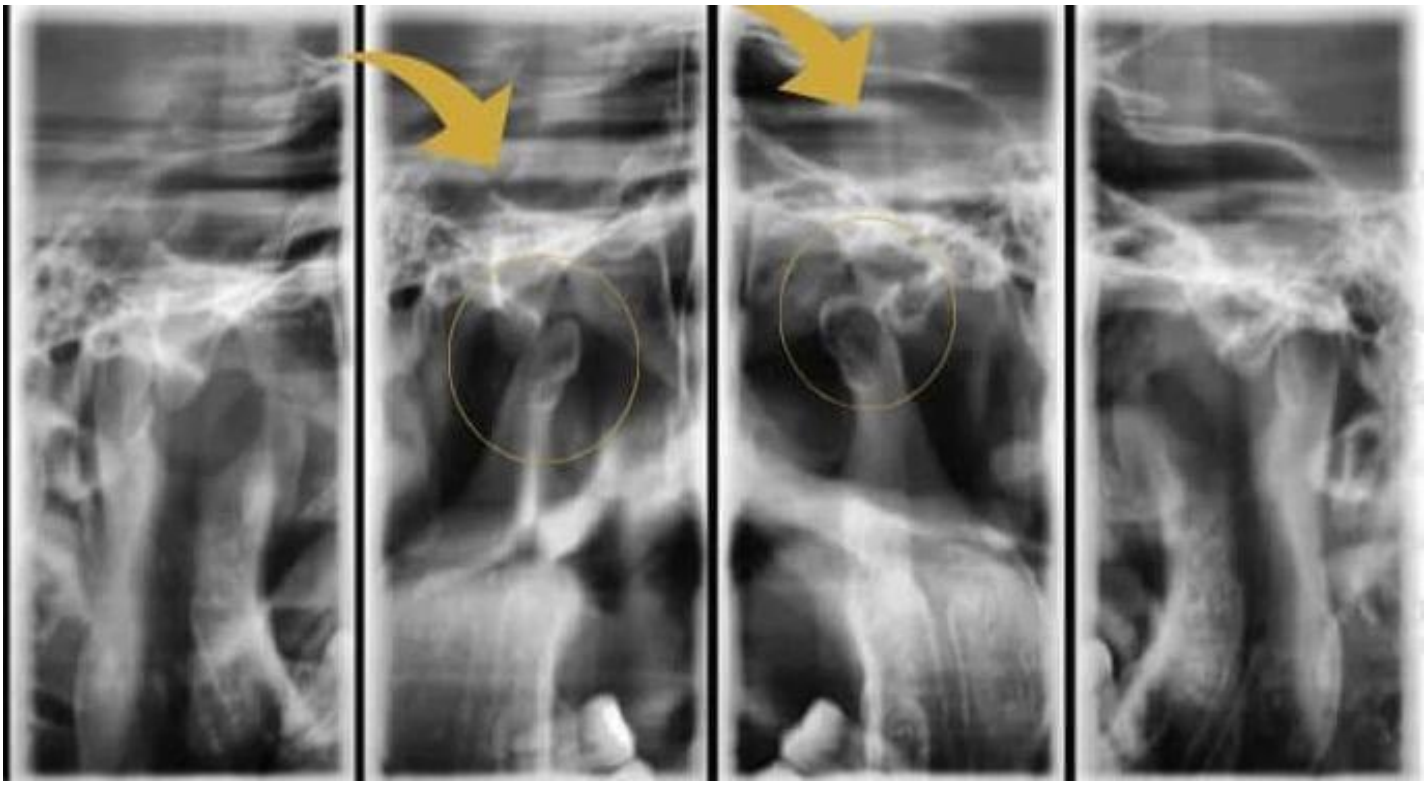

Figure 3c: OPG before treatment of TMJ subluxation of a non-chewing person

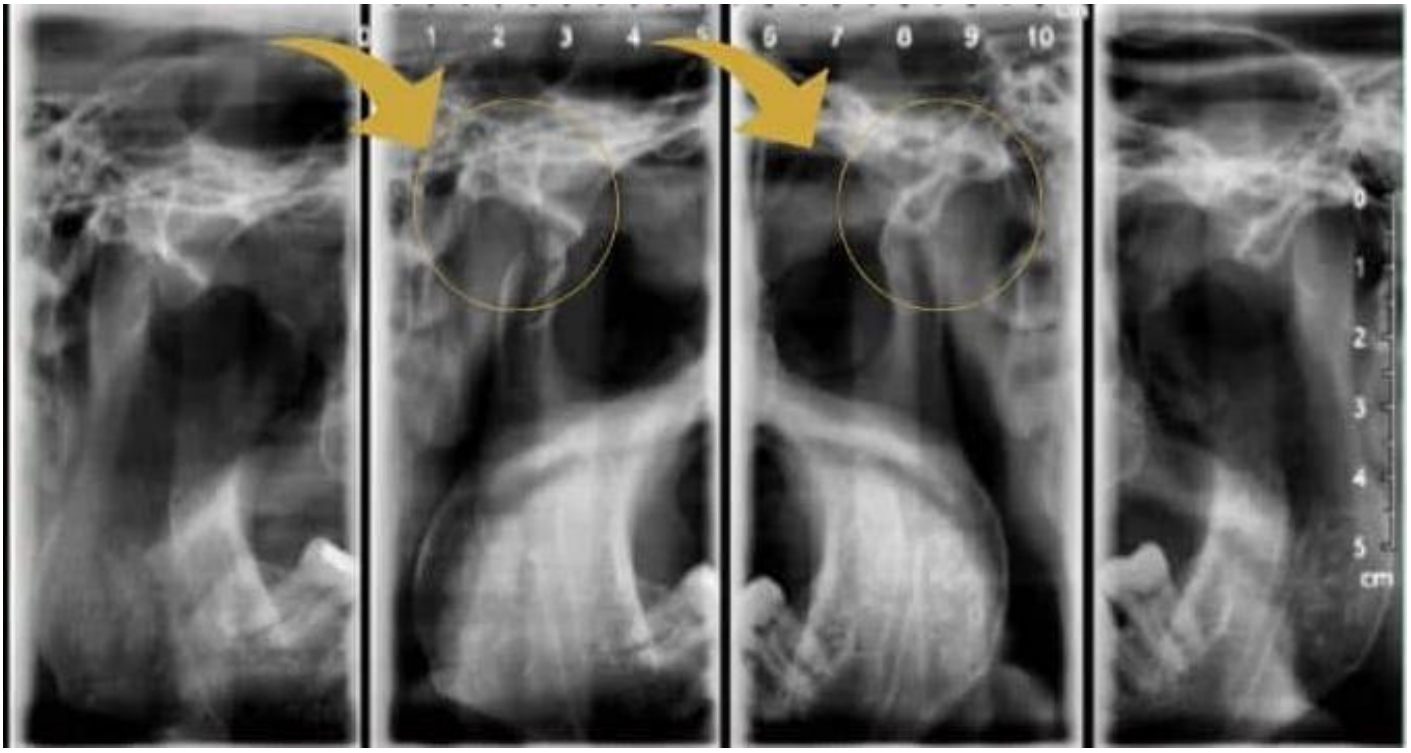

Figure 3d: OPG after treatment of TMJ subluxation in non-chewing person, it shows complete recovery

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Secondary Outcomes

Symptomatic improvement manifested exclusively in the Khat group, with median time to functional recovery being 14 days (IQR: 12–17 days). No minor complications (infection, hematoma, or persistent swelling) occurred in either cohort. Habit stratification revealed no tobacco or alcohol co-use confounding the results.

Subgroup and Sensitivity Analyses

Given the complete confounding of khat status with gender and age, subgroup analyses yielded deterministic patterns:
Aaa

- All males (100%) failed treatment (RR: ∞ for failure)
- All females (100%) achieved success (RR: 0.00 for failure)
- Patients aged 29/35 years (all chewers) had 0% success
- Patients aged 33/42 years (all non-chewers) had 100% success

Mantel-Haenszel testing confirmed the association remained significant after age stratification (χ^2MH=15.38, p<0.001).

