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Original Article

บทความวิชาการ

Restoration of dental erosion in silent gastroesophageal reflux patients: a case report

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Abstract

Teeth are the important elements of a person's face. Thus, enamel loss in the anterior teeth can affect a person's overall appearance and confidence. Enamel loss can be caused due to physiological factors (abrasion, attrition and abfraction) or by chemical dissolution (erosion), as occurs in a gastroesophageal reflux disease (GERD) patient. GERD is the retrograde flow of gastric contents into the oral cavity. Most GERD patients present classical symptoms (a heartburn sensation or regurgitation). In the case of a silent refluxer, dental erosion might be the first condition that can be observed. Among the responsibilities of the dentist is to recognize tooth wear from GERD, allowing early detection of silent GERD before complications develop and it becomes more difficult to treat. This paper describes the sequence of treatment for a silent GERD patient, including clinical examination, medical diagnosis, and medical and dental treatment. This can be used as a guideline to provide optimal treatment for GERD patients, especially those with silent GERD. In the case study, posterior teeth were restored with direct resin composites, onlays and crowns, following a minimally invasive concept. The patient was referred for proper medical treatment to stop the progression of GERD. Temporary crowns of anterior teeth were used to assess function, phonetics and dental esthetics of the patient. Once the temporary crowns were deemed appropriate, they were transferred for fabrication of all-ceramic crowns. As a result of this treatment, excellent function was obtained, while the patient regained confidence because of her new, esthetically pleasing smile.

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Key words: anterior restoration; dental erosion; lithium disilicate crown; silent GERD

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Introduction

Tooth wear is defined as non-carious destructive processes resulting in loss of tooth structure. They are referred to as abrasion, attrition, abfraction and erosion.^{1,2} Dental erosion is a non-bacterial chemical dissolution of the tooth surface that does not involve bacterial action. Erosion was found to be prevalent in 42% of dental patients, thus it is a common finding in oral examinations.³ Dental erosion has a smooth, spoon-shaped appearance. Erosion does not affect restorations leading to outstanding of old amalgam restorations.⁴ In severe erosion of anterior teeth, translucency might be observed because of extensive loss of enamel. Erosion can be caused by either intrinsic or extrinsic factors. Extrinsic factors include overconsumption of acidic foods and beverages, as well as certain medications. Intrinsic factors may include psychosomatic disturbances, as occur in anorexia nervosa and bulimia patients, or gastroesophageal reflux in GERD patients.⁵ The dissolution of dental structure occurs at approximately pH 5.5, whereas the pH of gastric reflux is around 2.0. Therefore it is strong enough to damage or soften the tooth surface.⁶ The frequent regurgitation of stomach acids into the mouth that occurs in GERD patients can cause dental erosion, especially on the lingual surface of upper anterior teeth.⁷

Nowadays, the stress of modern life has resulted in a high incidence of stress-related diseases. One of the most common of these diseases is gastroesophageal reflux disease (GERD). GERD, or acid reflux, is a gastrointestinal disorder in which stomach acid refluxes into the esophagus, causing mucosal damage and dental erosion. Gastroesophageal reflux may occur in healthy individuals; however, it is defined as GERD when reflux is severe enough to overwhelm mucosal defense, resulting in mucosal damage.⁸

A high prevalence of GERD (ranging from 10% to 48%) has been found in developed countries. Seven percent of Americans experience reflux symptoms at

least once daily, 20% experience them weekly, and 44% in the course of one month.^{9–11} Even though several previous studies showed a relatively low incidence of GERD symptoms in Asian people^{12–14}, a recent study reported an increasing prevalence of GERD compared to other studies from the previous decade.¹⁵

The major cause of GERD is failure of the anti-reflux barrier, which is composed of two major elements: the lower esophageal sphincter (LES) and the crural diaphragm. Both structures generate a high-pressure zone between the esophagus and stomach, and serve as a mechanical barrier to prevent the reflux of gastric acid into the esophagus. The transient relaxation of the LES and/or failure of the crural diaphragm lead to acid reflux that can irritate the mucosal lining and cause esophagitis.⁸ In mild cases, acid reflux might cause only microscopic changes in the cells of the mucosa. In more severe cases, bleeding and superficial linear ulcers can be observed.⁷

