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ORIGINAL ARTICLE

Two-year clinical performance of glass ionomer and resin composite restorations in xerostomic head- and neck-irradiated cancer patients

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Abstract The aim of this study was to evaluate the clinical performance of adhesive filling materials in class V cavities in xerostomic head- and neck-irradiated cancer patients, in terms of marginal adaptation, anatomical form and recurrent caries. We selected 35 high-caries-risk, post-radiation, xerostomic adults with ≥3 cervical carious lesions in the same arch. Every patient received a KetacFil (KF), PhotacFil (PF) and Herculite XRV (HX) restoration. Patients were instructed to use a neutral 1% sodium fluoride gel in custom trays, on a daily basis. After 6, 12, 18 and 24 months, the restorations were examined for material loss, marginal integrity and recurrent caries. Fluoride compliance was determined at each recall appointment and recorded as the percentage of recommended use during that interval [compliance of ≤50%=NFUs, >50%= FUs]. Only 30 patients were available for recall at 6 months, with 28 patients at 12 and 18 months, and 27 patients at 24 months. In the NFU group, differences in recurrent caries were found between KF and HX at all observation times ($p<0.05$). Differences ($p<0.05$) in adaptation and/or anatomical form were found between KF and PF in NFUs after 18 and 24 months. In FUs, significant differences were observed between KF and PF, and KF and HX after 6 and 12 months, between KF and HX, PF and HX after 18 and 24 months. In summary, glass ionomers (especially the conventionally setting formulation) provide clinical caries inhibition but erode easily, while composite resin provides greater structural integrity.

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Introduction

Therapeutic ionising radiation has a deleterious effect on the human dentition. Radiation caries has a sudden onset and is a rapidly progressing and very destructive form of dental decay. It is also one of the most common side-effects of radiotherapy used to treat malign tumours in the head and neck region. Important factors influencing the rapid tooth decay are hyposalivation as a result of the radiation [1] and changes in the daily diet that result in altered composition of the oral flora [2].

Dental caries not only affects smooth surfaces, occlusal surfaces and incisal ridges [3], but also typically encircles the cervical areas [4]. Active caries lesions are visible after 3 months of radiotherapy and excessive damage of the dentition is commonly seen within a year after radiation therapy [5].

When cavitating, class V lesions are not immediately restored in this specific patient population and due to their circumferential manifestation, lesions progress rapidly and a full fracture of the crown is possible. Inadequate mouth hygiene, which is frequently seen in patients with head and neck cancer, will also contribute to tooth decay. Hence, a rapid restoration of the carious lesions not always enabling enough mechanical retention in the form of the cavity preparation is advocated and an active preventive programme is mandatory to limit the development of new and secondary caries [6]. Unfortunately, it appears that there is still a need to widen concepts for the dental care of patients undergoing radiotherapy, especially following the radiation in order to avoid ruined teeth. [7, 8]

The use of adhesive restorative materials is recommended for the treatment of radiation caries [9]. Clearly, these tooth fillings survive longer not only when there is a good seal but also when protection against secondary decay is provided. Glass ionomer cements do not appear to fulfil these requirements in a healthy population, as they have a shorter survival than resin composites in the cervical region, and they are associated with a high incidence of secondary caries [10]. Glass ionomer cements, however, appear to provide better protection against secondary caries than resin composites in irradiated patients [6, 11, 12]. The limited number of clinical studies in xerostomic patients and/or patients irradiated in the head and neck region clearly demonstrate that (1) fluoride-releasing materials may reduce caries surrounding restorations in these high-risk patients who do not routinely use topical fluoride, and (2) glass ionomer cements are prone to erosion by fluoride gels, whereas resin composites maintain their structural integrity.

Research on the restoration of radiation caries with clinical follow-up appears to be limited to two research groups, one Canadian [6, 11] and the other Chinese [13, 14]. Studies from these groups report that glass ionomers provide significant protection against secondary decay.

Aim of this study

We initiated this study in light of the limited number of studies investigating the survival of restorations in xerostomic head and neck cancer patients, and also because of the current debate regarding the caries preventive potential of fluoride-releasing restorative materials, especially in high-risk patients. The optimal material for use in the cervical area of xerostomic head and neck cancer patients is currently not stated in the existing literature, in contrast to the present day recommendations for the use of glass ionomer cements for the restoration of root caries [15].

