A Comparative Study to Evaluate the Efficacy of Lycopene and Curcumin in Oral Submucous Fibrosis Patients: A Randomized Clinical Trial

Abstract

Background: Oral submucous fibrosis (OSMF) is a most prevalent potentially malignant disorder associated with betel quid chewing frequently observed in the Indian population. The present study conducted is much of a keen interest because there is much new information, both in the press and the medical literature, about the benefits of fresh fruits and vegetables and antioxidants (such as lycopene and curcumin) for both prevention and treatment of diseases. As clinicians, we often prescribe medications with significant adverse effects, and certainly, if armed with evidence to support using such antioxidants as safer therapeutic alternatives for treatment of OSMF. Aims and Objective: The aim of the study was to compare and evaluate the efficacy of lycopene and curcumin given orally in clinically diagnosed OSMF patients. Materials and Methods: Sixty patients were divided randomly into two groups Group A and Group B. After fulfilling the eligibility criteria, sixty patients were randomly allotted based on fishbowl method into thirty each. This technique eliminated the selection bias arising in the study. Group A individuals were treated with 4 mg of lycopene and Group B individuals were given 300 mg of curcumin thrice daily for 3 months. Both the groups were assessed in terms of mouth opening and burning sensation. The statistical analysis was done using SPSS Version 16.0 statistical Analysis Software. Results: In Group A, the initial burning sensation was 65.83 ± 3.98%, and in Group B, it was 62.33 ± 5.22% (visual analog scale). After 3 months, there was complete cessation of burning sensation in both the groups. Burning sensation between the groups was statistically nonsignificant (P > 0.05). In Group A, mean mouth opening at baseline (1st visit) observed was 3.17 ± 0.08 cm which improved to 3.52 ± 0.07 cm after 3 months of the treatment period. In Group B, mean mouth opening at baseline (1st visit) observed was 3.32 ± 0.07 cm which improved to 3.52 ± 0.08 cm after 3 months of the treatment period. On comparing intergroup, the difference was statistically nonsignificant (P > 0.05). However, on comparing intergroup, average percent change in mean mouth opening from 1st visit to subsequent time intervals across the time period was found to be statistically significant (P < 0.05). Group A showed 11.1 ± 1.0% improvement in mean mouth opening and Group B showed 6.2 ± 0.4% improvement in the mean mouth opening from the 1st visit till the posttreatment period. The change in the mean mouth opening from 1st visit till posttreatment in Group A was 0.35 ± 0.14, and in Group B, it was 0.20 ± 0.09. Conclusion: Lycopene showed better results than curcumin in improving mouth opening; both the drugs were equally effective in decreasing burning sensation in OSMF patients.

Keywords: Antioxidants, curcumin, lycopene, noninvasive, oral submucous fibrosis, treatment

Introduction

Oral submucous fibrosis (OSMF) is the most common prevalent potentially malignant disorder of oral cavity associated with betel nut chewing.[1] The workshop co-ordinated by WHO collaborating centre for Oral Cancer and pre-cancer is of the view to refer to all clinical presentations that carry a risk of cancer under the term “potentially malignant disorders” to reflect their widespread anatomical distribution.[1] Pindborg defined it as insidious chronic disease affecting any part of oral cavity sometimes pharynx, associated with juxtaepithelial fibroelastic change in the lamina propria.[2] A wide range of treatments have been advised for the treatment of OSMF, including habit control (i.e. cessation of areca nut use), physical therapy, and medical and surgical interventions. Lycopene, a red-colored carotenoid, prevents the promotion of carcinogenesis by interfering with various cellular processes.[3]
Curcumin, a compound of turmeric and belonging to the family of curcuminoids, acts as scavenger of hydroxyl radicals and catalyzes the formation of hydroxyl radicals.[4]  

Materials and Methods

This study was conducted in the Department of Oral Medicine and Radiology, Babu Banarasi Das College of Dental Sciences, Lucknow. The ethical clearance for the study was obtained from the institutional ethical committee. The study population was drawn from the patients attending the Outpatient Department of Oral Medicine and Radiology. After fulfilling the eligibility criteria, sixty patients with OSMF were randomly allotted into two groups with thirty patients each, based on fishbowl method. This technique eliminated the selection bias arising in the study. Criteria used for the clinical grouping of OSMF patients was based on the classification given by Khanna and Andrade 1995.[5]  

In the present study sixty patients who presented with characteristic signs and symptoms of OSMF such as restricted mouth opening, presence of blanching with palpable vertical fibrous bands, burning sensation on eating spicy food were clinically categorized into Group-A and Group-B with equal distribution of 30 each after fulfilling the eligibility criteria for OSMF.

