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COMPARISON OF ROCABADO'S 6×6 EXERCISE PROGRAM AND A MULTICOMPONENT JAW EXERCISE PROGRAM ON PAIN, RANGE OF MOTION, AND QUALITY OF LIFE IN INDIVIDUALS WITH ORAL SUBMUCOUS FIBROSIS: A COMPARATIVE STUDY

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ABSTRACT

Background: Oral submucous fibrosis (OSMF) is a chronic disease characterized by oral fibrosis as well as reduced opening of the mouth, pain and limited mobility of the temporomandibular joint (TMJ), which can impair regular functioning in daily life. Rocabado's 6×6 and multicomponent training programs may increase opening or decrease discomfort, although limited data are available in OSMF.

Aim & Objectives: This study aims to compare the effect of Rocabado's 6×6 exercise program and a multicomponent jaw exercise program on pain, jaw range of motion (ROM) and quality of life among OSMF participants emphasizing pain-relieving, ROM improvement and quality-of-life-promoting duties.

Methodology: In this comparative study, the individuals with OSMF were randomly divided into Group—A (Rocabado's 6×6 program along with TMJ mobilization) and group—B (multicomponent jaw exercise program) for six weeks. Outcomes were evaluated at baseline and following the intervention using the Numeric Pain Rating Scale (NPRS), jaw ROM, and OHIP-14

Results: Both treatments resulted in significant increases in pain, jaw ROM and quality of life disability ($p < 0.05$). Pain reductions and functional gains in group A were marginally greater, but quality of life improvements was equivalent.

Conclusion: Both Rocabado's 6×6 and multicomponent jaw exercise programs effectively enhance jaw mobility, reduce pain, and improve quality of life in OSMF patients, with Rocabado's approach offering more improvement in pain and functional outcomes.

Keywords: Rocabado's Exercise Program, Multicomponent Jaw Exercise, Oral Submucous Fibrosis, TMJ mobilization, OHIP-14

INTRODUCTION:

Oral Submucous Fibrosis (OSMF) is a chronic, progressive and potentially malignant disorder that mainly affects the oral cavity and is observed primarily in South Asian population due to areca nut chewing. Oral Submucous Fibrosis is a fibrosing disease of oral mucosa that results in stiffness of the oral tissues, limited mouth opening, burning sensation, mastication difficulties and speech and swallowing complications [1], severely affecting the quality of life. OSMF has been increasing in incidence with time all over India [2], and it is most prevalent in the younger age groups making it a potential public health crisis.

Patho-physiologically, OSMF involves excessive deposition of collagen in the submucosal tissues along with reduced collagen degradation, resulting in dense fibrous bands within the buccal mucosa, soft palate, and other oral structures [3]. This fibrosis progressively reduces the elasticity of the oral tissues, leading to trismus and restricted mandibular movements. As the condition advances, involvement of the

muscles of mastication and temporomandibular joint (TMJ) structures further exacerbates functional limitations, contributing to pain and reduced jaw mobility [4].

The TMJ is a synovial joint, specifically the articulation between the condyle of the mandible and the temporal bone, stabilized by ligaments and muscles around it with an articular disc in place providing for smooth movements including opening-closure-protrusion-retrusion-lateral deviation [5]. Efficient functioning of the TMJ is essential for daily activities such as eating, speaking, and facial expressions. In individuals with OSMF, fibrosis and associated muscular tightness disrupt the normal biomechanics of the TMJ, resulting in decreased range of motion (ROM), altered movement patterns, and increased joint loading [6].

Mandibular movement depends on the coordinated action of the muscles of mastication, including the masseter, temporalis, medial pterygoid, and lateral pterygoid muscles. In OSMF, chronic

inflammation and fibrosis lead to reduced muscle extensibility and altered neuromuscular coordination, further limiting jaw opening and functional efficiency [7].

Additionally, persistent pain and restricted mobility contribute to compensatory movement patterns, increased muscle fatigue, and decreased participation in social and functional activities, thereby negatively impacting oral health-related quality of life [8].

Management of OSMF involves rehabilitation through therapeutic exercises, which can improve the extensibility of the tissue and mobility of joints, leading to local pain relief. Among the commonly used approaches, Rocabado's 6×6 exercise program is a structured protocol designed to restore normal TMJ function through six specific exercises performed six times per day. This program focuses on correcting head and neck posture, improving neuromuscular control, and promoting coordinated mandibular movements, thereby enhancing joint stability and reducing dysfunction [9, 10]. By addressing both muscular and postural components, Rocabado's approach aims to normalize the functional relationship between the cervical spine and the TMJ.