A relation between GERD and dental erosion has been reported in many studies.^{16–18} Eccles and Jenkins first described the relationship between GERD and erosion of the lingual surface of anterior teeth. They classified the severity of dental erosion by the following grading system: grade I, loss of enamel surface texture with no dentin involvement; grade II, erosion of dentin involving less than one-third of the tooth surface area; grade III, dentin erosion involving more than one-third of the tooth surface.^{19,20}

The most common symptom found in GERD patients is heartburn, or a burning pain in the chest (under the breastbone). This symptom is worsened if the patient has recently consumed fatty or spicy foods, large meals, alcohol, or caffeine.²¹ A GERD patient may have epigastric or retrosternal (noncardiac) pain, sour throat and stomach (because of regurgitation of gastric acid contents into the mouth), and/or difficult or painful swallowing (dysphagia).^{16,17,22,23}

Chronic GERD patients may not experience heartburn, belching, sour taste, or regurgitation. This condition has been termed “silent GERD”, which makes diagnosis difficult. Such patients have been described as “silent refluxers”. In this situation, dental erosion is often the first symptom of GERD that can be observed. Therefore, the dentist might be the first person to identify, diagnose and refer a patient to receive proper treatment before initiating dental therapy for reestablishment of dental function and esthetics.

This article presents a case report on the clinical manifestations, diagnosis, and medical and dental management of a silent GERD patient with severe dental erosion.

Case report

A 24-year-old female patient presented to the clinic with the chief complaint of unsatisfactory esthetic appearance and mild sensitivity of her maxillary anterior teeth. The patient had a history of GERD since 2009. She was treated with rabeprazole sodium (Pariet, 20 mg/day). She admitted that she had stopped follow-up consultations, and had not taken medication for her GERD condition for 3 months after she voluntarily ended post-treatment.

Clinical examination revealed a high smile line, and incorrect proportion of width and height of anterior maxillary teeth. The upper dental midline was



Fig. 1 Preoperative photos of the patient. 1a, Photo of patient's smile shows the relationship between maxillary incisors and lips. 1b, Frontal view shows severe erosion of upper anterior maxillary teeth, improper intratooth and intertooth proportions, and discrepancy of gingival margins of teeth 11 and 21. 1c and 1d, Occlusal views show severe erosion of upper anterior teeth, and improper amalgam restorations of teeth 16, 17, 26 and 27.

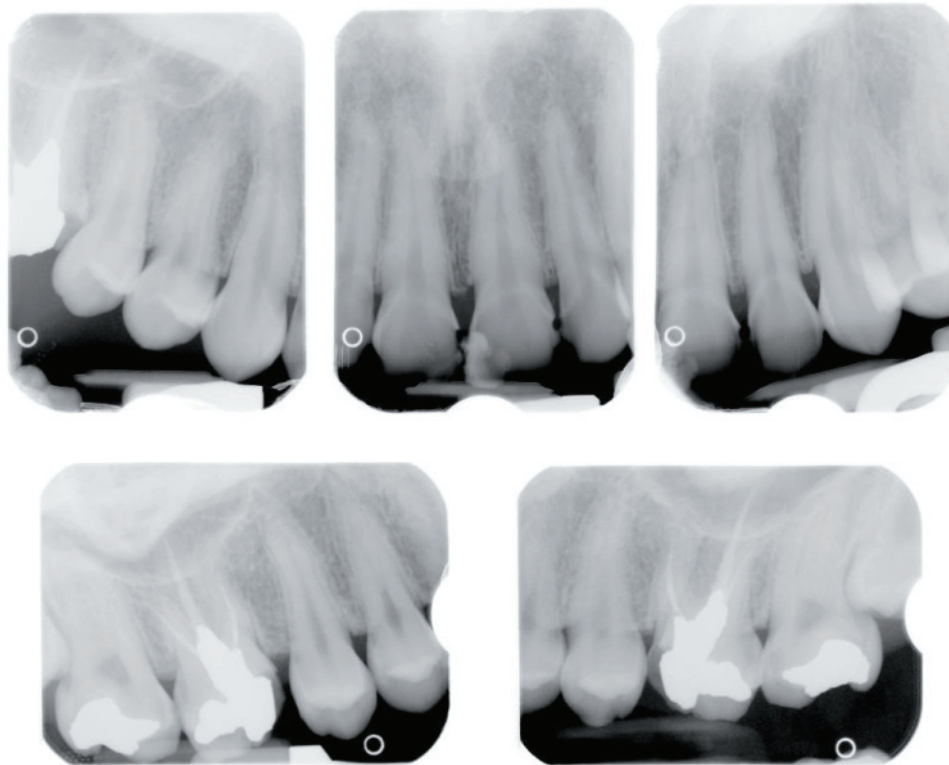


Fig. 2 Radiographs showing enamel loss of maxillary anterior teeth, with normal periapical tissue.

