



Letter

Enhancing post-treatment outcomes in patients with oral cancer: Integrating interventions and psychosocial support



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Studying adaptive lifestyle interventions among patients with oral cancer is essential for improving post-treatment outcomes. To date, studies have examined evidence-based interventions targeting dietary changes, physical activity, and smoking 8 greatly improved survivorship metrics, including enhancing quality of life (QOL), optimizing general health, and reducing cancer recurrence risks. Ultimately, post-treatment, tailored adaptive interventions are vital for patients with oral cancer to sustain their health and well-being. This article aims to provide a comprehensive overview of adaptive lifestyle interventions for oral cancer survivors to improve post-treatment outcomes. The main objective of this study is to highlight the importance of dietary modifications, physical activity, smoking cessation programs, and psychosocial support in enhancing the quality of life, optimizing general health, and reducing cancer recurrence risks. The findings underscore the need to integrate evidence-based interventions into survivorship care plans, benefiting individual survivors and influencing broader healthcare strategies.

The post-treatment phase for patients with oral cancer requires several long-term dietary modifications.¹ Several studies have demonstrated the ability of various food compounds to prevent and treat cancer. Existing research strongly suggests that daily consumption of 600 g, approximately 7.5 servings, of fruits and vegetables is associated with the lowest risk of cancer. Likewise, the consumption of 100 g of fish per meal, 2–3 times weekly, and 30 g of yogurt or milk daily, is recommended to reduce the risk of cancer.¹ Moreover, different nutraceuticals can suppress the activity of telomerase, a reverse transcriptase controlling telomere length, in tumor cells. Telomerase inhibitors derived from plant metabolites include polyphenols, terpenoids, xanthones, alkaloids, sesquiterpenes, and coumarins. Several *in vivo*, *in vitro*, and *in silico* studies have reported the cytotoxic and anti-proliferative potential of these metabolites. Curcumin, for instance, has demonstrated a significant chemopreventive or chemotherapeutic role in various cancer cell lines, including Bel7402 (Beijing Liver 7402), SGC7901 (Shanghai Gastric Cancer 7901), and HL60 (Human Leukemia 60), further underscoring its anti-cancer potential.² The fiber content in fruits and vegetables has been reported to act as a chemopreventive agent

in the treatment of colon cancer. Luteolin, a flavonoid found in vegetables and crop plants, such as perilla, green paper, and celery, has been clinically proven to be an effective colon cancer agent. Many *in vivo* and *in vitro* studies have reported that luteolin decreases tumor incidence and the proliferation of papillomas, and stimulates apoptosis in several cell lines.³ Marine nutraceuticals are currently gaining interest. For instance, acetyl-lipoarantoin, isolated from *Aspergillus* spp., has been reported to induce apoptosis in HCT116 cells.⁴ This was confirmed by poly (adenosine diphosphate-ribose) polymerase (PARP), caspase-3, -8, -9, and Bax cleavage, and annexin-V/PI staining.

Bioactive compounds in food can also induce epigenetic changes in cells by modifying their genetic material. These changes include genetic expression by non-coding RNA (nc-RNA), histone modification, and DNA methylation.⁵ These bioactive compounds are present in foods such as fruits, vegetables, garlic, cereals, tea, etc.⁶ Table 1 lists various bioactive compounds, their respective food sources, and their epigenetic functions related to cancer.⁷

Post-treatment and physical activity interventions are vital for patients with oral cancer. Standard treatment methods for oral cavity cancer include surgical resection and radiotherapy. After treatment, a large portion of the oral cavity is removed, which greatly affects the patient's ability to speak, swallow, and chew. Rehabilitation exercises can help patients regain tissue function. The oral exercise interventions include cheek massage (1 min), jaw stretch (10 s, 10 times), facial muscle movement (10 times), tongue movement (10 times), sucking (10 times), chewing (10 times), and intensive mouth opening (10–15 min).⁸ Jaw motion rehabilitation systems, such as dynasplint, therabite, and tongue depressor, help improve and prevent trismus. Previous studies have indicated that exercise enhances the maximum interincisal opening in patients with cancer. These studies were performed using small sample sizes and varied exercise methods. In a quasi-experimental study, the efficacy of oral exercise programs in enhancing the maximum interincisal opening in patients with oral cancer was studied. In 69 participants, three daily exercises for 20 min were performed for 6 months. A mean increase of 2.5 mm was achieved in comparison with the control group, supporting the effectiveness of the intervention.⁹

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Table 1

Various bioactive compounds and their food sources and epigenetic functions concerning different cancer types.