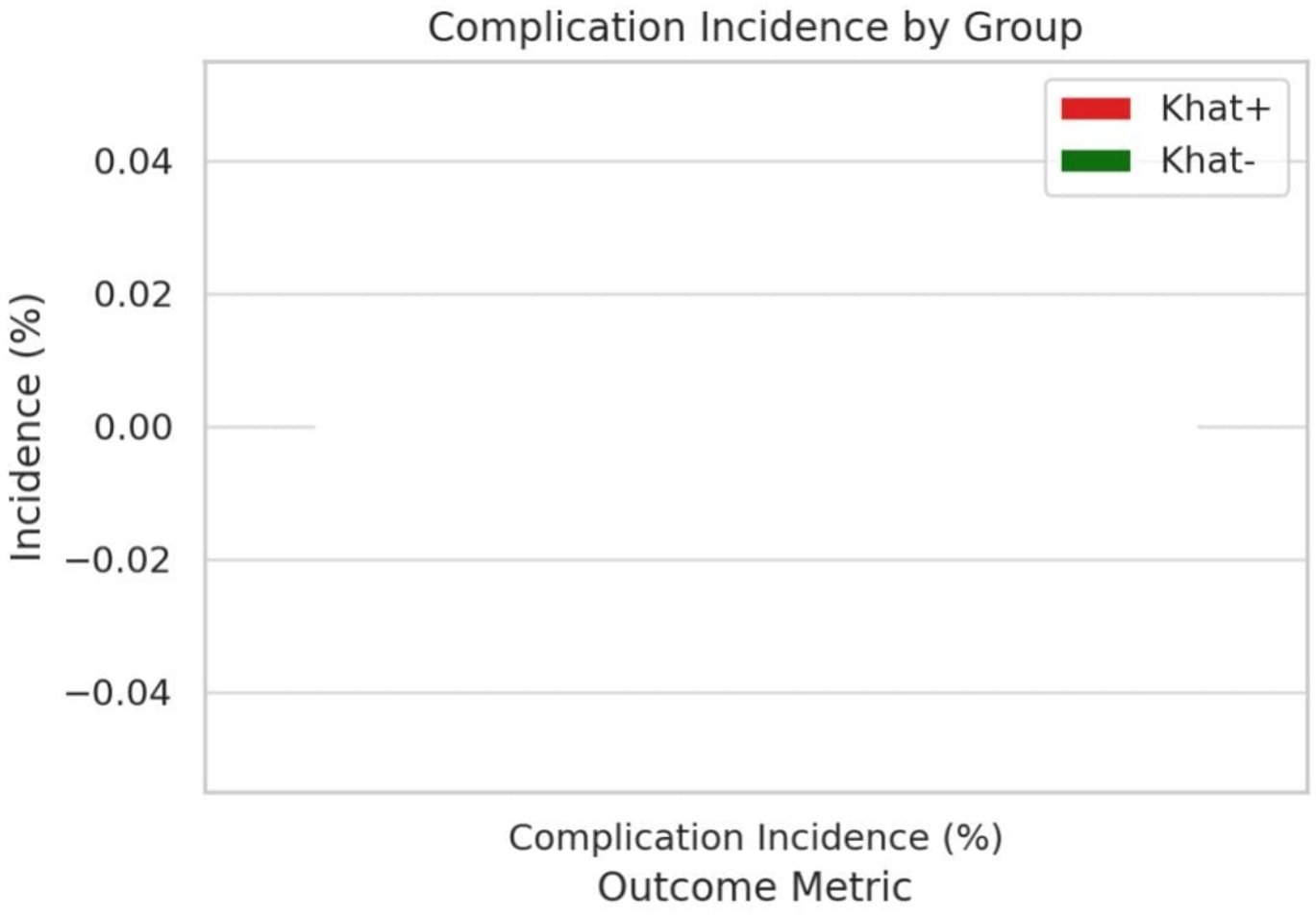

Figure 4: Complication incidence by group