Multicomponent jaw exercise programs incorporate a combination of interventions such as active range of motion exercises,

TMJ mobilization techniques, cryotherapy, and postural correction strategies. These programs are designed to provide a comprehensive approach by targeting multiple contributing factors including pain, inflammation, joint stiffness, and muscular imbalance [11]. Active exercises improve mobility and muscle strength, while manual therapy enhances joint play and reduces stiffness. Cryotherapy helps in pain modulation, and postural correction addresses biomechanical alignment, thereby optimizing overall functional outcomes [12].

Despite the documented benefits of both Rocabado's 6×6 exercise program and multicomponent jaw exercise approaches in temporomandibular disorders and related conditions, there is limited comparative evidence regarding their effectiveness specifically in individuals with OSMF. The progressive nature of the disease, which affects oral function as well as quality of life, makes identifying the most effective rehabilitation strategy essential when it comes to improving patient outcomes.

Therefore, the present study aims to compare the effectiveness of Rocabado's 6×6 exercise program and a multicomponent jaw exercise program on pain, jaw range of motion, and quality of life in individuals with Oral Submucous Fibrosis.

Objectives of the Study

- To assess the effect of Rocabado's 6×6 exercise program on pain, jaw range of motion, and quality of life using NPRS, jaw ROM, and OHIP-14.
- To evaluate the effectiveness of a multicomponent jaw exercise program on the same outcome measures.
- To compare both interventions in improving pain, mandibular mobility, and quality of life in individuals with Oral Submucous Fibrosis.

MATERIALS AND METHODS:

Study Design: This was a comparative study conducted over a duration of 6 weeks, aiming to evaluate and compare the effectiveness of Rocabado's 6×6 exercise program and a multicomponent jaw exercise program on pain, range of motion, and quality of life in individuals with Oral Submucous Fibrosis (OSMF).

Sample Size & Participants: A total of 28 individuals diagnosed with Oral Submucous Fibrosis were recruited for the study and randomly assigned into two equal groups of 14 participants each. All subjects provided written informed consent before participation.

Materials Used: Numerical Pain Rating Scale (NPRS), Goniometer/scale for jaw range of motion (lateral excursion and protrusion), OHIP-14 (Oral Health Impact Profile) questionnaire, Exercise mats, Mirror (for feedback), Stopwatch, Recording sheets.

Participants diagnosed with Oral Submucous Fibrosis (OSMF) were included based on predefined inclusion and exclusion criteria. Individuals willing to participate and able to follow instructions were included. Participants with severe systemic illness, recent oral surgery, neurological disorders, or conditions affecting temporomandibular joint function other than OSMF were excluded.

Intervention Protocol

Group A: Rocabado's 6×6 Exercise Program

- Participants in Group A performed Rocabado's 6×6 exercise program focusing on temporomandibular joint alignment, postural correction, and neuromuscular control [9].
- The program consisted of six exercises performed six times per day.
- Exercises were performed 4 days per week for 6 weeks under physiotherapist supervision.

Component	Description
Intervention Type	Rocabado's 6×6 Exercise Program + TMJ Mobilization
TMJ Mobilization	Applied when restriction present to improve joint mobility
Mobilization Techniques	Distraction; Distraction with anterior glide; Distraction with anterior & lateral glide (R/L); Lateral glide without distraction
Tongue Resting Position	Tongue placed on palatal ridge behind upper incisors
TMJ Rotation Control	Slow, controlled mouth opening and closing
Cervical Spine Liberation	Chin tuck exercises to improve posture and mobility
Shoulder Girdle Retraction	Scapular retraction exercises for alignment
Rhythmic Stabilization	Isometric/resisted jaw exercises for neuromuscular control
Breathing	Nasal–diaphragmatic breathing with posture control

Group B: Multicomponent Exercise Program

- Participants in Group B followed a multicomponent jaw exercise program including stretching,
- mobility, and functional jaw movements [11].
- Training was conducted 4 days per week for 6 weeks under physiotherapist supervision.

