

ORAL HYGIENE IN PATIENTS WITH ORAL CANCER UNDERGOING CHEMOTHERAPY AND/OR RADIOTHERAPY AFTER PROSTHESIS REHABILITATION: PROTOCOL PROPOSAL

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SUMMARY

Purpose. This study was aimed at assessing the effectiveness and the importance of an oral hygiene (OH) protocol in patients undergoing radiation therapy and chemotherapy after prosthesis rehabilitation, in order to reduce or minimize oral complications.

Materials and methods. This study was carried out at the Department of Dental Science, at the University of Bari-Italy from December 2012 to December 2015 on 34 selected patients with primary oral cancer undergoing chemotherapy and radiotherapy after prosthesis rehabilitation. They were divided into 2 groups according to their age, sex and cancer therapy. Seventeen patients were assigned to the control group and seventeen in the experimental one. In the experimental group (Table 1), patients underwent an oral hygiene protocol whereas in the control group (Table 2) patients received the usual care provided within the clinical setting. All the patients gave written informed consent. It has been asked and obtained the authorisation from the Ethics Committee of the Dental Science and Surgery Department.

Results. Results show that in patients undergoing the oral hygiene protocol, the complications and the risks of infection and permanent dental problems have been minimized. Indeed, of the seventeen patients undergoing the OH protocol, 70% obtained positive results and were satisfied with the program outcome.

Conclusions. The role of the health care providers is essential to educate patients to adhere to the prescribed treatments and reinforce their motivation in oral hygiene. The oral hygiene procedures prevent and ameliorate oral complications due to the radiation therapy and chemotherapy.

Key words: oral cancer, oral hygiene protocol, chemotherapy, radiotherapy.

Introduction

Thanks to the improvement of therapeutic techniques, the survival rate in patients with head and neck cancer has gradually increased. Depending on the site and extent of the primary tumour and the status of the lymph nodes, oral cancer may be a consequence due to radiation therapy and chemotherapy. A wide range of functions may be affected including speech, deglutition, the management of oral secretions and mastication.

The oral complications displayed by head and neck cancer patients that undergo radiation therapy are mucositis, bacterial, viral and/or fungal infections, salivary gland dysfunction, dysgeusia, swallowing, major tooth decay, sore mouth, jaw stiffness, denture problems, smell voice quality and larynx swelling (1-5). Indeed, due to the deleterious side effects of these treatments, patients experience a significant drop in their quality of working and social life (1, 6), which can adversely complicate the subsequent rehabilitation.

Given that the oral health care in the supervision oral health before, during, and after cancer therapy is necessary to reduce the incidence and severity of oral complications (1), the aim of this study was to highlight the importance of oral hygiene and provide an oral hygiene protocol for the oral management during chemotherapy or radiation therapy.

Materials and methods

At the Dental Science and Surgery Department, at the University of Bari-Italy from December 2012 to December 2015 34 patients with primary oral cancer undergoing chemotherapy and radiotherapy after prosthesis rehabilitation were examined. To reduce the increased risks of infection and permanent dental problems, an oral hygiene protocol was applied. They were divided into 2 groups according to their age (average 60-70 years), sex (10 males, 7 females), type of cancer therapy (head and neck surgery, chemotherapy, head and neck irradiation and blood and bone marrow transplant). Seventeen patients were assigned to the control group and 17 to the experimental one. In the experimental group (Table 1), patients underwent an oral hygiene protocol whereas patients in the control group (Table 2) received the usual care provided within the clinical setting. All the patients gave written informed consent. It has been asked and obtained the authorisation from the Ethics Committee of the Dental Science and Surgery Department.

Oral complications can cause serious and disabling problems in patients undergoing cancer therapy. Therefore, it is important to develop a specific instrument to measure oral mucosal changes during therapy. The Oral Mucosa Rating Scale (OMRS) has an examination rating scale to quantify the type and severity of clinically evident oral mucosal changes (atrophy, erythema, ulceration, and pseudomembranous, hyperkeratotic, lichenoid, and edematous changes), with a scale ranging from 0 to 3 (normal to severe). Separate visual analogue scales are obtained for dryness and osteoradionecrosis. To measure the severity of bleeding, it has been used the World Health Organization (WHO) standardized grading scale ranging from 0 to 4 (no bleeding to debilitating blood

loss).