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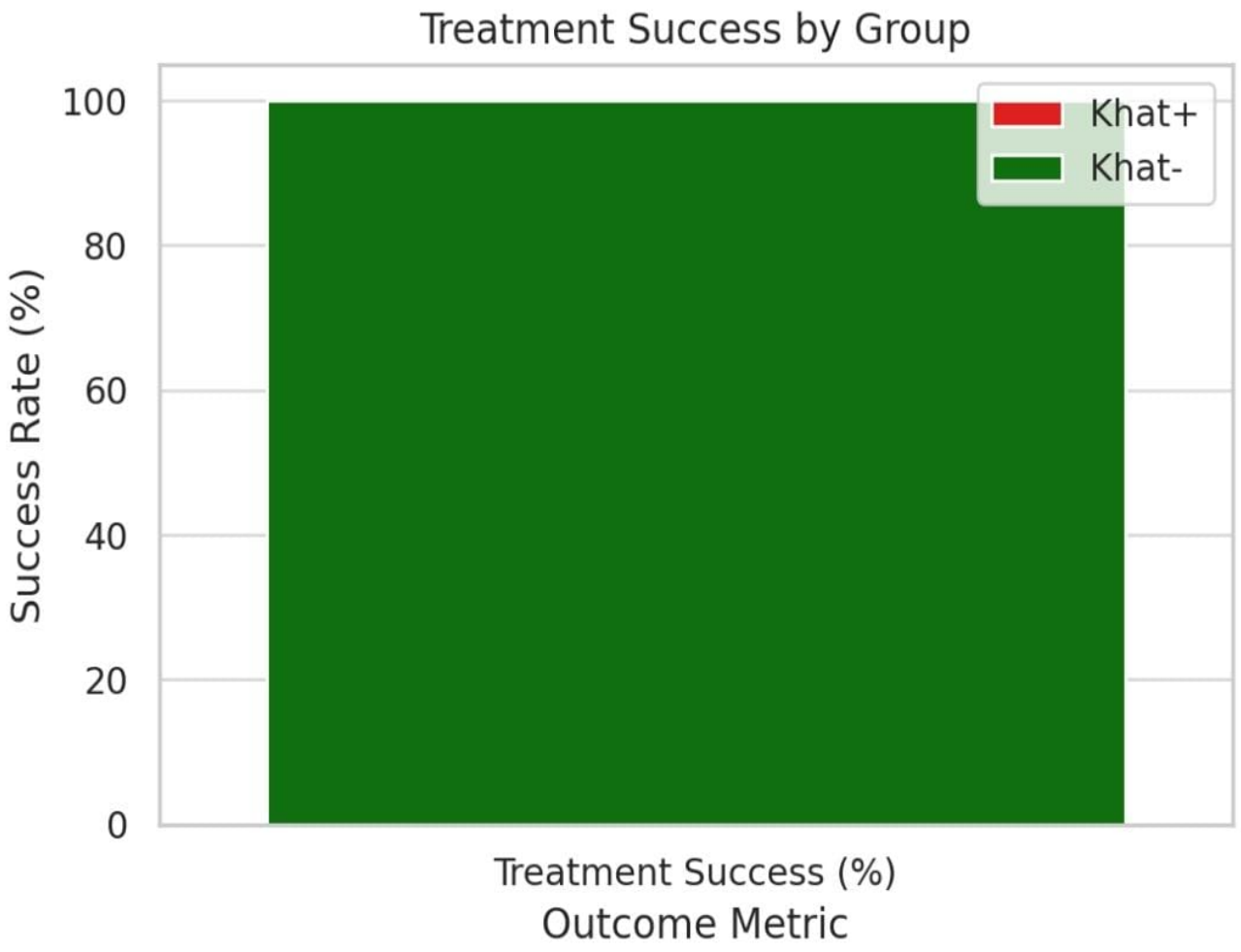