Each patient was informed about the protocol and was given appropriate instructions after obtaining a written consent.

All the patients who were selected for the study were randomly divided into two groups:

- Group A – It had thirty patients who were treated with lycopene capsules (lycopene: 4 mg, zinc: 7.5mg, selenium: 35mg), orally given per day in two divided doses for a period of 3 months (lycopene was under the trade name Lycored manufactured by Jagsonpal Pharmaceuticals Ltd, New Delhi, India)

- Group B – It had thirty patients who were treated with curcumin tablets (curcuma longa extract: 300 mg and piper nigrum: 5 mg). Patients were advised to take one tablet thrice daily per day for a period of 3 months (curcumin was under the trade name of Turmix manufactured by Sanat Pharmaceuticals Ltd, New Delhi, India)

Both the drugs were purchased from local pharmaceutical shop and were Food and Drug Administration (FDA) approved with Lycored having reference no FDA-2012-S-1144-0604 and curcumin FDA-1997-21 CFR 170.36. The medications were self-funded.

To test the antioxidant and anti-inflammatory properties of lycopene and curcumin, the current study was undertaken, and the patient was counseled to quit the habit of chewing gutkha. The Five As (Ask, Advise, Assess, Assist, and Arrange) is a five to fifteen minute research-based counseling tool that has proven to be successful given by Fiore et al.[6] The another technique employed was educating patient through main principles of motivational interviewing techniques by Miller and Rollnick[7] It was also established that the treatment of tobacco dependence reduces the risk of oral cancer as reviewed by Warnakulasuriya et al.[8]

Patients from both the groups were evaluated every 15 days during the treatment period for 3 months, and posttreatment evaluation was done after 1 month. During each visit, the patients were examined for:

**Burning sensation**

- Burning sensation with intolerance to spices was evaluated using a Visual Analogue scale (VAS) of 0-100, where 0 is no burning sensation and 100 is worst possible burning sensation. This was recorded at baseline and at 15 day intervals.

**Mouth opening**

- Mouth opening was measured using a Vernier caliper and was recorded in centimeters. This was assessed as the interincisal distance measured from the mesioincisal edge of the upper left central incisor tooth to the mesioincisal edge of the lower left central incisor tooth.

Statistical analysis

All the relevant data were entered in a pro forma. It was then sorted, tabulated, and statistically analyzed to draw a conclusion. The statistical analyses were done using SPSS (Statistical Package for Social Sciences) Version 16.0 (IBM, Chicago) statistical Analysis Software. The values were represented in number (%) and mean ± standard deviation; Chi-square test was used for determination of age and sex distribution of the patients between the groups. The Kolmogorov–Smirnov test (K–S test or KS test) and the Mann–Whitney U-test were used for evaluation of the statistical significance of burning sensation and mouth-opening values between groups. The P value was set at 0.05 and was considered highly significant at <0.01 and very highly significant at <0.001.

Results

**Age and sex distribution**

In the present study, 60 OSMF patients were included and were randomly divided into two groups. Majority of the patients in both Group A (63.3%) and Group B (70%) were <30 years. The mean age of the patients of Group A and Group B was 26.00 ± 6.43 and 27.90 ± 8.66 years, respectively. Statistically, there was no significant (P > 0.05) difference between the groups in terms of age (P = 0.58) [Table 1 and Graph 1].

Among 60 patients, 93.3% were males and 6.7% were female patients in both the groups, showing an extreme male predominance over female with the ratio of 14:1. Statistically, there was no significant difference in terms of gender between the two groups (P = 1.00) [Table 2 and Graph 2].
Habits

All patients of this study had a positive history of chewing areca nut or any of its commercial preparations. The most common form of areca nut used was found to be gutkha 90% and 10% pan masala in both the groups [Table 3 and Graph 3]. Individuals of both the group gave up the tobacco habit after the systematic counseling given from the baseline and in between the period of intervention which was reinforced once in fifteen days period for 3 months.

An element of social desirability bias cannot be overruled as it was a verbal reporting from the individuals that they have left the habit.