Our aim was, therefore, to compare the clinical performance of fluoride-releasing materials (conventionally setting and resin modified glass ionomer cements) and another non-fluoride releasing adhesive material (resin composite), in a Flemish population of head and neck tumour irradiated patients.

In this study, we emphasised the use of a fluoride gel with neutral pH. We used materials recommended by our University Clinic at the time of this study: KetacFil (KF, a conventionally setting glass ionomer cement—3M/ESPE, Seefeld, Germany), PhotacFil (PF, a resin modified glass ionomer cement—3M/ESPE) and Herculite XRV (HX) with Optibond FL (Kerr—Sybron Gmbh, Karlsruhe, Germany). A clinical evaluation of PF and HX in xerostomic mouths with radiation caries has not yet been published, while KF has been used in previous studies and can therefore be used as a reference material.

Materials and methods

A total of 35 patients participated in this study. Details of tumour pathology and sex of the patients are listed in Table 1. The selection criteria for this study were as follows: the presence of at least three carious cervical lesions in the same arch; ≥18 years old; given agreement to participate in the study. We recruited a total of 28 male and seven female patients, with an average age of 45 years and 7 months (male) and 44 years 8 months (female), respectively.

The protocol for the present investigation was approved by the ethical committee of the Ghent University Hospital (2004/008). The patients were informed that the materials used had already proven their clinical efficacy and that these materials were used on a routine basis for treatment of carious lesions in non-irradiated patients; therefore, they were not exposed to new or experimental materials. Patients confirmed that they were willing to be present at follow-up appointments after 6, 12, 18 and 24 months. In light of their medical background (tumour patients), the authors were aware that not all patients would be able to participate in the 2-year clinical follow-up study. The study was spread over a 6-year period in order to conduct sufficient consecutive follow-up appointments to collect 2 year information from 35 patients.

The cervical lesions in all patients were restored with the following restorative materials: KF, PF and HX with Optibond FL (Kerr—Sybron Gmbh; Table 2). These materials were used in the same quadrant or sextant of the mouth. KF was used as the reference material, the study design being based on a previous study by McComb et al. [11]. The restorations were placed by three operators being member of the oncologic team of the dental school, where patients' files are discussed on a regular basis. Treatment options and follow-up in this patient group were discussed on a two-weekly basis and, within the confines of this study, a standardised restorative procedure was implemented. The restorative procedure itself is described in the next paragraphs.

Conventional class V cavities were prepared with rounded line angles and without retention grooves. After curettage of the caries with curettes, cavities were prepared with burs at high speed (red hand piece–120,000 rpm) and low speed (blue hand piece–40,000 rpm) under constant water cooling. When using resin composite, the surrounding enamel was bevelled over a width of 1 mm. The enamel

Table 1 Tumour characteristics (location and histology) and distribution among the patients

	Tumour information	Number	Number according to sexes	
			Male	Female
Location	Oral cavity	16	14	2
	Oropharynx	11	9	2
	Glottis	3	2	1
	Hypopharynx	3	2	1
	Rhinopharynx	2	1	1
Histology	Poorly differentiated epidermoid epithelioma	10	8	2
	Moderately differentiated epidermoid epithelioma	17	15	2
	Strong differentiated epidermoid epithelioma	5	3	2
	Other	3	2	1

borders of the cavities where glass ionomer cement was placed were also finished with burs, ensuring a smooth cavity border.

Prior to the start of the study, we developed an allocation table to ensure that each material was placed in the anterior, middle and posterior tooth position an equal number of times. Materials were used according to the manufacturer's instructions, including the preconditioning for the glass ionomer material. Conditioning consisted of the application of Ketac Conditioner (3M/ESPE) for 15 s (s), followed by 30 s rinsing and gentle drying. For HX restorations, the bevelled enamel was etched for 30 s with 35% phosphoric acid gel (Ultra-Etch, Ultradent Products Inc., South Jordan, Utah, USA), the dentin for 20 s, and consequently rinsed and gently air dried. After the conditioning phase, primer was applied, followed by the bonding agent and light curing (Demetron LC Curing Light, Kerr) of the whole surface for 40 s.