Week Range	Treatment Component	Repetitions / Duration
Week 1	Cryotherapy	10–15 min
	Ultrasound	6 min
	AROM exercises for TMJ	1 set × 10 repetitions
	Rhythmic stabilization	2 sets × 10 repetitions
	TMJ Mobilization – Grade 1	3 sets × 10 repetitions
Week 2	Cryotherapy	10–15 min
	Hot moist pack	10–15 min
	AROM exercises (TMJ & cervical)	2 sets × 10 repetitions
	TMJ Mobilization – Grade 2	3 sets × 10 repetitions
	Posture correction exercises	3 sets × 10 repetitions
	Breathing exercises	3 sets × 10 repetitions
Week 3–4	TMJ Mobilization – Grade 2–3	3 sets × 10 repetitions
	ROM (TMJ, cervical, shoulder)	3 sets × 10 repetitions
	Facial & tongue PNF	3 sets × 10 repetitions
	Breathing exercises	3 sets × 10 repetitions
	Thoracic expansion exercises	1 set × 10 repetitions
Week 5–6	TMJ Mobilization – Grade 2–3	3 sets × 10 repetitions
	Resisted ROM exercises	3 sets × 10 repetitions
	Thoracic expansion exercises	3 sets × 10 repetitions
	Breathing exercises	1 set × 10 repetitions

Outcome Measures:

Assessments were conducted at baseline and after 6 weeks of intervention.

Numerical Pain Rating Scale (NPRS): To assess pain intensity

The Numerical Pain Rating Scale is a widely used subjective measure of pain intensity, where participants rate their pain on a scale

from 0 (no pain) to 10 (worst imaginable pain). It is simple, reliable, and sensitive to changes over time. NPRS has demonstrated high test-retest reliability (ICC = 0.86–0.95) and strong validity in assessing pain in musculoskeletal conditions [13].

Jaw Range of Motion (ROM): To evaluate functional mobility of the temporomandibular joint

Jaw range of motion includes assessment of lateral excursion and protrusion movements, which reflect the functional capacity of the temporomandibular joint. Measurements are taken using a ruler or scale by recording the distance of mandibular movement in specific directions. It is a clinically relevant and reliable method for evaluating TMJ mobility and functional limitations [14].

Oral Health Impact Profile (OHIP-14):

To assess quality of life related to oral health The OHIP-14 is a validated questionnaire used to evaluate the social impact of oral disorders on well-being. It consists of 14 items across seven domains, including functional limitation, physical pain, psychological discomfort, physical disability, psychological disability, social disability, and handicap. Each item is scored on a Likert scale, and higher scores indicate poorer quality of life. The OHIP-14 has demonstrated good internal consistency (Cronbach's $\alpha > 0.80$) and strong validity in assessing oral health-related quality of life [15].

Procedure: The study was conducted following ethical clearance from the Institutional Ethics Committee. Participants were screened based on inclusion and exclusion criteria, and informed consent was obtained prior to participation. Baseline assessment was carried out for pain (NPRS),

jaw range of motion, and quality of life (OHIP-14). Participants were then randomly allocated into two groups (Group A and Group B) using a simple random sampling method. Both groups underwent their respective interventions for 6 weeks under the supervision of a licensed physiotherapist. Post-intervention assessment was conducted using the same outcome measures by the same assessor. All data were collected systematically for further analysis, ensuring participant safety and confidentiality throughout the study.

Statistical Analysis: Data were analyzed using SPSS version 29.0 software. Descriptive statistics were used to summarize baseline characteristics. Paired t-tests were applied within groups to assess pre- and post-intervention differences, while independent t-tests were used for between-group comparisons. A p-value < 0.05 was considered statistically significant.

RESULTS:

The demographic data in **Table 1** shows that both groups had similar age, height, weight, and BMI values. This indicates that the participants were well-matched at baseline, making the groups comparable.

This **Chart 1** shows that Group A and Group B have very similar values for age, height, weight, and BMI. The bars for both groups are almost equal in each category, indicating that the participants were comparable and well-matched at baseline.

Table 1: Demographic Data of participants

Variable	Group A (Mean $\pm$ SD)	Group B (Mean $\pm$ SD)
Age (years)	35.20 $\pm$ 6.10	36.40 $\pm$ 5.80
Height (cm)	165.30 $\pm$ 7.20	166.10 $\pm$ 6.90
Weight (kg)	64.50 $\pm$ 8.40	66.20 $\pm$ 7.80
BMI (kg/m ²)	23.60 $\pm$ 2.50	24.00 $\pm$ 2.30

