Helen L Craddock

Treatment and Maintenance of a Dentate Patient with 'Radiation Caries'

Abstract: Patients with xerostomia are presenting dental practitioners with challenges in caries control, long-term restoration and prosthodontic difficulties. In many cases, extraction may be the best option, but for younger, dentate patients, this may be inappropriate. This paper describes the management of a young partially dentate patient with severe xerostomia following irradiation of the salivary glands. Preventive and restorative management are discussed, together with treatment and healing of peri-radicular pathology. The case report demonstrates that long-term stabilization and management of caries and peri-radicular lesions are possible over a seven-year period for a patient with severe radiation caries.

Clinical Relevance: Many dental patients present with some degree of xerostomia due to age, side-effects of anti-hypertensive and psychotropic drugs and also as a side-effect of radiotherapy. General dental practitioners are ideally placed to monitor and provide early intervention for this highly caries-susceptible group of patients. With good patient motivation and professional support, tooth loss is not inevitable and this case report suggests strategies and demonstrates the clinical stages in the management of severe caries due to xerostomia.

Dent Update 2006; 33: 462-468

Pre-treatment planning for patients likely to be affected by post-radiotherapy xerostomia, is always a challenge.[1,2,3] Bearing in mind that the needs for each individual patient will be different, experience of difficult to control caries in these patients often prompts practitioners to prescribe multiple extractions, in the knowledge that good maintenance is difficult to achieve.

Many of these patients will be elderly and some will already have neglected mouths. Changing lifestyle and habits, as well as coping with a life-threatening illness, may be beyond their capacity. On the other hand, in younger patients, who already have experienced good oral health and dental care, there may be a chance of achieving oral

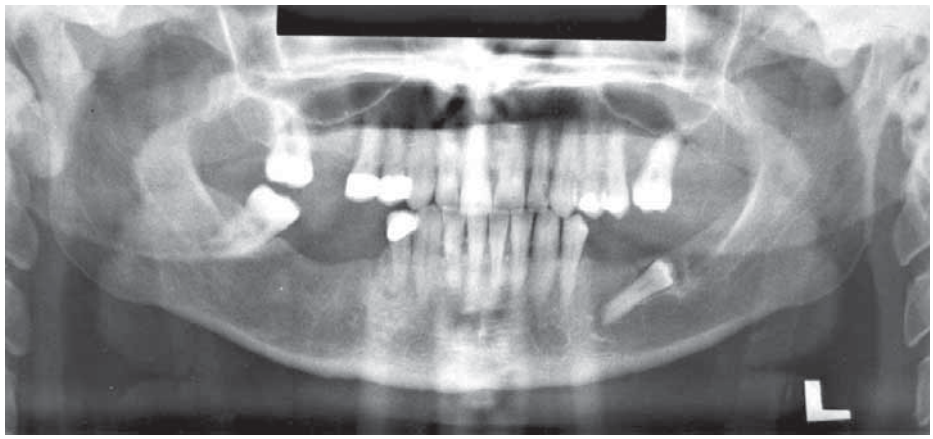

Figure 1. OPT prior to radiotherapy.

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Figure 2. Anterior dentition.

Figure 3. Right view.

Figure 4. Left view.

conditions conducive to the prevention of dental disease.

This case study demonstrates the treatment and maintenance of a young female patient who, prior to radiation therapy, was generally free of dental disease and was well motivated. She has continued to achieve a good level of oral health for the last seven years.

Case study

A female, 35-year-old patient was referred to Leeds Dental Institute by her GDP, as he had been unable to control her 'rampant' caries. She had undergone laryngectomy about 18 months previously for laryngeal carcinoma, followed by radiotherapy. The irradiated fields included all the major salivary glands. Surgery also included thyroidectomy. Prior to her diagnosis of laryngeal carcinoma, the patient smoked 40 cigarettes per day for approximately 20 years, but had given up on diagnosis of her illness. She was a regular attender and had had a full dental assessment prior to undergoing radiotherapy. A panoramic radiograph taken two weeks prior to radiotherapy is shown in Figure 1. Her general dental practitioner had been given a treatment plan to follow, including diet advice, topical fluoride and *Corsodyl* (Glaxo Smith Kline, UK) administration and regular oral hygiene advice and maintenance.

Dental condition

On examination, the patient displayed signs of severe xerostomia, with shiny, dry mucous membranes, with very little saliva being evident. The dentition was grossly carious. All teeth were affected by carious attack to some extent, with gross loss of tooth tissue in many cases (Figures 2–5). Extensive caries was detected at the margins of the existing crowns. Several teeth were missing, producing a modified shortened dental arch. BPE scores of 1 and 2 were recorded, and the patient reported difficulty in practising oral hygiene procedures owing to extreme sensitivity.

