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RESEARCH ARTICLE

RADIATION THERAPY AND ITS PROSTHODONTIC IMPLICATIONS: REVIEW

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ABSTRACT

Cancer associated with maxillofacial part is most common type of disorder, and it accounts for more than 550,000 cases annually worldwide. Multidimensional potential risk factors of dental implants failure must be considered when planning implant placement therapy in patients undergoing radiation therapy especially in maxillofacial region. Meticulous treatment planning along with careful preoperative oral examination and good coordination with oncologic specialists cannot be overemphasized. It is also important for the dental profession to keep abreast of the latest available radiation therapy technologies. Additional evidence-based clinical guidelines for implant use in patients undergoing radiation therapy are expected. Hence this paper reviews on literature behind the effect of radiations on dental implants.

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INTRODUCTION

The use of dental implant therapy for rehabilitation of missing teeth offered many benefits over the conventional tissue born prosthesis. These benefits include good stability, retention, mastication, improved patients comfort and acceptance however, implant therapy in rehabilitation of orofacial parts was considered to be complex and contraindication in the patients undergoing radiation therapy. Radiation therapy causes injury to the remodeling system by damaging the osteoblast and osteoclast cells, and reduce the proliferation of bone marrow, collagen, and blood vessels. The injury to the vascular system shows as hyperemia followed by endarteritis and decreasing microcirculation. The bone marrows become hypocellular, hypovascular that shows signs of marked inflammation, fibrosis, and fatty degeneration. The placement of dental implants in such irradiated areas is difficult, due to reduced blood circulation and damaged bone remodeling system. Recently the new technique was introduced for placement of dental implants that is facilitated by computer-guided implant placement, which helps in identification of the ideal site for placement of implant during surgery (Basquill, 1994; Nakagawa *et al*., 2002; Sigmar Kopp, 2009). However, Primary placement and stability of implant may be affected due to ongoing or post radiation therapy.

Secondary placement allows evaluation of the postsurgical status of the patients and the prognosis of patient's health status post radiation therapy. When secondary placement of implant is considered, the patient is aware of the altered physical state due to oncologic therapy, and accepts the drawbacks, inadequacy and is psychologically prepared for the extended treatment options and rehabilitation of the diseased tissue and lost teeth. There is no unanimity or available data in the literature review about the amount of dose of radiation that may interfere and affect the osseointegration and survival rate of dental implant. The bone disoeder Osteoradionecrosis and the survival of dental implant may depend on the threshold dose of radiation. It was reported in the literature review that the risk of osteoradionecrosis was high with doses of radiation that exceed 50Gy, 60Gy, 65Gy, and 70Gy. The necrosis of soft tissue can take place with doses even lesser than 4Gy to 50Gy, followed with injury to major and minor salivary glands that can occur with the doses of even lesser than 20Gy (Schoen1, 2008; Steven, 1996). The endangerment and severity of osteoradionecrosis is directly proportional to dose of radiation, the volume of irradiated soft and hard tissue, and to the health of the patients. It is always recommended to consult with the radiation oncologist to obtain better knowledge of patients health who is undergoing radiation therapy that may assist in

planning the best site and locations for implant placement. Several authors reported better survival rates with lower doses of radiation doses. Nevertheless, low incidence of small-dose radiation therapy studies preclude confirming such findings. The timing of implant placement plays a very important role, whether pre or post radiotherapy which can affect the success or failure of osseointegration of dental implant. The most common side effects of such radiation therapy to the maxillofacial region are well documented in the dental literature. This treatment modality creates long-term changes in the oral mucosa, vascular supply, taste sensation, flow of saliva, and decreased healing potential of the soft and hard tissue. These objective signs of radiation treatment are accentuated by the subjective statements of patients who receive this treatment (Joel, 2003; Lavendag, 1990). It is not unusual to hear the recipient of radiation therapy describe their tissues as "weak, thin, sore or fragile." The prognosis of removable partial dentures commonly depends on the quality of the anatomic structures, the ability of these structures to tolerate increased physiologic demands from dental prostheses, and the capacity of the patient to accept the prostheses. Therapeutic dose of radiation will cause physiologic changes that may adversely affect the rehabilitation and reconstruction of lost tissue with removable prosthetic device (Timmenga, 1991).