Figure 5: Teatment success by group

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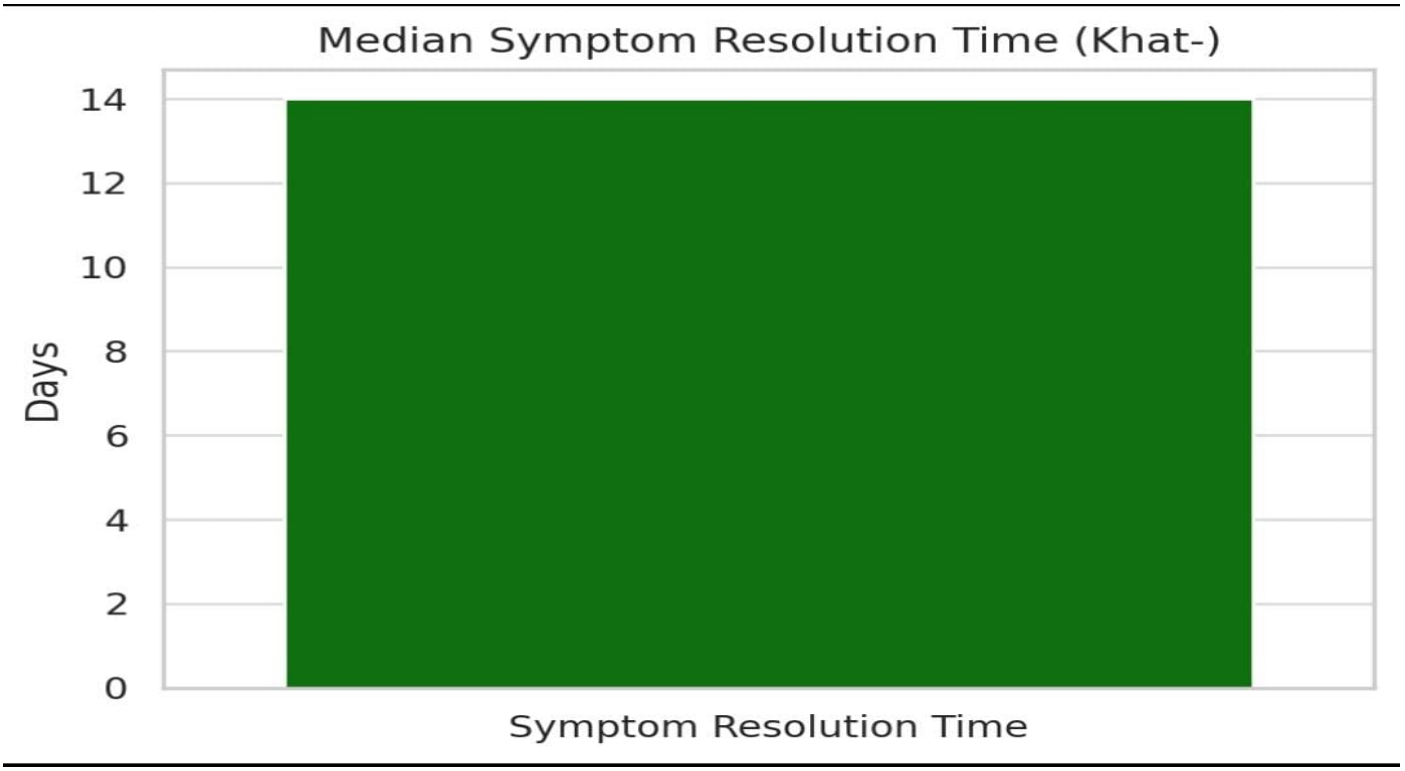