deviated 1 mm to the right. Upper anterior teeth had a thin translucency of enamel on the labial surface and almost complete loss of enamel on the palatal surface (grade III dental erosion), with incisal chipping of maxillary anterior teeth. Due to extensive loss of enamel, yellow discoloration (Vita classic, A4) and thermal sensitivity were reported. Pulpals of several teeth in the anterior maxillary region were nearly exposed. Teeth 11 and 21 had discrepancy of the gingival margin. Evidence of periodontal disease was not found. Occlusal analysis revealed Angle's classification I, with 1 mm overjet and 2 mm overbite. Fractures of amalgam restoration were found at teeth 16 and 26. Teeth 17 and 27 had improper amalgam restoration with secondary caries.

Teeth 16 and 26 had a history of root canal treatment. The vertical dimension of the patient's occlusion was maintained by the posterior teeth. Panoramic radiographs revealed impactions of teeth 18,

28, 38 and 48. Figs. 1 and 2 show the preoperative clinical and radiographic examinations of the patient.

Treatment

Due to extreme loss of tooth structure and near-exposure of the pulp of upper anterior teeth, immediate treatment was considered to be the first priority. Minimal preparation was performed on teeth 11 and 21. Temporary crowns (TempSpan; Kerr, Orange CA, USA) were applied to teeth 11 and 21, and direct resin composite restoration (Premise; Kerr) was performed on teeth 12 and 22 to prevent the progression of erosion and complications from pulp exposure (Fig. 3).

The patient was referred to a gastroenterologist for a full diagnostic examination and proper medical treatment. The medical evaluation report confirmed a diagnosis of GERD. Omeprazole (Miracid, 20 mg/day)



Fig. 3 Temporary crowns (teeth 11 and 21) and direct resin composite restoration (teeth 12 and 22).

and domperidone (Molax, 10 mg/day) were prescribed. The patient was under medical evaluation for several months until the condition stabilized. She was then referred to a dental clinic for restorative dental treatment.

Diagnostic data consisted of a detailed clinical examination, preoperative photographs, a complete radiographic survey, diagnostic models, facebow measurement, and interocclusal records. Based upon the information gathered, a treatment plan was proposed to the patient, which she later accepted at a subsequent appointment.

Posterior teeth were restored based upon the principle of minimally invasive procedures. Resin composite filling was used at teeth 27. For teeth 16, 26 and 17, which had extensive loss of tooth structure, monolithic lithium silicate ceramic (ISP e.max; Ivoclar Vivadent, Amherst NY, USA) was fabricated for crowns at teeth 16, 26 and onlays at teeth 17 to protect the remaining tooth structure. Teeth 18, 28, 38 and 48 were surgically removed.

The diagnostic models were mounted on a semi-adjustable articulator (Artex[®] articulator; AmannGirrbach, Vorarlberg, Austria). Repeated ratio or continuous proportion—the repeated proportion of central-incisor-to-lateral-incisor width and lateral-incisor-to-canine width (as seen in frontal view), which is about 0.66–0.78 was used to calculate the width of each upper anterior tooth.^{24,25} The optimal width/height ratio of the upper central incisors is 0.88.^{26,27} Thus this was used to calculate the height of teeth 11 and 21.

A diagnostic wax-up was made to determine the optimal esthetic and function of restorations. Because of a discrepancy in the gingival margin of teeth 11 and 21, a crown lengthening treatment plan was proposed to the patient. However, she declined to proceed with any periodontal surgery.

Silicone putty (Flexitime[®]; Heraeus Kulzer, South Bend IN, USA) was used to duplicate the wax-up stone model. According to minimally invasive

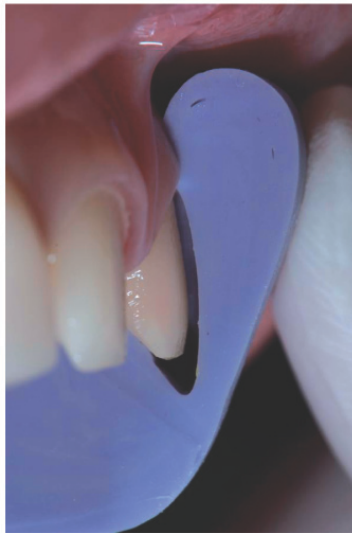


Fig. 4 A silicone index was used as a guide for crown preparation, following a minimally invasive principle. In this picture, the buccal surface was prepared to provide sufficient space for an all-ceramic crown.