Research have shown that fewer problems develop when oral disease is eliminated, when an oral prophylaxis is performed prior to the initiation of chemotherapy (7) and when excellent oral hygiene is maintained throughout therapy.

Therefore, the oral hygiene protocol during chemotherapy and radiation therapy should include the following steps:

First appointment (2 weeks before initiation radiations or chemotherapy)

- *Medical history or anamnesis:* patient's cancer diagnoses (disease and stage), past and planned treatments, the patient's oral health conditions and current treatments and his haematological health state with regard to the leukocyte and platelet count (7, 8).
- *Oral and clinical examination and radiographic evaluation:* dental formula, caries, mucositis and dry mouth, plaque score and plaque index, bleeding on probing, pockets and alveolar bone loss (Dental Panoramic Tomography, DPT or Serigraphy) (9).

Preventive and therapeutic care: any periodontally weak or mutilated tooth should be extracted. Abscessed teeth should be extracted or treated endodontically. All surgical procedures should be completed at least 10-12 days prior to onset of neutropenia. Additional therapy like restoration of carious teeth, replacement of faulty restorations, removal or correction of ill-fitting partial or complete prosthesis should be done. Dentures should be meticulously cleaned and soaked daily in nystatin to obviate often unsuspected source of fungi (7) as well as adequate time for wound healing before the induction of radiations and chemotherapy.

Conservative dentistry and extractions: at this stage, conservative treatment may be carried out. Endodontic therapy (10, 11) and extractions are not contraindicated, as long as the patient does not present signs and symptoms of osteoradionecrosis and haematological dysfunctions. Invasive therapies need antibiotic prophylaxis, especially in patients with leucopenia (7, 12).

Table 1 - Group A: Patients undergoing the oral hygiene protocol.

Sex	Age	Oral health status	Types of cancer	Stage of disease	Type of cancer therapy	Evaluation of oral complications
m	67	partially edentulous	oral cavity cancer: the alveolar ridge	Stage II	radiotherapy	no oral complications
m	73	edentulous	oral cavity cancer: the retromolar trigone	Stage III	surgery and postoperative radiation	minor improvement
f	75	edentulous	oral cavity cancer: the hard palate	Stage II	surgery and radiotherapy	no oral complications
m	66	partially edentulous	oral cavity cancer: the buccal mucosa	Stage II	radiotherapy	no oral complications
m	71	partially edentulous	oral cavity cancer: the alveolar ridge	Stage I	radiotherapy	no oral complications
f	74	edentulous	oral cavity cancer: the hard palate	Stage II	surgery and radiotherapy	minor improvement
f	65	partially edentulous	nasal cavity and paranasal sinuses	Stage II	chemotherapy and radiotherapy	no oral complications
m	70	edentulous	oral cavity cancer: the hard palate	Stage II	surgery and radiotherapy	no oral complications
f	68	partially edentulous	oral cavity cancer: the alveolar ridge	Stage II	radiotherapy	minor improvement
m	77	edentulous	nasal cavity and paranasal sinuses	Stage II	chemotherapy and radiotherapy	no oral complications
m	64	partially edentulous	oral cavity cancer: the retromolar trigone	Stage II	radiotherapy	minor improvement
f	63	partially edentulous	oral cavity cancer: the buccal mucosa	Stage II	radiotherapy	no oral complications
m	72	edentulous	oral cavity cancer: the hard palate	Stage III	chemotherapy and marrow bone transplant	minor improvement
m	70	partially edentulous	nasal cavity and paranasal sinuses	Stage II	chemotherapy and radiotherapy	no oral complications
f	63	partially edentulous	oral cavity cancer: the retromolar trigone	Stage II	radiotherapy	no oral complications
m	60	partially edentulous	oral cavity cancer: the alveolar ridge	Stage II	radiotherapy	no oral complications
f	78	edentulous	nasal cavity and paranasal sinuses	Stage II	chemotherapy and radiotherapy	no oral complications

Oral hygiene instruction and motivation: detailed oral hygiene instructions on specific oral care practices should be provided to ensure that patient fully understand what is required and may carry out appropriately at home (9).