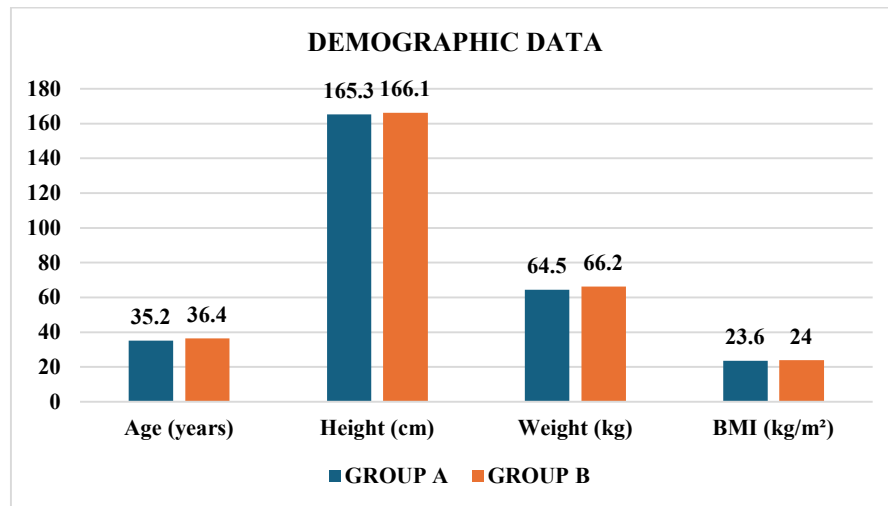


Chart 1: Demographic data

Table 2: Comparison of Outcome Measures Within and Between Groups

Parameter	Phase	Group A Mean	Group A SD	p value	Group B Mean	Group B SD	p value	Between Group p value
Pain	Pre	5.60	2.41	0.001	5.00	3.51	0.001	0.2358
	Post	2.70	2.05		3.75	2.31		0.2144
Mouth Opening (mm)	Pre	28.20	3.25	0.001	29.28	3.73	0.001	0.8955
	Post	35.40	3.92		32.00	5.06		0.0596
Right Lateral (mm)	Pre	6.02	2.23	0.001	5.85	1.46	0.001	0.8747
	Post	7.40	1.34		6.85	2.91		0.5238
Left Lateral (mm)	Pre	6.40	1.64	0.001	7.00	2.58	0.001	0.3354
	Post	8.42	2.29		8.20	2.99		0.8287
Protrusive (mm)	Pre	6.30	2.11	0.9315	6.14	2.26	0.7851	0.5568
	Post	6.90	2.51		6.57	2.50		0.4772
OHIP-14	Pre	25.89	2.54	0.001	26.05	2.89	0.001	0.5898
	Post	21.05	1.80		22.74	1.99		0.0295

Both Group A (Rocabado's 6×6 exercise program) and Group B (multicomponent jaw exercise program) showed significant improvements in most outcomes ($p = 0.001$ within groups). Pain, mouth opening, and lateral movements improved in both groups, with Group A showing comparatively better gains, though most between-group differences were not statistically significant.

Protrusive movement showed minimal change in both groups. Quality of life (OHIP-14) improved in both groups, with Group A showing significantly better results ($p = 0.0295$). Overall, both interventions were effective, with Rocabado's 6×6 program showing relatively better outcomes.