The filling materials were placed using transparent cervical matrices (Hawe Neos Dental SA, Bioggio,

Table 2 Chemical composition and modes of use of the materials used in this study

Material and type	Composition	Mode of use
Herculite XRV (Kerr-Sybron Gmbh) Hybrid composite	Ethoxylated bis-GMA/TEGDMA; quartz, colloidal silicon dioxide and barium glass	Application in layers not exceeding 2 mm and light curing during 40 s
Optibond FL (Kerr–Sybron Gmbh) Three-steps etch-and-rinse adhesive	Primer: HEMA, GPDM, MMEP, ethanol, water Adhesive: Bis-GMA, HEMA, GPDM, silicate filler (barium aluminoborosilicate glass, disodium hexafluorisilicate, fumed silica)	Application of primer followed by the bonding agent, the whole during 40 s;
Ultra-etch (Ultradent Products Inc.) Total etch	35% phosphoric acid	30 s application on enamel, 20 s application on dentin, gentle rinsing and drying with air spray until visible dryness of enamel and dentin
KetacFil (3M/ESPE) Conventional GIC	Powder: fluoroaluminosilicate glass Liquid: distilled water, acrylic-maleic acid copolymer, tartaric acid	Mixed during 10 s with the Capmix—coated with Optibond FL after finishing
PhotacFil (3 M/ESPE) Resin-modified GIC	Powder: fluoroaluminosilicate glass Liquid: distilled water, acrylic-maleic acid copolymer, HEMA, Magnesium HEMA ester	Mixed during 15 s with the Capmix, light cured during 20 s coated with Optibond FL after finishing
Ketac Conditioner (3 M/ESPE) Glass ionomer conditioner	Polyacrylic acid, distilled water	Application during 15 s, followed by 30 s rinsing and gentle drying

Bis-GMA Bisphenol A diglycidylmethacrylate, *GPDM* Glycerophosphoric acid dimethacrylate, *GIC* glass ionomer cement, *HEMA* 2-hydroxyethyl methacrylate, *MMEP* Mono-2-methacryloxy ethyl phthalate, *TMDDBMA* Trimethyl-4,13-dioxo-3,14-dioxadiylbismethacrylate

Switzerland). For the glass ionomers, the filling material was inserted in one attempt. For HX, two composite layers were placed owing to the extent of the cavities and the configuration factor when the size of the cavities was more than 2.5 mm high in the gingivo-occlusion direction. Both layers were light cured. The resin composite was light cured for 40 s with a Demetron LC Curing Light. KF was mixed for 10 s with the Capmix (3M/ESPE), and PF for 15 s. PF was light cured with the Demetron lamp for 20 s. Matrices were individualised such that they adapted to the form of each cavity. The borders of the matrix did not extend the border of the cavities by more than 1 mm. After removal of the matrix, excess glass ionomer was cut away with a sharp scalpel blade or scaler; when the excess was great, this was achieved by means of a diamond finishing bur at high speed and with water cooling. Finishing of the glass ionomer fillings was performed with diamond polishing burs with water cooling. After finishing, a coat of enamel bonding was applied (Optibond FL) and light cured for 40 s. Finishing of the composite fillings was performed with diamond burs (high speed and water cooling) and with Pop-On discs (3M/ESPE).

Patients were prescribed a neutral 1% sodium fluoride gel tray (made in the pharmacy of the university hospital, magistral preparation) for daily use (at the start of this clinical investigation, the use of trays was still popular). At each recall appointment, patients used a visual analogue scale ranging from 0-100% to describe their compliance with the fluoride procedure. Using these results and discussions with the patient, a percentage estimation of fluoride use in the previous 6 months was ascertained. If a patient documented fluoride use of 50% or less over the previous 6 months, they were classified as a 'non-fluoride user' (NFU), whereas if they documented fluoride use more than 50% of the time, they were classified as a fluoride user (FU).

Restorations were evaluated by two investigators. The examiners had agreed to a predetermined level of inter- and intra-examiner agreement of at least 95% per single criteria. The restorations were assessed for marginal adaptation (Table 3), loss of material (Table 4) and recurrent (marginal) caries (Table 5), all according to the criteria described in McComb et al. [10]. The diagnosis of recurrent caries involved the presence of irregular, softened or cavitated tooth structures immediately adjacent to the restoration boundary, as determined by tactile exploration. It was not possible to perform blinded evaluations because the different types of restorations are visibly different from one another.

The cumulative failure rates were compared among the three restorative materials at 6, 12, 18 and 24 months, using the Pearson's chi-square and the Fisher's exact tests. Stratified analyses of FUs and NFUs were also conducted. Statistical tests were two-tailed and interpreted at the 5% significance level.

Table 3 Evaluation criteria for assessment of marginal adaptation (according to McComb et al. 2002)

Grade 1: The restoration appears to adapt closely to the tooth along its periphery, with no crevice formation. An explorer will not catch on being drawn cross the margin, or if it does catch, then it will be in one direction.