Burning sensation

In Group A, burning sensation at baseline (1st visit) observed was 65.83 ± 3.98% (VAS) which reduced to 47.33 ± 3.95% (VAS) on the 15th day, showing a gradual decline in the burning sensation [Figures 1 and 2]. After 2 months (60th day), there was marked decline in mean burning sensation which was 6.00 ± 1.48% (VAS) when compared with the baseline. The burning sensation completely reduced after 3 months treatment period [Figures 3 and 4]. After posttreatment, there was complete cessation of burning sensation [Table 4 and Graph 4].

In Group B patients, burning sensation at baseline observed was 62.33 ± 5.22% (VAS) [Figures 5 and 6] which reduced to 43.67 ± 4.52% (VAS) on the 15th day, showing a gradual decline in the burning sensation. After 45th day, there was marked decline in mean burning sensation which was 17.00 ± 3.22% (VAS) when compared with the baseline. The burning sensation completely reduced after 3 months treatment period [Figures 7 and 8]. Posttreatment, there

| Table 1: Age distribution of the patients between the groups |
| --- |
| Age (years) | Group A (n=30), n (%) | Group B (n=30), n (%) | P^a |
| <30 | 19 (63.3) | 21 (70.0) | 0.58 |
| ≥30 | 11 (36.7) | 9 (30.0) | |
| Mean±SD | 26.00±6.43 | 27.90±8.66 | |

^aChi-square test. SD=Standard deviation

| Table 2: Gender distribution of the patients between the groups |
| --- |
| Gender | Group A (n=30), n (%) | Group B (n=30), n (%) | P^a |
| Male | 28 (93.3) | 28 (93.3) | 1.00 |
| Female | 2 (6.7) | 2 (6.7) | |

^aChi-square test

| Table 3: Distribution of the patients according to personal habit between the groups |
| --- |
| Personal habit | Group A (n=30), n (%) | Group B (n=30), n (%) | P^a |
| Gutkha | 27 (90.0) | 27 (90.0) | 1.00 |
| Pan masala | 3 (10.0) | 3 (10.0) | |

^aChi-square test

| Table 4: The posttreatment assessment of mean burning sensation in Group A across the time period |
| --- |
| Time period | Group A (n=30) |
| 1st visit | 65.83±3.98 |
| Day 15 | 47.33±3.95 |
| Day 30 | 29.33±3.80 |
| Day 45 | 14.67±2.70 |
| Day 60 | 6.00±1.48 |
| Day 75 | 1.67±0.69 |
| Day 90 | 0.00±0.00 |
| Posttreatment | 0.00±0.00 |

^aMann-Whitney U-test. Values are in mean±SE. SE=Standard error
was complete cessation of burning sensation [Table 5 and Graph 5].

On comparing burning sensation between the groups across the time period, in Group A, the initial burning sensation was 65.83 ± 3.98% (VAS), and in Group B, it was 62.33 ± 5.22% (VAS). After 1½ months, the mean burning sensation in Group A gradually reduced to 14.67 ± 2.70%, and in Group B, it was reduced to 17.00 ± 3.22%. After 3 months, there was complete cessation of burning sensation in both the groups and was statistically nonsignificant (P > 0.05) [Table 6 and Graph 6].

**Mouth opening**

In Group A, mean mouth opening at baseline (1st visit) observed was 3.17 ± 0.08 cm which improved to 3.52 ± 0.07 cm after 3 months of treatment period [Figures 9 and 10]. In Group B, mean mouth opening at baseline (1st visit) observed was 3.32 ± 0.07 cm which improved to 3.52 ± 0.08 cm after 3 months of treatment period [Figures 11 and 12]. On comparing both groups, the difference was statistically nonsignificant (P > 0.05) [Table 7 and Graph 7].

However, on comparing intergroup, average percent change in mean mouth opening from 1st visit to subsequent time intervals across the time period was found to be statistically significant (P < 0.05). Group A showed 11.1 ± 1.0% improvement in mean mouth opening and Group B showed 6.2 ± 0.4% improvement in the mean mouth opening, after 3 months of treatment period. The change in the mean from 1st visit till posttreatment in Group A was 0.35 ± 0.14, and in Group B, it was 0.20 ± 0.09. Lycopene produced

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### Table 5: The posttreatment assessment of mean burning sensation in Group B across the time period

| Time period | Group B (n=30) | Mean ± SE |
|-------------|---------------|-----------|
| 1st visit   | 62.33±5.22    |           |
| Day 15      | 43.67±4.52    |           |
| Day 30      | 27.33±4.07    |           |
| Day 45      | 17.00±3.22    |           |
| Day 60      | 7.33±2.08     |           |
| Day 75      | 1.67±1.08     |           |
| Day 90      | 0.00±0.00     |           |
| Posttreatment | 0.00±0.00  |           |