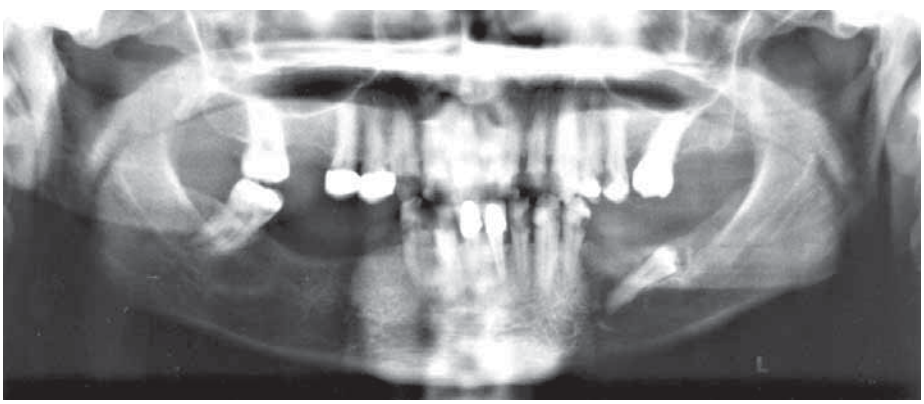

Figure 5. OPT at the time of the examination.

Diagnosis

A diagnosis of severe xerostomia was made. Chronic marginal gingivitis was present and many teeth displayed signs of gross carious attack, in many cases involving pulp. The pain that the patient was experiencing was diagnosed as pulpitis. Peri-radicular pathology was present at $\underline{2|2}$, $\overline{1|1}$. The aesthetics were extremely poor, and radiographs revealed a horizontally impacted lower left second premolar.

Treatment objectives

The treatment objectives were defined as:

- Relief of pain;
- Prevention of further dental disease;
- Treatment of dental disease;
- Production of good functional occlusion;
- Production of satisfactory aesthetic result;
- Maintenance of a stable oral environment.

Treatment options

A number of treatment options were evaluated and discussed with the patient; these included:

- Clearance under hyperbaric oxygen[4] and complete upper and lower dentures;
- Intensive preventive program;
- Restoration of key teeth and the provision of partial dentures;
- Shortened dental arch;[5,6]
- Attempt to restore all existing teeth, therefore removing need for any prosthetic replacement.

The patient was very distressed at the prospect of losing her teeth on top of the disfigurement from her tracheostomy and severe scarring, and therefore the option of a clearance was left as a last resort. If any teeth were to be


Figure 6. Long term provisional restorations.

saved, an intensive programme of plaque control, dietary control and fluoride applications would need to be instigated and maintained throughout life. This is an onerous task and totally dependent on patient motivation, oral hygiene skills and compliance. Regular reviews and reinforcement would be necessary for the continued success of this programme. Research has shown[7] that, in healthy mouths, some plaque retention is usually associated with partial denture wear. In this case, it was felt that any increase in plaque retention would be catastrophic. Also, as with full dentures, lack of saliva would compromise denture comfort.

One of the requirements for the conventional shortened dental arch concept[5] is that the remaining teeth are of good quality, and likely to be maintainable for some considerable time. In this case, most of the teeth likely to be used in the shortened dental arch were weakened by caries, endodontically treated and, in some cases, post-retained restorations were likely to be necessary. Increased occlusal loading on the remaining teeth in the traditional sense of the shortened dental arch could have compromised the longevity of these teeth.

It was decided that the final option, restoring all the remaining teeth, whilst being the most technically demanding choice, both for the dentist and the patient, left us with more options for future restoration should further individual teeth be lost. It is also possible that some salivary gland function may return in the future (dependent on patient age, field of radiation, and dose) and that, in years to come, prosthetic replacement may be possible. The patient was happiest with this option and it was felt that keeping all restorable teeth would give greatest flexibility to cope with future tooth loss.

Treatment

Treatment was divided into a number of phases, with patient compliance with oral hygiene procedures and dietary restriction being monitored constantly. The treatment plan was extensive and is briefly outlined in its various phases.

Stabilization

Stabilization involved the following:

- Oral hygiene instruction;
- Restriction of dietary sugar intake;
- Topical application – (chlorhexidine 0.2%) gel and *Gel-Kam* (3% stannous fluoride)(Colgate, UK)[8,9,10] daily on alternate days;
- Caries stabilization – excavation and provisional restoration of all carious sites;
- Endodontic treatment at $\underline{3\ 2}|\underline{2\ 3\ 4\ 5}$ and $\overline{2\ 1}|\overline{1}$.