Grade 2: A sharp explorer will catch in both directions and there is visible evidence of early crevice formation into which the explorer will penetrate.

Grade 3: A blunted explorer will penetrate and will catch in both directions, and there is visible evidence of early crevice formation into which the explorer will penetrate.

Grade 4: An explorer will penetrate into the crevice to a sufficient depth that the dentin is exposed. The restoration has failed and will require replacement.

Grade 5: The restoration is fractured or lost. The restoration has failed and will require replacement.

Results

In total, 35 sets of fillings were placed. Only 30 patients were available for recall at 6 months, 28 patients at 12 and 18 months, and 27 patients at 24 months. There were 15 NFUs at 6, 12 and 18 months, dropping to 14 at 24 months. There were 15 FUs after 6 months, and 13 after 12, 18 and 24 months. Reasons for patient drop-outs were death (four patients), withdrawal from the study (one patient) and failure to attend one of the recall appointments (three patients).

The following statistically significant differences were found ($p<0.05$):

1. Failure of the restoration, independent of cause and fluoride use of the patient: KF vs HX at 6 months; KF vs PF, and KF vs HX at 12 and 18 months; KF vs HX, and PF vs HX after 24 months (Table 6)
2. Adaptation of the margins and/or anatomical form, independent of fluoride use: KF vs HX at 6 months; KF vs PF, and KF vs HX at 12 months; KF vs PF, PF vs

Table 4 Criteria for the assessment of anatomical form (according to McComb et al. 2002)

Grade 1: The restoration is continuous with the existing anatomy of the tooth.

Grade 2: The restoration is not in continuity with the existing anatomy of the tooth but the discontinuity is insufficient to expose dentin and, hence, the restoration is clinically acceptable.

Grade 3: The restoration is not in continuity with the existing anatomy of the tooth; the discontinuity is sufficient to expose dentin. The restoration has failed and will require replacement.

Table 5 Evaluation criteria for recurrent caries (according to 11)

Grade 1: softness of the surface texture or a surface defect adjacent to the restoration is not greater than 0.5 mm in greatest diameter.

Grade 2: softening of the surface texture is such that the surface can be penetrated or a surface defect is greater than 0.5 mm and less than 3 mm in greatest diameter. The restoration has failed and requires replacement.

Grade 3: frank peripheral decay involves a section of tooth/filling margin greater than 3 mm in length. The restoration has failed and will require replacement.

HX, and KF vs HX after 18 months; KF vs HX after 24 months (Table 7)

3. Adaptation and/or anatomical form for NFUs: KF vs PF after 18 and 24 months (Table 7)
4. Adaptation and/or anatomical form for FUs: KF vs PF, and KF vs HX after 6 and 12 months; KF vs HX, and PF vs HX after 18 and 24 months (Table 7)
5. Failure of the restoration due to recurrent caries in NFUs: KF vs HX at 6, 12, 18 and 24 months (Table 8).

There were no statistically significant differences between the three filling materials for:

1. Marginal adaptation and/or anatomical form for NFUs at 6 and 12 months (Table 7)
2. Failure of the restoration due to radiation caries, independent of fluoride use, at 6, 12, 18 and 24 months (Table 8)
3. Failure of the restoration due to recurrent caries in FUs at 6 and 12 months (Table 8).

Discussion

Radiation caries is typically seen in areas where dentin is exposed to the oral cavity [8]. Especially at the level of the tooth necks its manifestation is a rapidly progressing circumferential decay which may result in decapitation of the crowns and finally the loss of teeth [16]. Development of preventive and therapeutic strategies is, therefore, of great importance for early treatment of radiation-induced tooth decay in irradiated patients [8].

When confronted with this complicated problem of tooth decay, maintenance of the dentition is the most appropriate decision. Today, there is substantial evidence demonstrating that the implementation of adequate preventive strategies focussing on xerostomia-related complaints will help reduce caries development [17–19]. These include strict and conscious oral hygiene, changes in diet, control over the cariogenic flora, and topical fluoride application on a regular basis. The daily application of a neutral 1% sodium fluoride gel by means of individualised trays helps to reduce the radiation caries [20, 21]. There have been reports that fluoride application every 2 days is more effective than daily rinses with fluoride solutions [22, 23]. The prevention of hyposalivation also helps to prevent radiation caries. Acidulated gels are not favoured due to the eventual damage to the irritation-sensitive mucosa; the acidic pH also demineralises the enamel and there is no remineralising effect of the saliva. In our clinic, the daily use of neutral 1% sodium fluoride gel and the use of individualised trays are recommended. Although fluoride trays are, at present, no longer commonly used by the population at large, their use is still advocated in irradiated patients [19]. In this study, it was clear that the fluoride users exhibited improved protection against secondary caries, especially for resin-containing restorations (Table 8).