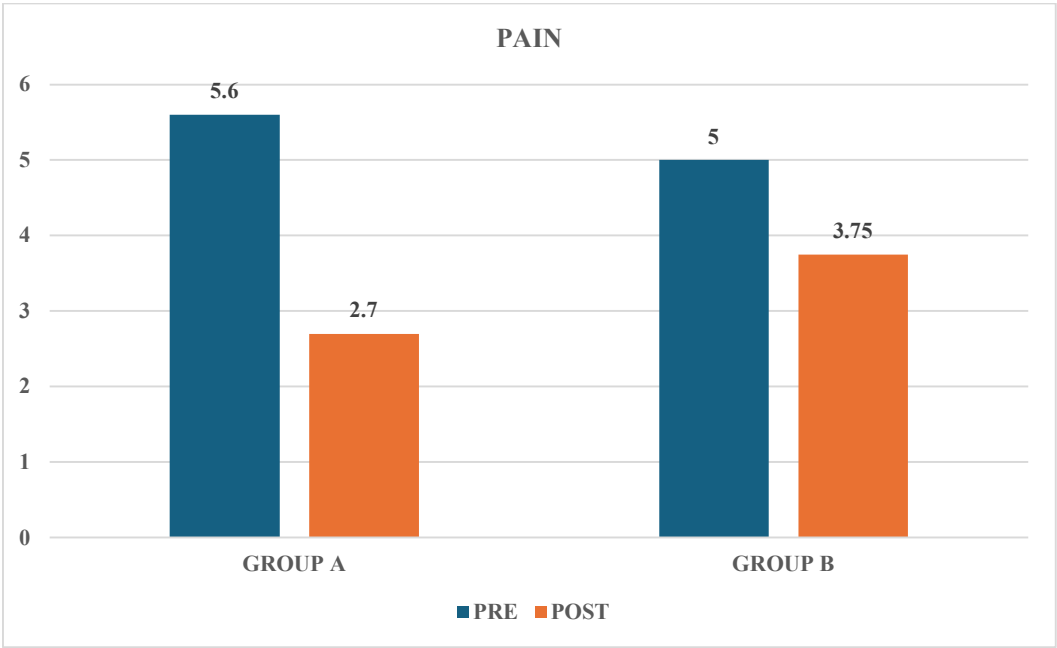


Chart 2: Pre- and post-intervention comparison of pain in Group A and B

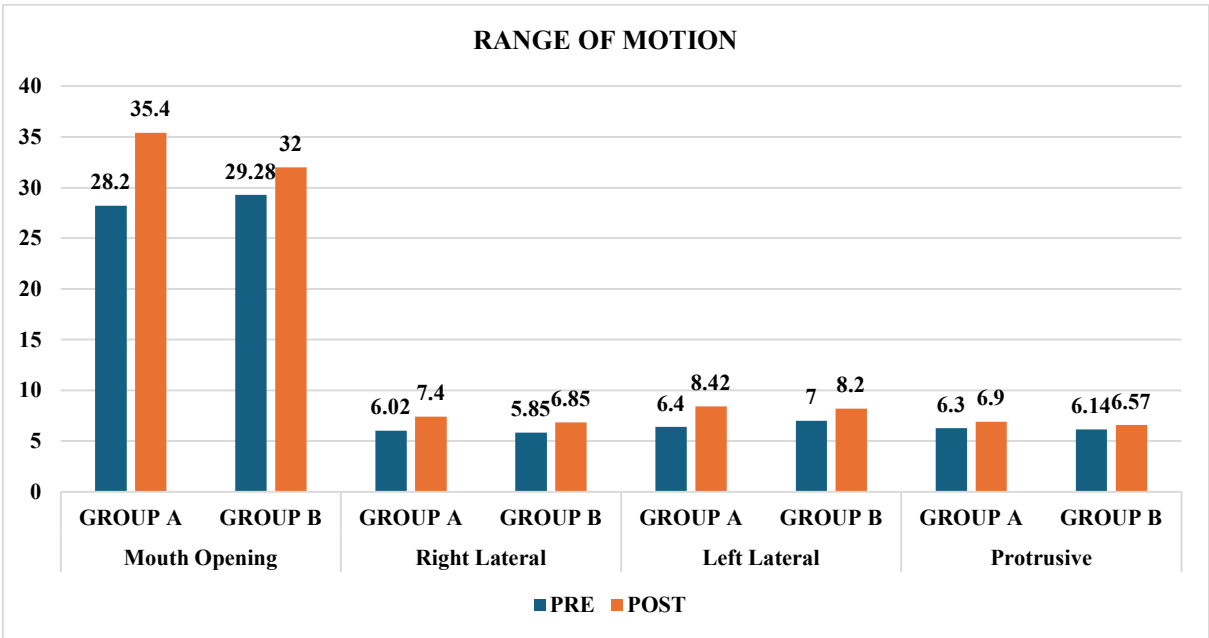


Chart 3: Pre- and post-intervention comparison of Range of motion in Group A and B