Impression taking for study models: preliminary gypsum models should be prepared for each patient who has experienced a surgical operation for the removal

of an oral neoplasia (3) in order to correct or minimize maxillary defects. Disabilities created by surgery of the hard or soft palate may cause problems: chewing (mastication) may be difficult (13), particularly for the patient without natural teeth. Because denture-bearing tissue surfaces are lost, it is difficult for the denture to seal completely around the edges, a key factor in holding it securely in place. Swallowing likely will be-

Table 2 - Group B: Patients who do not follow the oral hygiene protocol.

Sex	Age	Oral health status	Types of cancer	Stage of disease	Type of cancer therapy	Evaluation of oral complications
m	66	partially edentulous	oral cavity cancer: the alveolar ridge	Stage II	radiotherapy	mucositis, infection and xerostomia
f	68	edentulous	oral cavity cancer: the retromolar trigone	Stage III	surgery and postoperative radiation	mucositis, infection xerostomia and osteoradionecrosis
m	75	edentulous	oral cavity cancer: the hard palate	Stage II	surgery and radiotherapy	mucositis, infection xerostomia and osteoradionecrosis
m	67	partially edentulous	oral cavity cancer: the buccal mucosa	Stage II	radiotherapy	mucositis, infection and xerostomia
f	74	partially edentulous	oral cavity cancer: the alveolar ridge	Stage I	radiotherapy	mucositis, infection and xerostomia
m	61	edentulous	oral cavity cancer: the hard palate	Stage II	surgery and radiotherapy	mucositis, infection xerostomia and osteoradionecrosis
f	63	partially edentulous	nasal cavity and paranasal sinuses	Stage II	chemotherapy and radiotherapy	mucositis, infection, xerostomia and bleeding
m	73	edentulous	oral cavity cancer: the hard palate	Stage II	surgery and radiotherapy	mucositis, infection xerostomia and osteoradionecrosis
f	76	partially edentulous	oral cavity cancer: the alveolar ridge	Stage II	radiotherapy	mucositis, infection and xerostomia
m	68	edentulous	nasal cavity and paranasal sinuses	Stage II	chemotherapy and radiotherapy	mucositis, infection, xerostomia and bleeding
m	76	partially edentulous	oral cavity cancer: the retromolar trigone	Stage II	radiotherapy	mucositis, infection and xerostomia
f	78	partially edentulous	oral cavity cancer: the buccal mucosa	Stage II	radiotherapy	mucositis, infection and xerostomia
m	70	edentulous	oral cavity cancer: the hard palate	Stage III	chemotherapy and marrow bone transplant	mucositis, infection, xerostomia and bleeding
f	72	partially edentulous	nasal cavity and paranasal sinuses	Stage II	chemotherapy and radiotherapy	mucositis, infection, xerostomia and bleeding
m	69	partially edentulous	oral cavity cancer: the retromolar trigone	Stage II	radiotherapy	mucositis, infection and xerostomia
m	65	partially edentulous	oral cavity cancer: the alveolar ridge	Stage II	radiotherapy	mucositis, infection and xerostomia
f	79	edentulous	nasal cavity and paranasal sinuses	Stage II	chemotherapy and radiotherapy	mucositis, infection, xerostomia and bleeding

come awkward, since food and liquid may be forced up into the nasal cavity and out the nose. The nasal mucous membranes become dried out (desiccated) by abnormal exposure to the oral environment, causing chronic irritation. Nasal and sinus secretions may collect in the defect area. Facial disfigurement can result from lack of midface bony support for the facial soft tissues, or the necessary surgical damage to a branch of the facial nerve. In some cases, extensive tumour invasion requires surgical removal of the eye (14). To remedy the surgical defect after surgical resection of the hard or soft palate and improve patient's quality of life, a temporary prosthesis, known as an immediate surgical obturator, is placed. During the healing period, this prosthesis is relined periodically to compensate for tissue changes which occur as a normal part of the healing process. When these tissues become well healed and dimensionally stable (usually 3 to 4 months after surgery), the final prosthesis is made (14). The goal of an obturator prostheses is to maintain the physical separation between the oral and nasal cavities, thereby restoring speech and swallowing to normal, and to provide support to the lip and cheek. Inadequate retention of the obturator compromises stability. The remaining teeth, therefore, become extremely valuable in providing support, retention, and stability for these restorations. Immediate or early coverage of a palatal defect with an obturator is important (14). An obturator is used to provide a matrix upon which the surgical packing can be placed, minimizes contamination of the wound in the immediate postoperative period, and enables the patient to speak and swallow effectively immediately after surgery. In order to fabricate the prostheses, a stone model is made of the maxillary arch and the anterior portion of the soft palate. The obturator's size is determined by the surgical boundaries of the resection, as indicated by the surgeon. In the patient who still has natural teeth, those in the path of the surgical resection are removed from the model. The obturator can now be made before the surgery, using self-curing plastics, and be ready for immediate insertion afterwards. If necessary, this first obturator can be altered at surgery by trimming its size, or by adding a temporary denture relined material. After surgery, the prosthesis is wired to remaining teeth, alveolar ridge, or other available structures (14).

