Alternative Extraction Technique: Forced Eruption and Extraction in Irradiated Patients

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Abstract: Surgery followed by radiotherapy and/or chemotherapy treatment is commonly used modality for orofacial carcinomas. Complications after the radiotherapy are common. Radiation therapy kills the cancer cells induces unavoidable changes in the surrounding normal tissues, causing compromise in the function and host defenses with complications. Some patients require extraction and the treatment plan should be directed to solve the problem and to minimize the possible complications in irradiated patients. This article presents a method of orthodontic forced eruption using NiTi wire and subsequent atraumatic extraction of teeth in irradiated patients. This technique prevents the risk of osteoradionecrosis.

Key words: Radiation Therapy · Osteoradionecrosis · Forced Eruption · Atraumatic Extraction

INTRODUCTION

The treatment of tumor in head and neck region varies according to the stage, which is dictated by the site of the tumor, nodal involvement and the presence of distant metastasis. The standard treatment is surgical resection followed by postoperative radiotherapy and/or chemotherapy [1,2].

Ionizing radiation will kill cancer cells induces unavoidable changes in the surrounding normal tissues, causes complications. The short complications include mucositis, reduction of taste perception or opportunistic infection whereas long term complications include xerostomia, radiation induced caries, trismus or Osteoradionecrosis (ORN) [3,4]. ORN is a condition of exposed bone in a field of radiation (usually more than 6000 cGy) that has failed to heal either spontaneously or with treatment for at least six months. Although ORN can occur at any time after radiation therapy, it is most frequently noted (70-94%) in the first few years after completion of treatment. “Early onset” ORN (<2 years after radiation therapy), is thought to be related to radiation doses higher than 70 Gy or surgical trauma, whereas “late onset” ORN, is thought to arise from trauma in a chronically hypoxic tissue environment [4]. The bone is not viable and may or not show osteolysis. Following irradiation, the tissue becomes hypovascular, hypocellular and hypoxia. The most common cause of ORN in irradiated patients is traumatic extractions. The mandible is the most common site of these wounds primarily because the bone is poorly vascularized due to its density [5].

All patients should undergo prophylactic oral care prior to undergoing radiation therapy. All diseased teeth should be extracted. The optimal time for extraction of teeth is 21 days prior to initiating radiation therapy (no less than two weeks before starting therapy) [6]. Extraction under prophylactic hyperbaric oxygen (HBO) may be also done which may be necessary when post irradiation dental care involving trauma to the mandible is needed. This increases oxygen dissolved in the plasma and delivered to the tissues which reduces hypoxia and stimulates angiogenesis in the hypovascular tissue. But the advantage of using HBO for extraction in irradiated patient is its use is controversial and is expensive. HBO therapy could lead to proliferation of malignant cells and angiogenesis in a malignant tumor in much the same way it works on nonhealing wounds [7]. So, the use of HBO should be considered an adjunctive treatment only.

In most of the irradiated patient, dental extraction is contraindicated so an alternative treatment plan should be considered. Forced eruption is an alternative technique...
which is first used by Inqber in 1976 to manage poor prognosis and nonrestorable teeth [8]. This article presents the a technique of orthodontic forced eruption and subsequent atraumatic extraction of teeth in irradiated patients. The teeth are removed slowly by orthodontic force eruptions and the severe complication like ORN is prevented.

MATERIALS AND METHODS

This article presents a method of orthodontic forced eruption and subsequent atraumatic extraction of teeth in irradiated patients. A 72-year-old male presented to the Maxillofacial Prosthetic Service, Mahidol University with a chief complaint of dental caries and loss of some tooth. He had squamous cell carcinoma at left tonsil (T3N1M0) and surgical resection was done with excisional biopsy followed by radiation therapy of 70 Gy (35 fractions). Afterward, he has followed up for more than 15 years and he does not present any recurrence lesion. On intraoral examination, typical radiation induced caries in teeth #31 and #32 which were asymptomatic (Fig. 1). The crown portions of two teeth were lost and only retained roots were present. On periapical radiograph, periapical radiolucency on #31 and #32 were seen suggesting periapical lesions. From the intraoral radiograph, the root lengths were 8 mm and 7 mm of #31 and #32 respectively from bone level as measured from intraoral radiographs (Fig. 2). The prognosis of the two teeth for restoration was poor so atraumatic extraction was indicated. Option 1 would be extraction under HBO therapy but the financial condition of the patient did not allow him to choose extraction under HBO. Option 2 would be extraction by orthodontic forced eruption. So, in this case, we chose option 2. So, orthodontic forced eruption and when the teeth would erupt out from the bone subsequent atraumatic extraction was chosen.

Design of Attachments: At first, endodontic treatment of both teeth (#31 and #32) is done. Then, stainless wire of 18 gauze (hooked at coronal portion) was cemented with resin cement (Panavia F 2.0, Kuraray Medical Inc. Okayama, Japan) into the canal of both teeth as a post leaving apical 2/3rd portion with intracanal medication. The hooked portion of the wire was above the tooth portion for gaining retention for attachments from which it can exert the orthodontic force. Orthodontic bracket were attached at the buccal surfaces of 2 adjacent teeth on each side (Fig 3). Then, stainless steel (18 gauze) arch wire was engaged in the bracket of teeth #34, #33, #41 and #42 with E-chain.