Excavation of the carious lesions took place over four sessions, over a 10-day period. All the carious exposures were heavily contaminated, and it was decided that extirpation was indicated. The larger exposures were extirpated immediately, to minimize patient discomfort. Small exposures were extirpated electively. It would be difficult to monitor dentine bridge formation under coronal restorations, and also difficult to assess pulpal response. The risk of osteoradionecrosis in irradiated bone increased the risk of pulpal death, and peri-radicular infection made elective vital extirpation the preferred option. Since the initial pulpal extirpations, the patient has remained completely pain free.

Provisional treatment

Provisional treatment involved the following:

- Diagnostic wax-up;
- Placement of posts and core build-ups at $\underline{3\ 2}|\underline{2\ 3\ 4\ 5}$ and $\overline{21}|$.
- Long-term laboratory made provisional crowns (Figure 6);
- Monitoring and reviewing after 1, 3 and 6 months

At the six month review, the patient reported no symptoms. Her oral hygiene remained good and no caries was detected at the crown margins. Marginal gingival inflammation was detected at several sites, although no pocketing in excess of 3 mm was detected, nor was calculus present. The patient was very pleased with the improvement in aesthetics, and it was decided to provide definitive restorations.

Definitive treatment

The definitive treatment involved provision of the definitive restorations. Figures 7–9 show the existing occlusal scheme with metal ceramic crowns.


Figure 7. Anterior view of completed restorations.


Figure 8. Right view of completed restorations.


Figure 9. Left view of completed restorations.

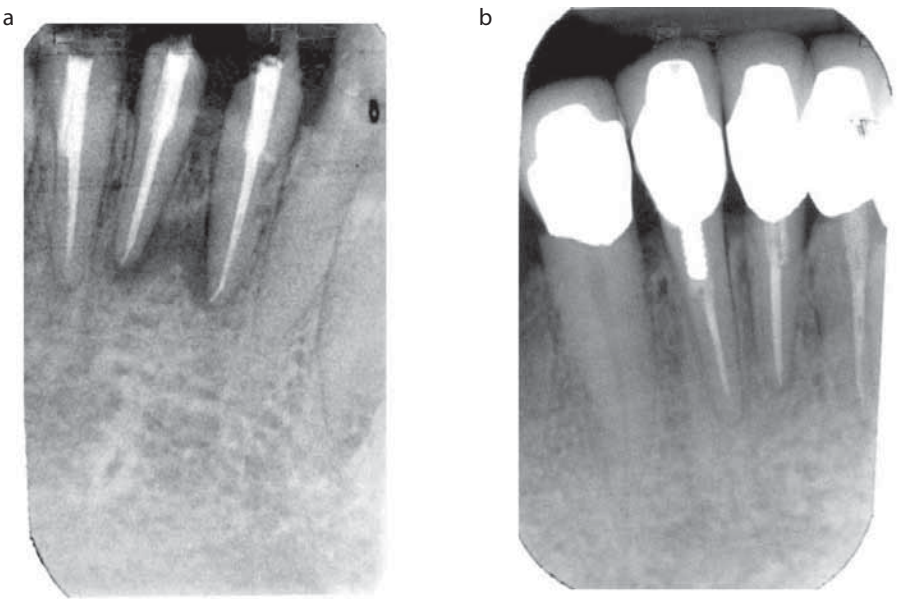

Figure 10. Resolution of peri-radicular pathology, $\overline{1|1}$ **(a)** at obturation and **(b)** 1 year later.

Maintenance

The maintenance of caries, periodontal disease and peri-radicular disease involved the following:

Caries

- Prevention – continuance and compliance with preventive programme;
- Early re-mineralization – patient or clinical application of topical fluoride if detected;
- Early intervention – treatment using minimum intervention and appropriate materials.

Prevention of further disease was my primary concern in the treatment of this lady as, without adequate control of the rapid carious attack, any level of success was unlikely. The patient was diligent with her topical applications and diet control, although less so with her oral hygiene measures. In spite of this, good disease control was obtained and has been maintained to date. As the initial caries extended subgingivally on virtually all the teeth to be restored, the placement of subgingival margins was inevitable. Of course, this is less than ideal in terms of periodontal health. It was hoped that protective mechanisms within the gingival crevice would remain unimpaired following radiotherapy and, in some way, dilute plaque acids at the gingival margin.

Periodontal disease

- Prevention – continuance and compliance with preventive programme;
- Monitoring – regular review and assessment;
- Early treatment.