Dietary advice: a sugar-free diet reduce the risk of developing caries.

Second appointment (5-6 days after radiations or chemotherapy)

Oral hygiene evaluation and motivation: by using a plaque score or a plaque index and by checking deposits on teeth and for all kinds of prostheses.

Prescription of medicaments: preventive measures are essential to minimize discomfort in patients undergoing radiotherapy and chemotherapy. In patients who suffer from mucositis, the interventions used to reduce mucosal toxicity should include allopurinol, growth factors and providing-based mouthwashes, hydrolytic enzymes, amiphostine, sucralfate and antibiotics, honey, low-intensity laser, oral hygiene, analgesics and anti-inflammatory drugs (15).

Oral management of the xerostomic patient includes (16): plaque removal: tooth brushing; flossing; other oral hygiene aids; remineralizing solutions (17): fluoride and calcium/phosphates; topical high concentration fluorides; topical antimicrobial rinses (chlorhexidine solutions/rinses; povidone iodine oral rinses; tetracycline oral rinses). Sialogogues (pilocarpine; cevimeline; bethanechol; antholectrithione).

Patients who develop osteoradionecrosis should be comprehensively managed to include elimination of trauma, avoidance of removable dental prosthesis if the denture-bearing area is within the osteonecrotic field, assurance of adequate nutritional intake, and discontinuation of tobacco and alcohol use. Topical antibiotics (e.g., tetracycline) or antiseptics (e.g., chlorhexidine) may contribute to wound resolution (18, 19). Hyperbaric oxygen therapy (HBO) is also suggested for the management of ORN, though it has not been universally accepted. In cases presenting early, 30 HBO dives to 2.4 atmospheres for 90 minutes have been advocated. Good responders should continue to a total of 40 dives. Those planned for radical surgery should have 20 dives preoperatively followed by 10 dives post operatively (20). Radical surgery may be required in severe cases of osteoradionecrosis (20).

Oral hygiene motivation reinforcement: patients should be informed about their oral hygiene condition and motivated/educated again if it was necessary. If the patient's oral hygiene is satisfactory, he will be encouraged to carry on. Considering the patient health status, the practitioner should always be aware that he is making a consistent effort. For this reason, his condition has to be improved (21). Patients suffering from xerostomia should be advocated to brush and floss regularly and to use fluoride daily (22). It is recommended to use a 0.4% stannous fluoride gel or a 1.1% neutral sodium fluoride gel, preferably unflavoured. If tooth decay continues, it is useful to apply the fluoride tray method.

It is possible to obtain a fluoride tray on a gypsum model resulting from alginate impressions. The tray margins may be smoothed with a fine bur for composite (23).

Third/fourth appointment (after 5-6 days)

Reassessment of oral hygiene and reinforcement of oral hygiene motivation: all patients should be monitored to check their periodontal hygiene and motivated once again (21) if necessary.

Following appointments (twice a month)

Periodontal assessment and reinforcement of oral hygiene motivation: it is recommended to check the patient oral hygiene and correct his oral hygiene techniques. It is suggested to check patients leukocyte and platelet counts and in relation to these values therapy might eventually be modified (3). Follow-up appointments are a good opportunity to substitute the conditioning material used for the obturator. When oral hygiene is satisfactorily reached and maintained (it usually takes three months), follow-up visits may be carried out on monthly appointments.

Follow-up (every 7-10 days)

Results

Results show that after the beginning of the oral hygiene protocol, the complications and the risks of infection and permanent dental problems have been minimized. Indeed, among the 17 dental assisted-patients, 70% obtained positive results in relation to those who received the common dental treatments. The oral cavity was free from sources of irritation and infections and patients were satisfied with the program outcome.