Another wire NiTi wire was engaged with elastics on the lower portions of the brackets engaging the hook of the stainless steel wires from the roots of #31 and #32 (Fig. 3) Regular follow ups were done at 1 month interval.
Fig. 4: NiTi wire engaged on the middle portion of the brackets of the adjacent teeth after teeth eruption.

Fig. 5: Extraction of the roots of teeth #31 and #32 and socket closure.

Fig. 6: Three months follow up after extraction showing no complications with mild bone loss.

At each visit, the lengths of erupted were measured using scale taking gingival levels of the same roots as a reference and from radiographs.

At 1 month follow up, the roots erupted were 1 mm (1 mm less within the bone compared to previous radiograph). And after 2 months follow up, roots were again erupted 1 mm more. Then, the NiTi wire was engaged at the middle portions of the brackets (Fig. 4). At 3 months follow up, the roots erupted were 1 mm more and the NiTi wire was engaged at the upper portion of the brackets (Fig. 5). At 4 months follow up, the roots erupted were 1 mm more. Then hook portions were removed from the roots of both teeth and the erupted portions of the root of both teeth were cut at the level of the gingiva. Then, the procedure was repeated as before.

At 6 months recall visit, the root had erupted in such a way that only 2 mm of the root portions were inside the alveolar bone in intraoral radiograph. Then, the hooks were removed the remaining root portions were extracted atraumatically and sutures were placed. Then, atraumatic extractions of teeth #31 and #32 were done under local anesthesia (2% lidocaineHCl with 1:100,000 epinephrine) and sutured for the primary closure (Fig. 6). The healing was satisfactory at 1 week recall visit and the sutures were removed gently. Follow up was done at 1 month and 3 months after the extraction of roots, the soft tissues around #31 and #32 showed normal healing with the absence of any complications. At 3 months follow up, both extraction sites showed mild bone loss (Fig. 7).

**DISCUSSION**

Forced eruption is an orthodontic process whereby a tooth is intentionally moved in a coronal direction through the application of gentle and continuous force in order to effect changes in the soft tissue and bone. Heithersay and Ingber were the first to suggest the use of forced eruption to treat “non-restorable” or previously “hopeless” teeth [9]. Since then, different clinicians have used various techniques to extrude teeth using removable devices [11] or fixed brackets [12]. The ultimate goal of all of these techniques has been to expose the sound tooth structure, maintain an acceptable crown-to-root ratio and to establish a biologic width before restoring the tooth, all the while maintaining good periodontal health [10].

Orthodontic forced eruption has been used in; a) in exposure of sound tooth structure for placement of restorative margin such as fracture of tooth below the gingival level and apply the eruption force to pull the tooth out until the fracture line above the gingival level, so it can be restored by fixed prosthesis; b) in case of high level embedded/impacted tooth, this technique aid in removing tooth out of the socket; c) in case of preparation site of implant placement. In this case, this technique aid in removing teeth where the patient had received a high dose of radiotherapy and there was a risk of osteoradionecrosis [7].

Generally, after orthodontic forced eruption, retention is needed for 6-8 weeks or more for reorganization of periodontal fibers. Where in some cases surgery may be also done severing of gingival fibers, thus reducing the retention period to approximately four weeks [13]. But in our case, this reorganization is not needed since we do the extraction after tooth extrusion.
When the eruption force is applied to a tooth, changes in the soft tissue and hard tissue around the tooth take place. Redness on the facial aspect of the gingival margin appears 1 week after applications of force. Soft tissue pocket depth appears which move coronally gradually. It is important that biologic width is not encroached upon when restoring teeth. But in our case, this is not considered.

Forced eruption is a viable option and it depends on the individual dentist. The majority of these studies has found that the tooth’s attachment apparatus also moves along with the tooth. Based on these reports, the general rule is to allow about one to one and one-half weeks for each mm of extrusion. Normally, for orthodontic force eruption, 2-4 months is needed. In our case, the complete eruptions were occurred in 6 months. The problem associated with orthodontic force eruption is the detachment of a button. This increases the number of visits of the patient and increases the treatment duration. The detachment of button mostly occurs due to adhesive failure between the button and the tooth surface. It might cause from: a) excessive force was applied to that tooth; b) weak bond between orthodontic attachments with the enamel. In our case, there was twice detachment of a button from the tooth. But in this case it was applied to several types of adhesive. The reason of detachment might be due patient factor (eating, biting). In this case we used, dual cure resin cement which his good bonding strength. In these two teeth, there may have some effects of radiation which might change the organic structure which affect the bonding with resin cement [13].

Orthodontic force eruption and extraction technique can be used in both anterior and posterior teeth. The advantages of this technique are: (1) atraumatic extraction, (2) much cost-effective than extraction of teeth under hyperbaric oxygen, 3) If any periapical lesion present, it may come out with the root. In most countries, the cost of the extraction under HBO is much more expensive than an orthodontic force eruption. The disadvantages of this technique are: (1) need more chair time, (2) increased number of appointments with increased treatment duration, (3) need to fix stainless steel wire in canal many times, (4) detachment of the wire from the canal, (5) difficult to maintain oral hygiene. This technique is contraindicated in poor oral hygiene, dry mouth and deep bite cases.

CONCLUSION

Orthodontic force eruption and extraction technique uses orthodontic forced eruption which can be utilized to aid in removing the tooth in irradiated patients. The risks of osteoradionecrosis or other complications are minimal from this technique allowing normal healing of soft and hard tissues after extraction. This technique is indicated in patients who cannot afford to go extractions under HBO therapy.

REFERENCES