Fig. 5 Temporary crowns of maxillary anterior teeth.

treatment guidelines, tooth preparation was performed on teeth 13–23 using a silicone index as a guide (Fig. 4). Provisional restorations of maxillary anterior teeth were made using chemically cured bis methacrylate resin composite (TempSpan; Kerr) and then veneered with A3 and A2 resin composite (Premise; Kerr) (Fig. 5).

After complete preparation, final impressions were taken with light- and medium-bodied polyvinyl siloxane impression material (Flexitime; Heraeus Kulzer). Bite registration and facebow transfer were

performed. Lower teeth impression was taken with alginate. Provisional restorations were adjusted and fixed with temporary resin-based cement (TempBond Clear; Kerr). Temporary crowns were used for assessment of esthetics, phonetics and function (Fig. 6). After several months of using temporary restorations, and once provisional crowns were considered to be appropriate, they were duplicated with silicone putty to use as an index for fabrication of the definitive restoration.

Anterior teeth, which require high esthetics, were restored with lithium disilicate coping (IPS e.max;



Fig. 6 6a and 6b Temporary crowns of teeth 13-23 were delivered and used to assess function, phonetics and esthetics of the patient.



Fig. 7 7a, E.max crowns of maxillary anterior teeth. 7b and 7c, Frontal view of upper anterior teeth following cementation of E.max crowns. 7d, Post-operative occlusal view of maxillary arch.

Ivoclar Vivadent) veneered with nano-fluoroapatite glass ceramic (Figs. 7a and 7b). Temporary crowns were removed, and prepared teeth were cleaned with pumice. All-ceramic crowns were tried-in without cement. The patient accepted the appearance and color of restorations. Inner surfaces of all ceramic crowns were acid-etched with hydrofluoric acid for 20 sec,

then silanized and air-dried for 60 sec. The adjacent teeth were separated using Teflon tape. Prepared teeth were cleaned, etched with 37.5% phosphoric acid (Kerr Gel Etchant; Kerr) for 15 sec, then rinsed and air-dried. Primer and adhesive bonding (OptiBond FL; Kerr) were applied to achieve excellent bonding. All-ceramic crowns were fixed with clear color



Fig. 8 8a, Post-operative photo of patient's smile, frontal view. 8b, Picture of patient smile after 18 months follow up. 8c, Frontal view of upper anterior crowns after 18 months follow up.

light-cured resin cement (Nexus3; Kerr). Light-curing was performed for 2–3 sec at the labial and lingual surfaces. Excess cement was removed; then all-ceramic crowns were light-cured for 40 sec on the labial and lingual surfaces. The same procedure was followed for the remaining anterior restorations. Occlusion was completely adjusted and checked (Figs. 7c and 7d). The patient was recalled at post-operative intervals of 1 week, 1 month, 3 months, 6 months and 1 year (Figs. 8 and 9).

Discussion

In general, GERD patients present with classical GERD symptoms. Therefore, GERD is commonly diagnosed based on the patient's reported symptoms. In contrast, silent GERD, in which the patient does not exhibit any symptoms, is difficult to diagnose and might

require special diagnostic tests: for example, barium swallow, endoscopy, pH monitoring, and proton pump inhibitor testing. The first sign that can often be observed in a silent refluxer is dental erosion. Therefore, the dentist can play an important role in diagnosing GERD and referring patients for appropriate treatment before their symptoms progress and are more difficult to restore.