Restorative procedures must be kept simple in this patient group in order to preserve tooth function as well as aesthetics. The use of adhesive restorative materials is recommended for treatment of radiation caries [9]. An additional protection against recurrent decay is also recommended. Resin composite materials appear to be the restorative materials of choice, thanks to their adhesive potential and sealing ability. In this study, the hybrid composite and the resin-modified glass ionomer demonstrated significantly better scores for marginal adaptation and structural integrity over the long term (Table 7). This is in contrast with the scores for recurrent decay, where the conventionally setting glass ionomer ensures significantly better protection than both resin-containing restorative materials (Table 8). This was most obvious in the group with low fluoride compliance. These findings are in agreement with McComb et al. [11].

The problems with prevention and restoration of radiation caries in the cervical region can be compared with the

Table 6 All class V restoration failures, independent of cause and patient fluoride use

	Time of recall appointment			
	Cumulative failures/recall evaluations (%)			
Restorative material	6 months	12 months	18 months	24 months
KetacFil	12/30a	19/28a	23/28a	26/27a
PhotacFil	6/30a,b	9/28b	16/28b	21/27a
Herculite XRV	5/30b	8/28b	9/28b	13/27b

For each time period, groups with the same letter are not significantly different at $p<0.05$

Table 7 Class V restoration failure due to marginal adaptation and/or anatomical form independent of fluoride use

Restorative material	Time of recall appointment											
	Cumulative failures/recall evaluations (%)											
	6 months			12 months			18 months			24 months		
	Complete sample	NFU	FU	Complete sample	NFU	FU	Complete sample	NFU	FU	Complete sample	NFU	FU
KetacFil	12/30a	3/15a	9/15a	19/28a	7/15a	12/13a	24/28a	11/15a	13/13a	26/27a	13/14a	13/13a
PhotacFil	6/30a,b	3/15a	3/15b	9/28b	3/15a	6/13b	16/28b	5/15b	11/13a	21/27b	10/14a,b	12/13a
Herculite XRV	4/30b	3/15a	1/15b	5/28b	3/15a	2/13b	8/28c	6/15a,b	2/13b	9/27c	7/14b	2/13b

For each time period, groups with the same letter are not significantly different at $p<0.05$

Complete sample: combining the fluoride non-users (≤50%) and fluoride users (>50%)

ones of root caries. For root caries, glass ionomers cements are nowadays the recommended restorative materials [15]. Although there is still a reserve to use glass ionomers as a restorative material among dentists in favour of resin composites, Peumans et al. [24] showed that glass ionomer cements demonstrated an excellent clinical performance and superior adhesion as compared to resin adhesives. In the study of Magni et al. [25], it became clear that glass ionomers showed interesting properties: (1) these materials had mechanical properties more similar to enamel and dentin than adhesives, (2) the stability under load (creep) was higher than for adhesives, (3) thanks to the chemical bond of glass ionomers with calcium ions of hydroxyapatite [26], together with the elastic behaviour, there is a better preservation of the integrity of the interface between tooth and restorative material.

The structural integrity of glass ionomer cements is compromised as a result of desiccation/dehydration and erosion [27]. In the present patient population, both factors played a role. Xerostomia causes dehydration of the glass ionomer and loss of material, resulting in rough and plaque retentive margins, such that a vicious circle of perpetual loss of material is created, ultimately causing the loss of the filling. Although more recent glass ionomer formulations appear to have better resistance against abrasion and reduced solubility [28, 29], resulting in a better protection against erosion, this is not the case in xerostomic mouths. KetacFil (Table 2) is a glass ionomer cement that uses maleic acid for its setting, and therefore becomes prone to acidic erosion [30]. Although PhotacFil also contains maleic acid (Table 2) and does not have superior mechanical properties [25], the presence of methacrylate-based polymers appears to protect this material against erosion and making them less susceptible to the formation of cracks due to dehydration [31]. Topical (acidulated) applications with fluoride gels also interfere with the structural integrity of glass ionomer cements [32]. This is because fluoride is a complexing agent and, hence, interferes with the setting reaction [33], and also because fluoride gels have an acidic pH [34, 35], resulting in a change of the structural integrity of the setting or set glass ionomer filling. Furthermore, it is known that glass ionomer fillings can serve as fluoride