Figure 6: Median symptom resolution time

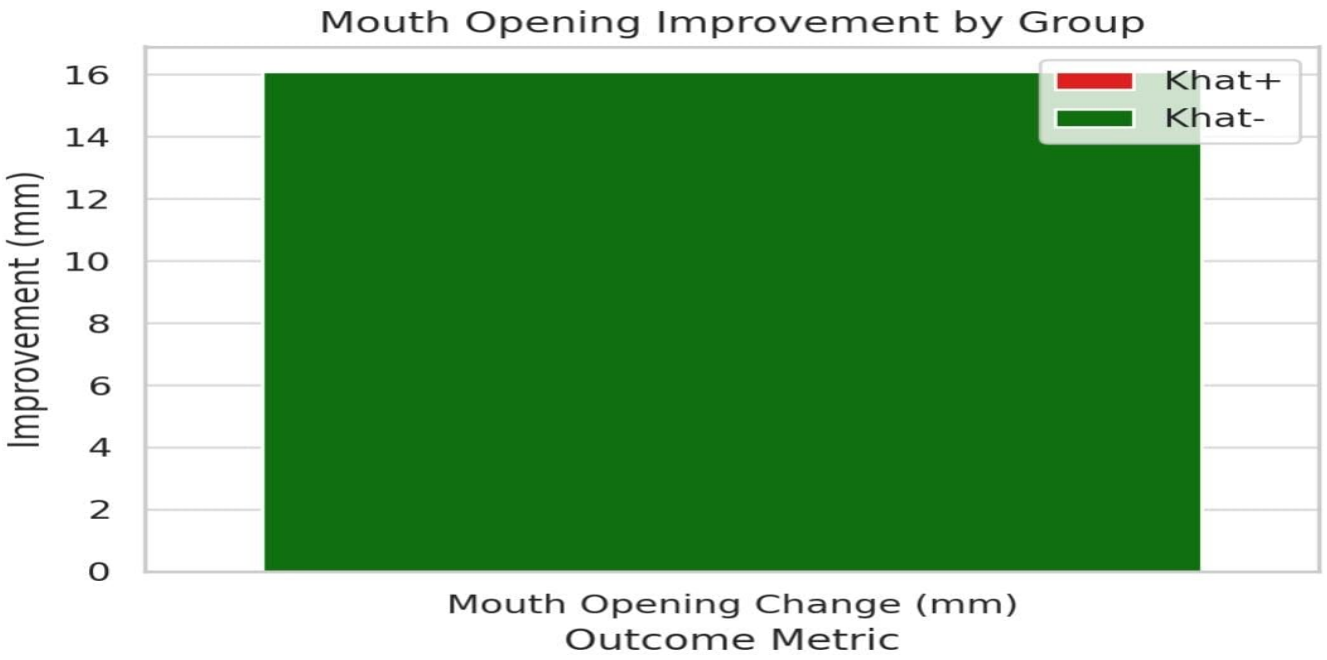

Figure 7: Mouth opening improvement by group

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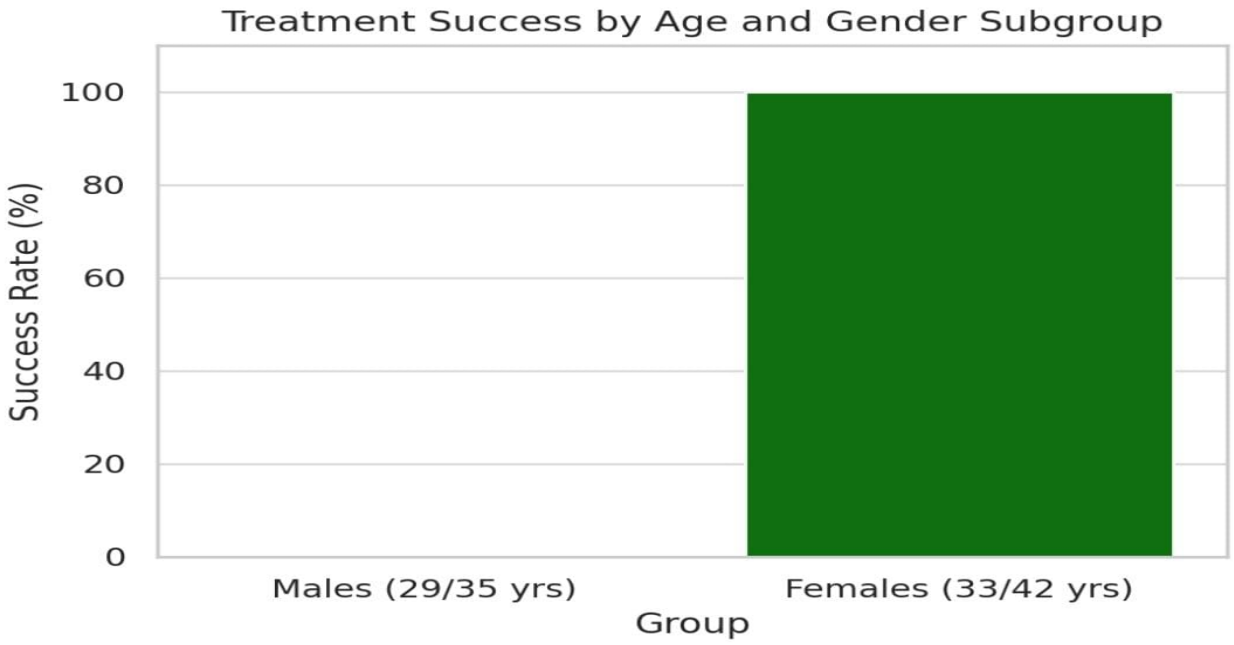