The BPE scores remained constant at 1 in each sextant throughout treatment and maintenance. This did not seem to correspond to the fluctuations in the patient's standard of oral hygiene. This may be due to the *Corsodyl* application limiting plaque bacterial proliferation supragingivally, however, the crown margins, placed subgingivally, continued to support plaque, allowing marginal gingivitis to remain.

Peri-radicular disease

- Appropriate radiographic review, following European Endodontic Society guidelines;
- Remedial treatment and review.

The success of the extensive endodontic treatment is likely to be crucial to the long-term prognosis for the majority of the teeth. The patient has remained asymptomatic and no swelling or tenderness to percussion has been present. It is encouraging that there was no deterioration in apical health during the follow up, and improvement was seen at most sites (Figure 10).

Good coronal seal was established to prevent re-infection of the canal systems, and prevent pulpal contamination of vital teeth via the dentinal tubules. The use of *Composiposts* for the lower central incisors was designed to allow rapid access for drainage, should further apical infection ensue. These were the only canals heavily infected towards the apex and, having a large apical area, had a poorer prognosis. As extraction was unlikely to be an ideal choice for rapid drainage of any future infection of these teeth, the easily removed *Composiposts* were chosen in preference to metal.

I have made no mention of the management of mucosal infections, which are often a feature of post-radiotherapy cases, as to date none has occurred in this patient. This may be the result of the inhibition of oral fungi owing to the use of *Corsodyl* gel.

Overall management

The patient was seen by a consultant oral surgeon five days prior to the start of radiotherapy. Radiographs revealed an apical radiolucency associated with the lower right first premolar. As time was limited, the lower right first premolar was extracted the same day. No specialist restorative opinion was sought, and the patient's GDP was instructed to review the patient regularly to check her oral hygiene and general dental condition.

A system whereby all head and neck radiotherapy patients receive a specialist pre-radiotherapy assessment is indicated, and it is hoped that patients who need intensive and prolonged preventive support will either be able to receive this from their GDP, under close supervision, or managed within the hospital setting. A close 'team' setting for pre-radiotherapy planning should involve all the relevant disciplines in order to optimize the care provided to these very caries-susceptible patients. Should patients be treated in general practice, some level of follow up by the restorative team would be advantageous in the early post-radiotherapy years. It is not always necessary for post treatment dental care to be provided within the hospital environment. Following a detailed assessment, a suitable treatment plan

Figure 11. Anterior view two years after definitive crown placement (three and a half years after initial presentation).

Figure 12. Anterior view seven years after initial presentation.

may be devised for use in the general dental practice situation. However, the GDP needs to be aware of the rapid deterioration that is possible in xerostomic patients, and consequently the need for regular vigilance.

It is also important, as in the case of the patient, that patients whose deterioration is of concern to their GDPs should be seen quickly by the specialist services. The patient's GDP recognized the urgency of this case and requested an 'urgent' appointment.

Despite the patient being young at the time of radiotherapy, there does not appear to be any improvement in the salivary flow during treatment and follow up, and the obvious oral dryness is visible on most of the post treatment photographs.

Evaluation

The maintenance of a stable oral environment in this patient is likely to be entirely dependent on her continued compliance with dietary restrictions, oral hygiene measures and topical applications. If there is no return to adequate salivary function, she will always be dependent on these measures and will need professional support with this. As she has been unable to obtain adequate support in general practice in the past, it is tempting to suggest that maintenance is carried out in the hospital system. This is not without difficulties, as maintenance patients are often given to more junior members of staff, and it is possible that the patient may be overlooked for an extended period of time during staff changes. She has continued to remain caries free, and early softening of the root surfaces at the crown margins in one or two cases was successfully arrested with topical fluoride application. Figure 11 shows and anterior view two years after definitive crown placement (three and a half years after initial presentation).

Five years after initial presentation |2 developed a vertical root fracture, and was extracted and replaced with an immediate cantilever bridge. This was replaced after five months with a permanent metal ceramic cantilever bridge. It is now seven years since this patient's initial presentation. She has continued to remain caries free, and a photograph of her present dental status is shown in Figure 12.

Long-term prognosis

The prognosis for this patient is very much dependent on the response of the peri-radicular tissues to endodontic therapy, and the patient's ability to control her increased susceptibility to caries by excellent dietary, oral hygiene and topical application measures.

Unless there is a marked recovery in salivary gland function, it is doubtful that removable dentures would be comfortable or well retained. It is therefore essential that all possible measures are taken to maintain at least a limited dentition in such a young patient.

The patient has shown great commitment to her oral health, particularly in view of her family commitments, and this bodes well for the future as her family grows up.

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