Table 8 Class V restoration failures due to marginal caries independent of fluoride use

Restorative material	Time of recall appointment											
	Cumulative failures/Recall evaluations (%)											
	6 months			12 months			18 months			24 months		
	Complete sample	NFU	FU	Complete sample	NFU	FU	Complete sample	NFU	FU	Complete sample	NFU	FU
KetacFil	0/30a	0/15a	0/15a	0/28a	0/15a	0/13a	2/28a	1/15a	1/13a	2/27a	1/14a	1/13a
PhotacFil	3/30a	3/15a,b	0/15a	4/28a	3/15ab	1/13a	5/28a	3/15a,b	2/13a	7/27a	5/14a,b	2/13a
Herculite XRV	4/30a	4/15b	0/15a	5/28a	5/15b	0/13a	6/28a	5/15b	1/13b	7/27a	5/14b	1/13a

For each time period, groups with the same letter are not significantly different at $p<0.05$

Complete sample: combining the fluoride non-users (≤50%) and fluoride users (>50%)

batteries; fluoride can be released but also taken up (loading of the fluoride battery). It is not known how this phenomenon has contributed to the structural integrity of glass ionomer fillings and/or the protection against secondary caries in this study. A decision was made to use a neutral 1% sodium fluoride gel in this patient group, hence limiting the deleterious effects of an acidulated fluoride gel on the surface texture of glass ionomers. Other studies have previously demonstrated the negative influence of fluoride gels on glass ionomer cements [6, 11, 36]. The extent of erosion in this study for the resin-modified glass ionomer was in between the ones of the conventionally setting glass ionomer and the resin composite (Table 7).

Secondary caries is responsible for 60% of all retreatments of fillings in daily practise [37]. Fluoride-releasing dental materials have gained importance as protectors against primary and secondary caries in the coronal portion as well as at the root surface of the tooth. On the one hand, for as far as glass ionomers are considered, information is available from the questionnaire of Mjör [10] where general practitioners indicated that secondary caries was the commonest reason for replacement of glass ionomer fillings. Due to the study design, the representativeness of these findings, however, cannot be ascertained. On the other hand, no prospective clinical studies have yet shown whether the reduced incidence of secondary caries is a result of fluoride release from the restorative materials [38, 39]. In the presence of glass ionomers, reciprocal diffusion of ions through the dentin/glass ionomer interface is demonstrated [40], as well as an increase in physiologic remineralisation of carious dentin [41, 42]. In earlier xerostomia studies, there is evidence of protection against recurrent decay in the presence of glass ionomer cements, in contrast to resin composite and amalgam studied in the same populations [6, 11]. A similar protection was demonstrated in the present study, in the group of patients with low fluoride compliance: significantly better protection against secondary caries was seen with the conventionally setting KetacFil as compared with the resin-modified PhotacFil and resin composite Herculite XRV. In fact, the fluoride release from conventionally setting glass ionomers is higher than from resin modified glass ionomers and composites [43, 44]. This alone may explain the higher protection against secondary caries in the presence of conventionally setting glass ionomer cements. Furthermore, it is also demonstrated that fluoride release is enhanced under acidic conditions [45, 46]. Regardless of the relatively low amount of fluoride released [41, 43, 44], this study also demonstrates that this protection remains after loss of the filling material or after extensive disintegration of the glass ionomer, particularly for the conventionally setting formulation. The latter observation is supported by previous studies [11, 14].

Conclusion and recommendations

In this high-risk xerostomic patient group with radiation caries, the use of conventionally setting glass ionomers is associated with protection against secondary caries (even after loss of filling material). A compromised marginal adaptation and disintegration, however, is more pronounced for glass ionomer cements than for resin composites.

Conventionally setting glass ionomers are the optimal choice for treatment of cervical radiation caries. If this material fails, which may occur owing to erosion and dehydration in the dry mouth, the failing restorative materials may be replaced. Alternatively, when oral hygiene is good and the patient survives the first 2 years after radiotherapy, it may be preferable to preserve the remains of the glass ionomer filling and restore the tooth with a sandwich technique (with a composite covering the remains of the glass ionomer cement).

Conflict of Interest None

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