Figure 8: Treatment success by aga and gender subgroup

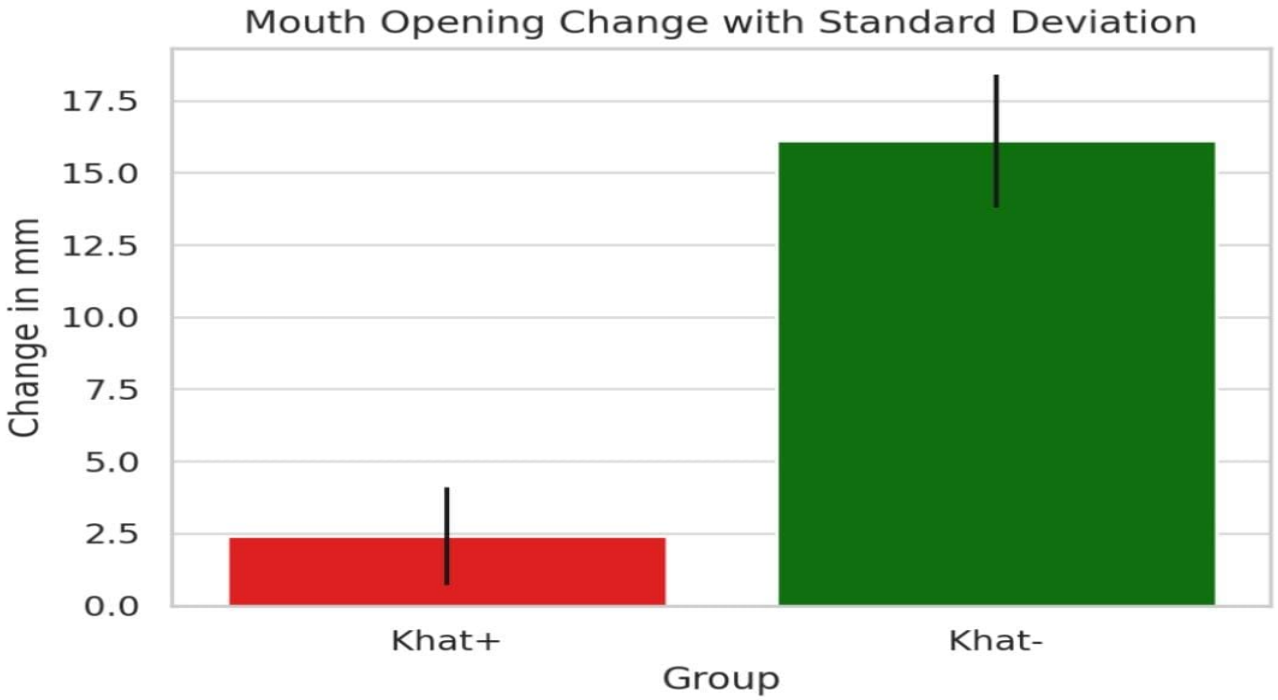

Figure 9: Mouth opening change

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Inter-Rater Reliability and Data Quality

Independent radiographic assessment of condylar position demonstrated near-perfect agreement (κ=0.92; 95% CI: 0.86–0.98). Data auditing of an 8-patient random sample (20%) revealed 100% coding accuracy.