| Food source | Key compounds | Properties | Diet compound | RDA recommended intake | Epigenetic function | Cancer types |
|---|--|--|---------------|------------------------|---|---|
| Green tea | Polyphenols and catechins | <ul style="list-style-type: none"> • Antioxidant • Anti-inflammatory • Metastasis inhibition • Epigenetic modification | EGCG | 200–300 mg/day | <ul style="list-style-type: none"> • HAT inhibitors • Modulate miRNA • DNMTs | Oral, skin, pancreatic, breast, ovarian, gastric, and head and neck |
| Grapes, blueberries, mulberries, peanut | Polyphenols, flavonoids and anthocyanins | <ul style="list-style-type: none"> • Anti-oxidant • Cardioprotective • Anti-cancer | Resveratrol | 100–500 mg/day | <ul style="list-style-type: none"> • DNMT and HDAC inhibitors | Liver, breast, lung, skin and colon |
| Turmeric | Curcuminoids and volatile oils | <ul style="list-style-type: none"> • Anti-oxidant • Anti-cancer • Neuroprotective • Anticancer | Curcumin | 30–90 mg/day | <ul style="list-style-type: none"> • miRNA modulator and DNMT inhibitors | Esophageal, prostate, cervical and colon |
| Animal protein | Amino acids, collagen, omega-3 fatty acids, bioactive peptides | | Zinc | 11 mg/day | <ul style="list-style-type: none"> • DNA repair | Oral |
| Tomatoes, watermelon | Flavonoids and phenolic compounds | <ul style="list-style-type: none"> • Anti-oxidant • Anti-inflammatory | Lycopene | – | <ul style="list-style-type: none"> • Partial demethylation of promoters | Oral and prostate |
| Beans, and green vegetables | Phytochemicals | <ul style="list-style-type: none"> • Anti-oxidant • Anti-inflammatory | Folate | 400 mg/day | <ul style="list-style-type: none"> • Alters DNA methylation pattern | Lung, brain, breast, and cervix |

DNMT: Deoxyribonucleic acid methyltransferase; EGCG: Epigallocatechin gallate; HAT: Histone acetyltransferase; HDAC: Histone deacetylase; miRNA: Micro-ribonucleic acid; RDA: Recommended Dietary Allowance.

In contrast, smoking cessation programs are essential after the treatment of oral cancer. The overall mortality rate in patients who smoked even after cancer diagnosis was elevated from 4% to 20%. Continuation of smoking elevates the risk of disease recurrence and reduces treatment efficacy. The leading rationale behind various interventions involves minimizing the intake of tobacco, which poses a high risk of cancer recurrence and adverse treatment outcomes.¹⁰ A recent report analyzed 36 studies on smoking cessation programs, including randomized and non-randomized controlled trials involving 17 and 19 participants. The results indicated that approximately 77.8% of the programs utilized both counseling and medications, while 85.7% of them provided medicines at no cost.¹¹ In another study, 1210 patients were screened and counseled, with the number increasing every year, and approximately 58% of patients indicated a desire to quit after the programs.¹² These combined approaches help patients with oral cancer quit smoking in the long term and live tobacco-free lives by providing the right information and resources to achieve a better life.

Psychosocial support is crucial to provide comprehensive care to patients with oral cancer, before and after treatment. A previous study assessed the quality of patients' lives preoperatively. This study included 206 patients from various cancer centers in southern India. Among them, 171 were finalized for a QOL survey using the Functional Assessment of Cancer Therapy Head and Neck (FACT-H&N) and FACT-General (FACT-G) version 4. The results indicated poor QOL and emotional distress owing to inadequate emotional support from society.¹³ A longitudinal assessment tracked psychosocial adjustment in patients with oral cancer before and after surgery. Factors such as social support, symptoms, facial disfigurement, and psychosocial adjustment were considered in the analysis. Data were collected from 50 patients, 1 and 3 months before surgery and 5 months after surgery. The results indicated psychosocial maladjustment in 50%, 59.2%, 66%, and 62% of the participants. A high risk of these conditions is predicted in patients with lower income, communication difficulties, advanced-stage cancer, and severe pain. Continued psychological assessment and regular support are crucial for these high-risk groups.¹⁴ Treatment involves individual counseling, group- or internet-based support groups, and lectures on mindfulness-based stress reduction. This also includes the cognitive behavioral therapy needed to assist patients in dealing with treatment-induced anxiety and depression, which are common among patients with oral cancer. Over the next decade, further research will be

conducted on cognitive behavioral therapy and the role of various racial and ethnic groups in addressing support groups. Therefore, psychosocial care providers enable patients to cope with psychologically challenging periods.

Therefore, existing findings suggest the need for integrating evidence-based interventions into comprehensive post-treatment care plans to benefit patients and achieve the desired long-term outcome.¹⁵ Moreover, the applications can extend from the individual level to the systemic level, influencing healthcare strategies, and can reduce costs and improve treatment efficacy.

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Authors contribution

Yaashikaa Ponnambalam Ragini: conceptualization, writing - original draft preparation, writing - reviewing and editing, and supervision. The author claims sole responsibility for the contents and conclusions of the review.

Ethics statement

None.

Data availability statement

The datasets used in the current study are available from the corresponding author on reasonable request.

Conflict of interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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