*aMann-Whitney U-test. Values are in mean±SE. SE=Standard error

### Table 6: Comparison of burning sensation between the groups across the time period

| Time period | Group A (n=30) | Group B (n=30) | P* |
|-------------|----------------|----------------|----|
| 1st visit   | 65.83±3.98     | 62.33±5.22     | 0.94 |
| Day 15      | 47.33±3.95     | 43.67±4.52     | 0.62 |
| Day 30      | 29.33±3.80     | 27.33±4.07     | 0.70 |
| Day 45      | 14.67±2.70     | 17.00±3.22     | 0.74 |
| Day 60      | 6.00±1.48      | 7.33±2.08      | 0.95 |
| Day 75      | 1.67±0.69      | 1.67±1.08      | 0.49 |
| Day 90      | 0.00±0.00      | 0.00±0.00      | NA  |
| Posttreatment | 0.00±0.00   | 0.00±0.00      | NA  |

*aMann-Whitney U-test. Values are in mean±SE. SE=Standard error, NA=Not applicable

### Table 7: Comparison of mouth opening (cm) between the groups across the time period

| Time period | Group A | Group B | P* |
|-------------|---------|---------|----|
| 1st visit   | 3.17±0.08 | 3.32±0.07 | 0.18 |
| Day 15      | 3.22±0.07 | 3.35±0.08 | 0.28 |
| Day 30      | 3.30±0.08 | 3.38±0.08 | 0.50 |
| Day 45      | 3.36±0.07 | 3.44±0.08 | 0.49 |
| Day 60      | 3.41±0.07 | 3.36±0.08 | 0.66 |
| Day 75      | 3.47±0.08 | 3.51±0.08 | 0.68 |
| Day 90      | 3.52±0.07 | 3.52±0.08 | 0.96 |
| Posttreatment | 3.52±0.07   | 3.52±0.08   | 0.96 |

*aMann-Whitney U-test. Values are in mean±SE. SE=Standard error
Curcumin (diferuloylmethane), an active component of turmeric, is a yellow pigment that has been isolated from the ground rhizome part of the curcuma plant species, zingiberaceae. The antioxidant activity of curcumin depends on the presence of both its central methylene hydrogens and the phenolic hydrogens, that are involved in the mechanism of formation of the phenoxy radicals. It has a conjugated structure and shows a typical radical trapping ability as a chain-breaking antioxidant properties. In general, it has dual effect in oxygen radical reactions, it can act as a scavenger of hydroxyl radicals, or it catalyzes the formation of hydroxyl radicals. The antioxidant activity of curcumin could be mediated through antioxidant enzymes such as superoxide dismutase, catalases, and glutathione peroxidase.[4]

Curcumin exhibits low oral bioavailability in rodents and may undergo intestinal metabolism; absorbed curcumin undergoes rapid first-pass metabolism and excretion in the bile. It is estimated that about 40%–85% of curcumin remains unaltered after ingestion in the gastrointestinal tract where it is absorbed by the intestinal mucosa. Therefore, as the bioavailability of curcumin is low, its effect also reduces in the oral mucosa.[11]

The results of the present study highlights that lycopene and curcumin due to its anti-inflammatory and antioxidant property are effective in reducing the burning sensation and also have ability to increase some amount of mouth opening in patients with early stages of OSMF.

Majority of the patients in both Group A (63.3%) and Group B (70%) were <30 years; this was similar to the age range reported by Kumar et al.[12] (70.69%), Maher et al.,[13] and Borle et al.[14]

Among 60 patients, 93.3% were males and 6.7% were female patients, similar male predominance was reported by Pindborg[15] (81 out of 118 were male 2.2:1), Ahmad et al. (male to female ratio was 2.7:1),[16] and Hazarey et al. (male to female ratio was 4.9:1).[17]

Lycopene
In the current study, Group A patients who were treated with lycopene showed significant reduction in the burning sensation from the initial visit where mean
was 65.83% ± 3.98% (VAS) after 3 months; there was complete cessation of burning sensation. Similar findings were reported by Kumar et al. who conducted a study on 89 OSMF patients where lycopene with intralesional injection was found effective in reducing the burning sensation and the associated symptoms of OSMF.[12]