Several methods have been used to treat GERD patients. Lifestyle modification is considered to be the most conservative treatment, including dietary changes, eating smaller meals, smoking cessation, sleeping with the head elevated 4 to 6 inches, avoidance of late meals, decreasing body weight^{8,21}, and medical modification to avoid certain medications (such as tranquilizers and beta-blocking agents) that can reduce saliva production, LES pressure, esophageal motility and gastric emptying.^{28–30} Antacids can be prescribed to increase the



Fig. 9 Comparison photos of patient's smile. 9a, 9b and 9c, Photos of patient's smile pretreatment, after 6 and 18 months follow-up.

pH of the refluxate and neutralize the acid.²¹ Histamine-2 (H₂) receptor blocking agents are typically prescribed for 6 to 12 weeks. For patients resistant to H₂ receptor blockers, or for patients with severe GERD, proton pump inhibitors (PPIs) that can provide strong acid suppression are the treatment of choice. Surgery might be recommended in cases where GERD symptoms cannot be treated with lifestyle changes and medication. In this case, omeprazole (a PPI) is usually prescribed together with domperidone (which is used to increase esophageal peristalsis and lower esophageal sphincter

pressure) for the treatment of GERD symptoms.

A number of studies have demonstrated the method of restoring dental erosion in GERD patients. In cases of mild or moderate dental erosion where there is still sufficient tooth structure to achieve promising adhesion, direct resin composite restoration can be considered as the most conservative treatment.³¹ Lingual ceramic veneers are an alternative treatment option that provides an esthetic appearance and firm coverage of tooth structure on the palatal surface.³² In cases of severe erosion, where the enamel on the

lingual and facial surfaces is extensively lost, porcelain fused to metal or all-ceramic crowns are used to restore function and esthetics. Even though all-ceramic restoration requires more tooth reduction and is more brittle, it provides superior esthetics, light translucency (similar to that of tooth structure), biocompatibility, and sufficient strength. Because of the development of ceramic systems and core materials, a high success rate of all-ceramic restoration has been reported in several studies.^{33,34}

IPS e.max Press ceramic is composed of lithium disilicate glass ceramic with high crystalline content (approximately 70%) in a glass matrix. It was introduced in 2005 to replace Empress II. Both IPS Empress II and IPS e.max have the same chemical basis. The firing process of IPS e.max has been improved; thus IPS e.max exhibits better physical and optical properties in comparison with IPS Empress II.³⁵ It can provide excellent translucency (four levels of translucency and unique opalescent shades) without compromising its strength (360–400 MPa of flexural strength). Due to its strength and translucency, IPS e.max requires less tooth preparation to achieve optimal physical and optical properties, compared to conventional ceramic systems.

According to the manufacturer, there are two designs for IPS e.max all-ceramic restorations: 1) lithium disilicate core veneered with porcelain; and 2) monolithic lithium disilicate ceramic. Because restoration was to occur in the upper anterior region, which is considered to be a high esthetic area, a lithium disilicate core with porcelain veneer was proposed for this patient. Monolithic lithium disilicate was chosen for posterior crowns and onlays. The advantage of monolithic material over other bilayer ceramic systems (e.g. zirconia) is that it eliminates the problem of porcelain veneer chipping. Delamination of porcelain veneered zirconia crowns was reported in between 3%

to 5% of cases in the first 5 years.³⁶ According to the study by Guess et al (2010), 90% of porcelain veneered zirconia crowns failed due to veneer chip-off fracture at 350 N after 100,000 cycles. In contrast, no chipping of monolithic lithium disilicate was reported at 900 N after 180,000 cycles.³⁷ Therefore, survival rates of monolithic lithium disilicate seem to be higher than for porcelain veneer zirconia when delamination is considered as one of the modes of failure.

Many clinical studies have demonstrated a high survival rate of IPS e.max crowns.^{38–40} Toksavul and Marquardt demonstrated 95% and 100% survival rates of IPS e.max crowns after five years.^{39,40} Boning *et al* (2006) showed that IPS e.max Press crowns had a survival rate as high as for gold metal-ceramic crowns over an observation period of 3 years.⁴¹ Moreover, an *in vitro* study reported that the fracture resistance of IPS e.max Press was comparable to that of natural unprepared teeth.⁴²

Several studies have shown that ceramic material has higher wear resistance compared to resin composite. On the other hand, it can cause antagonistic tooth damage, depending on the ceramic materials.^{43,44} Furthermore, some properties of ceramic materials—such as fracture toughness, internal porosities and surface defects—might accelerate the damage of antagonistic teeth.⁴⁵

Conclusion

This case report presents the clinical manifestations of dental erosion in a GERD patient. Especially in the case of silent GERD, where patients do not exhibit GERD-related symptoms, dental erosion might be the first sign observed during an oral examination. This presentation can assist dentists in diagnosis as well as proper medical and dental treatment, and also prevent further tooth erosion to the point where restoration becomes difficult.