Discussion

Orally side effects are a major source of illness in patients undergoing chemotherapy or radiotherapy. Complications associated with chemo-radiotherapy can be direct, caused by toxic action of treatment agents on the proliferative mucosal lining of the mouth, or indirect. Indeed, radiation of the head and neck may irreversibly injure oral mucosa, muscles and bones that may result in permanent xerostomia, rampant caries, soft tissue-necrosis and osteoradionecrosis (ORN) of the jaw. Chemotherapy side effects include: mucositis, mouth bleeding, dry mouth, taste changes, mouth infections, temporary hair loss, nausea with or without vomiting, diarrhoea, weakness, vulnerability to infection, easy bleeding and brushing, thrombocytopenia, leucopenia, neutropenia. Mucositis can occur in 40% of patients treated with chemotherapy (5, 24) and its frequency depends on the patient's diagnosis, age, level of oral health, and type, dose, and frequency of drug administration (5). A significant discomfort and impairment of the patient's ability to eat and swallow is related to acute severe OM which is also related to breaks in treatment, the placement in feeding tubes and hospitalization (24).

Patients with xerostomia often complain of taste disorders (dysgeusia), a painful tongue (glossodynia) and an increased need to drink water, especially at night. Furthermore, xerostomia can lead to increased dental caries, parotid gland enlargement, inflammation and

fissuring of the lips (cheilitis), inflammation or ulcers of the tongue and buccal mucosa, oral candidiasis, salivary gland infection (sialadenitis), halitosis and cracking and fissuring of the oral mucosa (25, 26).

Some regeneration can occur several months after treatment and the undesirable effects and symptoms of xerostomia (dry mouth with discomfort, difficulty in speech and swallowing) may be modified. However, recovery of adequate saliva for oral comfort and function may take up to 12 months; in some cases the saliva remains inadequate indefinitely, especially if the salivary glands are directly irradiated.

Osteoradionecrosis (ORN) is a complication that results from compromised vascularity following surgery or from radiation-induced hypovascularity as well as from cytotoxic effects on bone-forming cells and tissue, hypocellularity, and hypoxia of affected bone (27). With ageing and atherosclerotic changes there is an increased dependence on blood supply from the attachments. Besides, both the mandible and maxilla are the only bones in the body that are exposed directly to the external environment through the gingival attachment of the teeth. Any breaches in the integrity of the tissues result in healing with an increase in bone turnover. In an irradiated field, minor insult such as periodontal disease, pulpal infections and procedures such as dental extractions can result in delayed healing and in some cases develop into osteoradionecrosis. Complications associated with ORN include intractable pain, pathologic fractures, oral and cutaneous fistulas, and loss of large areas of bone and soft tissue (27).

Only a minority of patients goes on to develop osteoradionecrosis following radiotherapy and this number is thought to be falling thanks to a multidisciplinary collaboration along with developments in radiotherapy and radiotherapy protocols and a better patient education. Potentially riskful foci of oral disease should be eliminated before radiation therapy begins.

Bleeding may occur during chemotherapy when anti-cancer drugs affect the ability of blood to clot. Bleeding may be mild or severe, especially at the gum line and from ulcers in the mouth (28). When blood counts drop below certain levels, blood may ooze from the gums. Spontaneous gingival oozing may occur when platelet counts diminish to less than $30.000/\text{mm}^3$, especially when there is pre-existing gingivitis or periodontitis (28). In case of pre-existing gingivitis or periodontitis

gingival oozing can be induced even by normal function or routine oral hygiene (brushing and flossing) (28).

On the basis of these considerations, it is essential that a multidisciplinary approach is used for oral management of the cancer patient before, during, and after cancer treatment. A multidisciplinary approach is suggested because the medical complexity of these patients affects dental treatment planning, prioritization, and timing of dental care. Thus, a multidisciplinary doctors team that includes oncologists, oncology nurses, and dental generalists and specialists as well as ocidental hygienists, social workers, dieticians, and related health professionals can often achieve highly effective preventive and therapeutic outcomes relative to oral complications in such patients.

Conclusions

Patients who have been treated for oral neoplasia might minimize oral complications by changing their behaviours in their oral hygiene. Indeed, oral hygiene protocols may ameliorate and prevent oral complications of cancer therapy and improve the quality of their life. Thus, health care providers should continue to educate patients and advise them to begin daily oral hygiene home care routine as soon as possible and adhere to prescribed oral hygiene procedures.

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