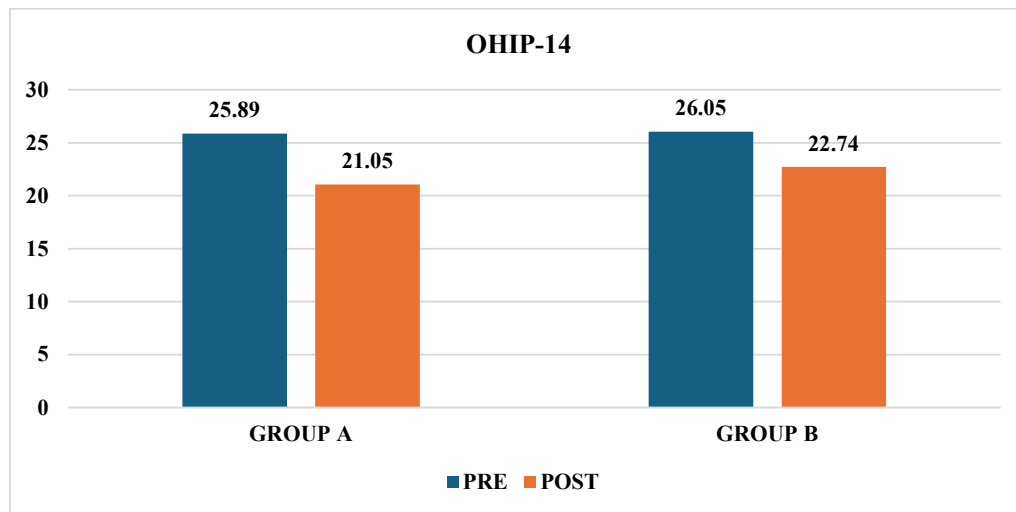


Chart 4: Pre- and post-intervention comparison of Oral health impact profile in Group A and B

DISCUSSION:

Oral Submucous Fibrosis (OSMF) is a chronic, progressive condition characterized by fibrosis of the oral mucosa, leading to restricted mouth opening, pain, reduced jaw mobility, and compromised quality of life. The present study aimed to compare the effectiveness of Rocabado's 6×6 exercise program and a multicomponent jaw exercise program on pain, jaw range of motion (ROM), and quality of life in individuals with OSMF. The findings demonstrated that both intervention groups showed significant improvements in most outcome measures, indicating that both approaches are effective in managing functional limitations associated with OSMF. However, the Rocabado group (Group A) showed comparatively better improvements across most parameters, particularly in quality of life.

Rocabado's 6×6 exercise program focuses on temporomandibular joint alignment, postural correction, and neuromuscular control. This holistic approach likely contributed to greater improvements observed in Group A. The reduction in pain and improvement in jaw mobility may be attributed to improved joint mechanics, muscle relaxation, and enhanced coordination between cervical and mandibular structures. These findings are consistent with Gaurav Patel (2025), who emphasized that TMJ-specific exercises help in reducing pain and improving function through neuromuscular re-education and postural alignment. Similarly, structured TMJ rehabilitation programs have been shown to enhance mandibular mobility and reduce functional limitations [16].

In contrast, the multicomponent jaw exercise program, which includes stretching, mobility exercises, and

functional movements, also demonstrated significant improvements in pain and ROM. These exercises likely improved tissue extensibility, reduced fibrosis-related stiffness, and enhanced functional jaw movements. Previous studies such as those by Pundkar *et al.* (2019) [17] and Shinde *et al.* (2023) [18] have reported that multicomponent exercise approaches are effective in improving jaw function and reducing symptoms, supporting the findings of Group B in the present study.

In terms of specific outcomes, both groups showed significant reduction in pain and improvement in mouth opening and lateral movements, while protrusive movement showed minimal change. Although most between-group differences were not statistically significant, Group A demonstrated better clinical improvement, especially in quality of life (OHIP-14), which showed a statistically significant difference favouring the Rocabado approach. This improvement in quality of life may be due to the combined effect of pain reduction, increased mouth opening, and enhanced functional ability in daily activities such as eating and speaking. These findings are in agreement with Salahuddin S (2025) [9], who reported that improvement in oral function directly enhances overall quality of life in OSMF patients.

Despite the positive findings, certain limitations should be considered. The

sample size was relatively small ($n = 28$), which may limit the generalizability of the results. The duration of intervention was limited to 6 weeks, which may not reflect long-term outcomes. Additionally, the absence of a control group limits the ability to compare the interventions against natural progression or standard care.

Both Rocabado's 6×6 exercise program and multicomponent jaw exercise programs can be effectively incorporated into rehabilitation protocols for individuals with OSMF. However, the Rocabado approach may offer added benefits due to its comprehensive focus on posture, neuromuscular control, and TMJ function, making it particularly useful for improving overall functional outcomes and quality of life.

CONCLUSION:

Both Rocabado's 6×6 exercise program and the multicomponent jaw exercise program were effective in improving pain, jaw range of motion, and quality of life in individuals with Oral Submucous Fibrosis. However, Rocabado's 6×6 exercise program showed comparatively better clinical outcomes, particularly in enhancing quality of life. Although most between-group differences were not statistically significant, both interventions can be considered beneficial in the management of OSMF, with Rocabado's approach offering a more comprehensive advantage.

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