In today’s scenario, there is no treatment protocol that can restore the mouth opening to normal, but an improvement of a few millimeters was seen in the present study.
Lycopene showed an improvement of mean mouth opening 0.35 ± 0.08 cm (3.5 mm) after 3 months of the treatment period. The findings were similar with Karemore et al. who conducted a study on the effect of newer antioxidant lycopene in the treatment of OSMF that included 92 patients with OSMF. There was significant difference of maximum mouth opening between study and placebo group with Z calculated value of 5.65 mm as maximum mouth opening.\textsuperscript{[13]}
Patil et al. also conducted a study on one hundred and twenty clinicopathologically diagnosed OSMF patients who were included in the study. They were divided equally into Group A (lycopene group) and Group B (aloe vera group). Group A was administered 8 mg lycopene in two divided doses of 4 mg daily and Group B was given 5 mg aloe vera gel to be applied topically thrice daily for 3 months. Results showing clinical improvements in mouth opening and tongue protrusion were significant in Group A ($P < 0.001$), which was in accordance with our study. Lycopene can bring about significant clinical improvements in symptoms such as mouth opening and tongue protrusion when compared to aloe vera.$^{[19]}$

Similar preliminary study was carried out by Sudarshan et al. in 2012 to compare the efficacy of aloe vera with antioxidants in the treatment for OSMF. Aloe vera is a mannoprotein containing many amino acids called wound healing hormones. The polysaccharides contained in the gel of the leaves induce the promotion of wound healing and also have anti-inflammatory, immunomodulatory, and antioxidant properties. Aloe vera responded better in all the parameters assessed and responded in all the clinicohistopathological stages particularly in those with mild-stage clinically and early-stage histopathologically.$^{[20]}$

Hence, this study was designed to evaluate the efficacy of systemic and topical aloe vera in the treatment of OSMF. It also compared the efficacy of aloe vera with intralesional injections of hydrocortisone, hyaluronidase with antioxidant supplements.

Another study performed by Anuradha et al. suggested that systemic aloe vera and topical gel give promising results which were comparable with hydrocortisone injection in treatment of OSMF patients.$^{[21]}$

Hence, this study was designed to evaluate the efficacy of systemic and topical aloe vera in the treatment of OSMF. It also compared the efficacy of aloe vera with intralesional injections of hydrocortisone, hyaluronidase with antioxidant supplements.

A study was performed by Singh et al. on forty-four patients of OSMF which were divided randomly into two groups. The results showed mean improvement in mouth opening in Group A was 37.62% (12 mm) when compared to Group B patients (only intralesional steroids) which showed an average improvement of 13% (3.9 mm) and the results were statistically significant.$^{[22]}$

The initial inflammatory response in OSMF causes the burning sensation and intolerance to spicy foods. Chronic inflammation subsequently leads to progressive fibrosis. Steroids and other immunomodulatory drugs will effectively reduce inflammation but will not reverse existing fibrosis and may explain why such therapies show limited efficacy in patients who present too late when fibrosis is severe.$^{[23]}$

The results of this study suggest that lycopene, similar to steroids, exerts an anti-inflammatory effect, rather than an antifibrotic effect. Lycopene has also shown efficacy as a chemopreventive agent for oral premalignant lesions, presumably because of its antioxidant activity. It would thus be reasonable to hypothesize that lycopene could exert a similar effect on malignant progression in OSMF, and however, more studies are needed.$^{[24]}$

### Curcumin

Curcumin has been found to inhibit many disease processes through their anti-inflammatory, antioxidant, and anticancer properties. Curcuminoids isolated from turmeric have been found to have effective antioxidant, DNA-protectant, and antimitagen action.$^{[4]}$

In Group B, patients who were treated with curcumin showed marked reduction in the burning sensation on 1st follow up itself where the mean was 62.33 ± 5.22% (VAS), and after 3 months, there was complete cessation of burning sensation. In Group B, mean mouth opening improvement was 0.2 ± 0.07 cm (2 mm) after 3 months of the treatment period.