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การบูรณะฟันสึกกร่อนในผู้ป่วยกรดไหลย้อนแบบไม่แสดงอาการ: รายงานผู้ป่วย

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²หลักสูตรทันตกรรมบูรณะเพื่อความสวยงามและทันตกรรมรากเทียม คณะทันตแพทยศาสตร์ จุฬาลงกรณ์มหาวิทยาลัย

บทคัดย่อ

ฟันเป็นส่วนประกอบสำคัญของใบหน้า ดังนั้นเมื่อเกิดการสูญเสียส่วนของเคลือบฟันและเนื้อฟันในฟันหน้าจะส่งผลกระทบต่อภาพลักษณ์และความมั่นใจของบุคคลนั้น การสูญเสียเคลือบฟันสามารถเกิดได้จากหลายปัจจัย อาทิเช่น แรงจากการแปรงฟัน แรงจากการกัดเคี้ยว หรือจากการจากสารเคมีที่มีความเป็นกรดดังเช่นที่สามารถพบได้ในผู้ป่วยโรคกรดไหลย้อน กรดไหลย้อนคือการไหลย้อนกลับของกรดในกระเพาะอาหารสู่ทางเดินอาหารและช่องปาก ในผู้ป่วยโรค กรดไหลย้อนส่วนใหญ่มักมีอาการเจ็บแสบที่หน้าอกจากกรดไหลย้อน ซึ่งแพทย์สามารถวินิจฉัยโรคกรดไหลย้อน ได้จากอาการดังกล่าว ในทางกลับกันมีคนไข้บางกลุ่มอาจไม่มีอาการแสดงของโรคกรดไหลย้อน การสังเกตการสึกกร่อนของชั้นเคลือบฟันจากกรดที่ไหลย้อนเป็นอีกวิธีหนึ่งที่สามารถนำมาวินิจฉัยโรคดังกล่าว ดังนั้นทันตแพทย์ควรต้องมีส่วนร่วมในการสังเกตการสูญเสียเคลือบฟันในผู้ป่วยโรคกรดไหลย้อนตั้งแต่ระยะเริ่มต้น เพื่อป้องกันโรค กรดไหลย้อนไม่ให้รุนแรงขึ้นจนยากต่อการรักษา ในบทความนี้ได้อธิบายถึงขั้นตอนในการรักษาผู้ป่วยโรคกรดไหลย้อนรวมถึงการตรวจวินิจฉัย และการให้การรักษาทันทีในทางการแพทย์และทางทันตกรรม ซึ่งสามารถนำไปใช้เป็นแนวทางในการให้การรักษาทันตกรรมในผู้ป่วยโรคกรดไหลย้อนเบื้องต้นโดยเฉพาะอย่างยิ่งในผู้ป่วยกรดไหลย้อนแบบไม่มีอาการ ผู้ป่วยในกรณีศึกษารายนี้ทันตแพทย์เริ่มการรักษาโดยการบูรณะฟันหลังด้วยวัสดุเรซินคอมโพสิต อ่อน เลย์ และครอบฟันตามความเหมาะสมโดยรักษาส่วนของเคลือบฟันและเนื้อฟันไว้ให้มากที่สุด ทั้งนี้ในการรักษาผู้ป่วยได้ถูกส่งตัวไปรับการรักษาโรคกรดไหลย้อนและป้องกันไม่ให้เกิดกลับมามีอาการอีก ในการบูรณะฟันหน้าครอบฟันชั่วคราวที่ทำขึ้นตามแบบจำลองฟันถูกนำมาใช้เพื่อประเมินการกัดเคี้ยว การออกเสียง และความสวยงามของคนไข้ หลังจากครอบฟันชั่วคราวถูกปรับแต่งจนเหมาะสมแล้วครอบฟันเซรามิกจะถูกทำขึ้นตามแบบครอบฟันชั่วคราว และนำมาใส่เพื่อให้ผู้ป่วยกลับมามีฟันที่สวยงามและมั่นใจในรอยยิ้มของตนเองอีกครั้ง

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คำสำคัญ: การบูรณะฟันหน้า; ครอบฟันเซรามิกชนิดลิเทียมไดซิลิเกต; ฟันสึกกร่อน; โรคกรดไหลย้อนแบบไม่แสดงอาการ

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