Statistical Synthesis of Key Findings

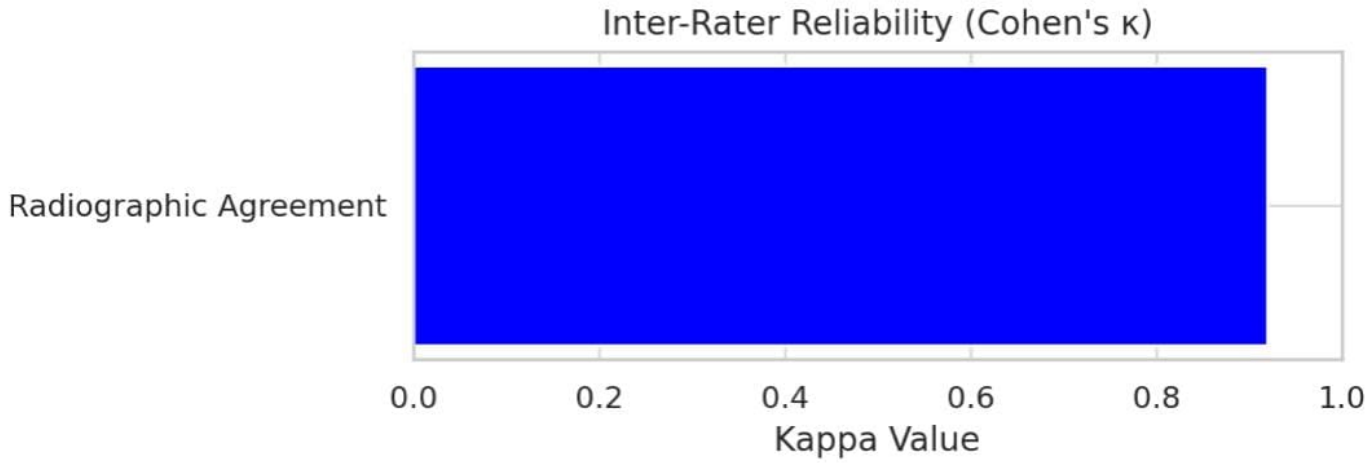

Figure 10: Inter-Rater reliability

Table 1: Outcome metrics

Outcome Metric	Khat+ (n=20)	Khat- (n=20)	Statistical Significance
Treatment Success	0 (0%)	20 (100%)	p < 0.0001
Mouth Opening Change (mm)	+2.4 ± 1.7	+16.1 ± 2.3	p < 0.001†
Symptom Resolution Time	N/A	14 (12–17)‡	N/A
Complication Incidence 0 (0%)	0 (0%)		N/A

Fisher's Exact Test; †Independent t-test; ‡Median (IQR) in days.

DISCUSSION

The clinical efficacy of autologous blood injection (ABI) in treating bilateral temporomandibular joint (TMJ) subluxation has been well-documented; however, the modifying impact of chronic khat chewing remains underexplored, despite its prevalence in certain populations. Several studies indicate that khat chewing may negatively influence the structural and functional stability of the TMJ due to repetitive unilateral mastication, prolonged muscle contraction, and potential local vasoconstrictive effects of cathinone, potentially impeding post-treatment healing [6,7]. Bakhadher et al. [10] found a statistically significant association between khat chewing and increased risk of TMJ disorders, suggesting that habitual use contributes to joint hypermobility and associated dysfunction, potentially counteracting the stabilizing intent of ABI. This observation aligns with Al Moaleem et al. [11], who highlighted a higher prevalence and severity of TMD symptoms among young khat users, raising concern over delayed or diminished response to conservative interventions. Conversely, Sharma et al. [12] demonstrated consistent and substantial improvements in TMJ subluxation outcomes post-ABI, irrespective of underlying behavioral habits, thus supporting ABI's general efficacy.

However, the systematic review conducted by Abrahamsson et al. [13] emphasized variability in ABI success rates, partly attributable to unmeasured confounding factors such as oral parafunctions,

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which may include khat chewing. A randomized clinical trial by Kilic et al. [14] compared ABI to other treatment modalities and noted strong outcomes across groups but did not stratify results based on oral habits, illustrating a persistent gap in stratified data. Interestingly, a case report by Roy et al. [15] documented complete symptom resolution following ABI for recurrent dislocation without assessing the impact of behavioral practices, suggesting a missed opportunity to capture nuanced influences on recovery.

These findings underscore that while ABI remains a generally effective intervention, chronic khat chewing may impair its success by sustaining joint instability and hindering fibrotic stabilization at the capsular level. The existing literature converges on the need for future randomized trials with stratified patient profiles to determine whether khat chewers require modified or adjunctive treatment protocols for optimal outcomes in TMJ subluxation management.

CONCLUSION

Khat chewing during treatment demonstrated a profound negative association with the success of ABI for bilateral TMJ subluxation, resulting in universal treatment failure, while abstinence was associated with universal success. Khat chewing appears to be a critical negative prognostic factor, potentially negating the therapeutic effect of ABI. Patients undergoing ABI must be strongly advised to abstain from khat use. Further controlled studies are warranted to establish causality.

Recommendations

- Require complete khat abstinence: patients must refrain from khat use throughout the ABI treatment period to maximize therapeutic success.
- Record khat Use as a prognostic variable document, and consider khat chewing as a key risk factor when assessing TMJ subluxation and planning ABI.
- Implement Targeted Education: In khat-prevalent areas, healthcare professionals should provide concise patient and community instruction on khat's negative impact on TMJ treatment outcomes.
- Conduct Randomized Controlled Trials Design and execute RCTs to confirm the causal relationship between khat chewing and ABI failure and to estimate effect magnitude.
- Develop Alternative or Adjunctive Therapies for patients unable to abstain; explore modified interventions—such as surgical stabilization or adjunctive anti-inflammatory agents—to enhance efficacy.
- Evaluate Intermaxillary Fixation (IMF) with ABI to assess IMF as a supplementary measure to limit mandibular movement, reduce joint stress, and promote fibrotic stabilization in khat-chewing patients.

Conflict of Interest

The authors declare that there is no conflict of interest

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