DISCUSSION

Radiotherapy is largely used for treatment of head and neck cancer. Although the radiotherapy and chemotherapy can increase in cure rates of cancer, the drawback of such therapies are such that patient is more susceptible to secondary effects of radiation dose, leading to series of potential orofacial complications. Radiation therapy and its adverse effects Cancer cells are in a continuous state of mitosis. Ionizingradiation produces energy that injures or destroys cells by damaging nuclear DNA or altering the molecular characteristics of individual cells. Most patients with head and neck cancer receive between 50 and 70 Grays as a curative dose. For concomitant use, 45Gy are used preoperatively and 55 to 60 Gy postoperatively (Survival E. Schiegnitz, 2013; Tomas Albrektsson,) These doses are typically fractionated over a period of 5 to 7 weeks, once a day, 5 days a week, with a daily dose of approximately 2Gy. (23) Long term radiation therapy may lead to progressive fibrosis of blood vessels and soft tissues of oral cavity, that results in xerostomia, osteoradionecrosis, and reduction of bone-healing capacity, among others. Because of the cumulative effects of radiation on bone vascularity, the regenerative capacity of these tissues is limited, and this may have a deleterious impact on subsequent placement of implant and its osseointegration. It is believed that the irradiated tissue that is hypocellular, hypovascular and hypoxic tissue is the main cause of failures in dental implants osseointegration especially those implants located within the radiation field, that should be closely evaluated (Gosta Granstrom, 2006; Takako Imai Tanaka *et al*., 2013). However, the tooth/teeth present in the field of of high-dose radiation, they should be considered for extraction before undergoing radiation therapy, if they can be saved by significant dental treatment like restorative procedure, periodontal therapy or endodontic therapy they should be treated. Patients undergoing radiation therapy have to be assessed in pre radiotherapy, the health of dental status include the overall condition of the patient's dentition (9)(Orett, ?; Shugaa-Addin, 2016), previous dental history, present oral hygiene, the emergency of the cancer treatment, the planned radiation and chemotherapy, the prognosis of the cancer. Almost all patients undergoing head and neck radiation therapy experience confluent mucositis by approximately the third week of treatment. Another potential risk factor of radiation therapy of the oral cavity is fibrosis of blood vessels and muscles of mastication, leading to inability of patients to do the functional movements. It is believed that exercises of oral muscles and regular jaw movements may limit the severity of obstruction in move,ment of muscles of mastication, but they will not help in mobilizing the fibrotic changes once it has occurred. The radiation dose that directly affects the bone tissue that might be exposed to high levels of radiation undergoes irreversible physical and physiologic changes including reduced blood circulation by narrowing of the vascular channels, which diminishes and reduces the blood flow to the irradiated area, and loss of osteocytic activities. The bone essentially becomes fragile and non vital, which leads to loss of remodelling capacity of bone that leads to delayed wound healing potential (Kim1, 2011; Richard J Shaw, 2011) Xerostomia may be reduced by inducing Systemic sialagogues that may increase the production and flow of natural saliva from all the major and minor salivary glands. There is no optimal substitute for salivary flow that can be used in patients with when low salivary flow or suffering from xerostomia. Other important treatment option is to use Oral Balance Gel that may be the accepted by patients because of its extended duration of action in production of saliva. Other agents like chewing sugarfree gums or flavored lozenges may also help in stimulating salivary secretion in patients suffering from obstructive salivary flow disorders. Other agents like sugarfree popsicles, plain ice cubes or ice water may be used to moisten the oral cavity. Encouraging patients to Eat foods with high in ascorbic acid, malic acid or citric acid will stimulate the glands to increase salivary flow, but this measure is not recommended in dentate patients because the acidity can further irritate oral tissues and contribute to the demineralization of teeth. For the prevention of rampant dental demineralization and caries, patients should apply a 1.1% neutral sodium fluoride gel daily, using a custom fitted vinyl tray if possible.

This practice may be started on the first day of radiation therapy and continued daily as long as salivary flow rates are low and the mouth remains dry (Jie Yang, 1999) Oral care providers should be concerned about preventing local and systemic infections in addition to managing oral symptoms. Treating infections as soon as they are detected will help to reduce pain, as well as the spread of infection. A fungal, bacterial or viral culture is recommended if infection is suspected (Mah *et al*., 2003; Tomohero Okana, 2010).Candida colonization tends to increase in patients undergoing radiation therapy, it increases throughout the course of radiotherapy and remains increased in patients suffering from xerostomia. Anti candidal drugs plays an important role in treating the parients suffering from candida infections,the drugs like nystatin rinses are the most widely prescribedin treatment for oral candidal infections (Burke Bds Fds Rcs, ?) Severe fungal infections are treated with systemic antifungal medication such as fluconazole or amphotericin B is recommended. For cancer patients with viral infections, such as Herpes simplex 1, acyclovir or derivatives are recommended, that can be used as prophylactic or as treatment regime. Penciclovir, a newer kind of topical antiviral drug with increased tissue penetration, is now available. The use of a common oral rinse, such as isotonic saline or sodium bicarbonate, chlorhexidine is often

suggested for oral mucosities. It has been suggested that patients begin use of chlorhexidine as oral rinse to prevent or to treat the onset of any kind of microbial infection, gum inflammation and bleeding, and to reduce the risk of caries are more common. While some studies reported that a the use chlorhexidine oral rinse has no potential effects on mucositis, especially radiation induced mucositis. Use of oral rinses should be discontinued to avoid drying and irritating effects on the oral mucosa (Burke Bds Fds Rcs, ?; Yuji Teramoto, 2016). The discomfort associated with mucositis can be reduced by using agents like topical anesthetics and analgesics, although use of systemic analgesics are frequently recommended. Aluminum hydroxide/magnesium hydroxide (milk of magnesiamaalox) and sucralfate have been suggested as coating agents for the oral mucosa. Sucralfate suspension may also be helpful in the treatment of oral pain, although the effect on mucositis has not been clearly documented. According to the current literature, maintaining good oral hygiene, using appropriate topical fluorides for prevention of dental caries and use of benzydamine offer the greatest benefits for the patients after completion of radiation therapy, acute oral complications associated with radiotherapy usually begin to resolve patients should be motivated follow an oral health self-care regimen to keep the teeth and gums in healthy state and also to facilitate the repair of any kind of inflammatory or residual damage in oral cavity. Oral exercises should be continued and followed to reduce the risk and severity of trismus. Additional good dietary counseling has to be carried out that may be appropriate for patients to adapt for permanent changes in oral cavity produced by surgical management and radiation therapy. Radiation therapy on implant survival many studies have shown that dental implant therapy in irradiated patients is not significantly less favorable than in the non-irradiated population.

Conclusion

Survival rates of dental implants may be affected negatively by radiotherapy, however, they can Osseointegrated and remain functionally stable and hence they can be considered a viable treatment option for rehabilitation and improvement of the quality of life of head and neck cancer patients. More literature studies have to be carried out to draw more evidence based conclusions about survival of dental implants in head and neck cancer patients.

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