In addition, findings were reported in the study by Hazarey et al. that burning sensation reduced effectively in patients taking curcumin when compared with application of tenovate ointment. Results also showed that curcumin group showed 5.93 ±2.37 mm increase in mouth opening when compared to the control group 2.66 ±1.76 mm.$^{[25]}$

Yadav et al. performed a randomized interventional study using intralesional injection and curcumin on forty patients with clinically and histologically proven OSMF. Burning sensation improved in both the groups beginning from early to late stages. Complete resolution of burning sensation was noted in patients consuming curcumin and they concluded that curcumin was effective in reducing burning sensation in early stages of OSMF. There was slight increase in mouth opening of 1.25mm noticed with curcumin whereas intralesional group showed an increase of 3.13mm which was greater when compared to curcumin.$^{[26]}$

In accordance with our results, Das et al. performed a study where they compared curcumin and turmeric oil with multinal and concluded that curcumin and turmeric oil when compared was beneficial from invasive methods, affordable and noninvasive form of treatment in patients with OSMF.$^{[27]}$

Srivastava et al. have demonstrated the scavenging effect of curcumin on superoxide radicals, hydroxyl radicals, and lipid peroxidation. These studies also suggest that curcumin readily decreases atrophy of mucosa thereby reducing burning sensation.$^{[28]}$

Agarwal conducted a study to check the efficacy of turmeric in 30 OSMF patients. An improvement in mouth opening and burning sensation was noticed. It was hypothesized that
curcumin exerts anti-inflammatory activity by inhibiting a number of different molecules that participate in the process of inflammation. They also exhibit fibrinolytic property due to its ability to inhibit lipid peroxidation and check cellular proliferation, thereby reducing the rate of collagen synthesis.\[29\]

The Cochrane review by Fedorowicz et al. was with the objective to assess the effectiveness of interventions in the management of pain and restricted jaw opening or movement occurring as a result of OSMF. Only randomized controlled clinical trials of patients with trismus or restricted jaw opening and a confirmed diagnosis of OSMF by clinical examination and biopsy were considered.\[30\]

Primary outcome for the reviewers set out to assess included (i) resumption of normal eating, chewing, and speech, (ii) improvement in maximal jaw opening, measured as interincisal distance, (iii) improvement in range of jaw movement utilizing any validated assessment tool, and (iv) change in severity of oral/mucosal burning pain using any recognized validated pain scale. Investigators also included other objective measures which include changes in tongue protrusion, degree of suppleness of the tissues, amount of blanching of the mucosa, presence of ulceration or vesicle formation, and amount of dorsal tongue papillation, although the methodology for measuring these other objective outcomes was poorly defined and of questionable reliability according to Kerr et al.\[30\]

The most recent study was conducted by Kopuri et al. in which they concluded lycopene has produced better improvement in mouth opening and reduction in fibrous bands than curcumin. Curcumin has produced better improvement in burning sensation and blanching. These findings were in accordance with our study.\[31\]

Some of the limitations of this study are described below; however, it is important to discuss these limitations, not for the purpose of criticism, but for the benefit of future studies. Having conducted clinical research in India, I am aware of the challenges researchers are facing and appreciate the authors for their efforts, particularly in dealing with potential individuals who belong to a backward socioeconomic group. Such individuals were poor and with no education, which has implications not only to an informed consent perspective but also related to their inability to return for follow-up visits.

Other limitations are the use of a VAS (or other validated pain-rating scale) to measure the oral burning sensation recommended at every follow-up visit. Kumar et al.\[12\] suggest that the use of the VAS may be true to its cultural difference which could result in a lower baseline score; this scale is very simple to incorporate into the design and there is undoubtedly value in recording the changes at different time points. The visual analog scale was considered as nonparametric for the results of this study. The outcome measure in the present study was of subjective type – VAS to measure the burning sensation but the mouth opening measured was on the clinical basis done under objective criteria as described by Khanna and Andrade\[35\] 1995 which is the most frequently measured outcome in various published studies; however, the validation of these measurements is not clearly defined in any of these studies.

Conclusion

The present study revealed that lycopene is better than curcumin in improving mouth opening and both the medication showed a beneficial effect on reducing the symptoms of Group-A and Group-B OSMF. Thus, both lycopene and curcumin act as a potent antioxidant for treatment of this debilitating potentially malignant disorder and are considered as safe, nontoxic, and effective alternative for many conventional drugs due to its distinguished therapeutic properties and multiple effects on various systems of the body.

Habit cessation alone as an intervention may have a large effect, on the symptoms of OSMF rather than reversing fibrosis.\[30\]

In contrast to other management modalities for submucous fibrosis, systemic oral treatment offers a noninvasive option that yields significant improvement in the symptoms as well as signs of the condition. Further studies on a larger sample size with longer follow-up periods are required to know the long-term effect of lycopene and curcumin.

Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent forms. In the form the patient(s) has/have given his/her/their consent for his/her/their images and other clinical information to be reported in the journal. The patients understand that their names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

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Conflicts of interest

There are no conflicts of interest.

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