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Implications Of Removable Partial Denture Treatment Using An Abutment Tooth Following Root Canal Treatment And Jacket Crown Restoration: A Case Report

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Abstract

Partial tooth loss remains a prevalent condition in Indonesia, with a prevalence rate of 51.4% based on data from the Basic Health Research (Riskesdas) of 2018. One of the most widely used treatment options for tooth loss is the fabrication of acrylic resin removable partial dentures (RPD). The advantages of acrylic resin RPDs include their cost-effectiveness and ease of fabrication. The success of an RPD is greatly influenced by the condition of the mucosal tissues and abutment teeth as supporting structures. A 23-year-old female patient presented with discomfort during eating following the extraction of residual roots from the posterior mandibular and maxillary teeth. The patient had previously undergone root canal treatment and crown placement on the mandibular left posterior tooth. The patient wants a removable denture to be made. The selection of clasp type for an abutment tooth that has undergone root canal treatment and been restored with a jacket crown requires careful consideration of the periodontal condition, undercut depth, and functional load distribution, so that the retention of the prosthesis can be adequately maintained. This case demonstrates that a tooth that has undergone root canal treatment and been restored with a jacket crown can serve as an effective abutment for a removable partial denture, provided that a comprehensive evaluation of the supporting tissues and appropriate design planning are carried out.

Keywords: Removable Partial Denture, C-Clasp, Cingulum Rest, Root Canal Treatment, Jacket Crown, Dental Supporting Tissue

INTRODUCTION

Partial tooth loss is the condition of losing one or more teeth without losing the entire tooth in a single jaw arch. This condition is multifactorial, with the main causes most commonly found being dental caries and periodontal disease. Based on data from Basic Health Research (Riskesdas) in 2018, the percentage of the Indonesian population who have experienced partial tooth loss reached 51.4%, while the prevalence of tooth loss in general was recorded at 19%. This figure shows that partial tooth loss is not only an aesthetic problem, but also an oral health problem that has a wide impact on the quality of life of sufferers (Ministry of Health of the Republic of Indonesia, 2019).

Tooth loss that is not treated immediately can trigger more complex medical problems, including the antagonistic teeth of the missing tooth will be extruded into the empty space and neighboring teeth will migrate to the *edentulous area*, this will disrupt the relationship between the upper and lower jaws, and alveolar bone resorbtion occurs. Therefore, replacing the missing tooth with a proper prosthesis is a measure that not only restores the function of masting and aesthetics, but also to preserve the remaining supporting tissue (Dawid et al., 2023).

Partially removable dentures (GTSL) are one of the prosthodontic treatment options indicated to replace one or more missing teeth, supported by the remaining teeth as well as the oral mucosa and can be inserted or removed by the patient on their own. Of the various types of GTSL manufacturing materials available, GTSL acrylic resin is still the most widely used choice, due to its economical nature, relatively simple manufacturing process, good biocompatibility, and ease of repair in case of damage. Nevertheless, the resilience of GTSL is highly dependent on the precision of planning, especially in terms of the selection and evaluation of *abutment teeth* and their supporting networks (Haddad et al., 2020; Sianturi et al., 2025).

The GTSL support network includes two main components, namely the support from the teeth through the periodontal ligament and the support from the mucosa that rests on the alveolar bone underneath. Support through the *abutment* teeth mediated by the periodontal ligament is

physiologically superior to that of mucosal support alone, because the periodontal ligament has proprioception capabilities, more even load distribution, and better tolerance to occlusal forces. Therefore, the condition of the periodontium in the *abutment* tooth, which includes gingival health, gingival pocket depth, alveolar bone damage, and tooth mobility, is a key parameter that must be carefully evaluated before the tooth is established as a GTSL buffer (Ali et al., 2024; Chowdhury et al., 2025).

The clinical condition becomes more complex, when the teeth planned as *abutments* have undergone root canal treatment (PSA) and are restored with a jacket crown. Teeth that have had PSA done have different structural characteristics than vital teeth, including reduced water and protein content in dentin, which has an impact on decreased flexibility and increased risk of root fractures. However, various studies have shown that well-performed non-vital teeth can still function as reliable *abutments* for GTSL, provided there are no signs of periapical pathology, adequate crown-root ratio, and periodontal tissue in healthy conditions (Alhamdan et al., 2024; Gündüz et al., 2025).

RESEARCH METHODS

Research Method

This study employed a descriptive case report design to describe the prosthodontic management of a patient requiring an acrylic removable partial denture (RPD) supported by an abutment tooth that had previously undergone root canal treatment (RCT) and was restored with a jacket crown. The case was managed at the Dental and Oral Hospital Soelastri, Universitas Muhammadiyah Surakarta. The subject was a 23-year-old female patient who presented with complaints of discomfort during mastication due to multiple missing posterior teeth in the maxillary and mandibular arches. Comprehensive clinical examination included medical and dental history taking, extraoral and intraoral examinations, periodontal assessment, and panoramic radiographic evaluation to determine the condition of the remaining dentition, supporting tissues, and potential abutment teeth. The edentulous areas were classified according to the Applegate-Kennedy classification system to guide prosthodontic treatment planning.

Treatment was initiated with patient education and informed consent, followed by diagnostic impressions using an irreversible hydrocolloid material. Study casts were fabricated and used to design the removable partial denture. The prosthesis design considered the distribution of functional loads, selection of direct and indirect retainers, major and minor connectors, and evaluation of the endodontically treated abutment tooth restored with a jacket crown. Surveying procedures were performed to determine the path of insertion, identify suitable undercuts, and optimize prosthesis retention and stability.

Subsequently, working impressions were obtained using a mucodynamic impression technique, followed by jaw relation recording, articulator mounting, clasp fabrication, arrangement of artificial teeth, wax try-in, acrylic processing, finishing, polishing, and insertion of the removable partial denture. Clinical evaluation at insertion included assessment of retention, stability, occlusion, phonetics, esthetics, and patient comfort. The patient received instructions regarding denture insertion and removal, oral hygiene maintenance, and denture care. A follow-up examination was conducted one week after denture insertion. Both subjective and objective evaluations were performed, including patient-reported comfort, assessment of mucosal health, retention, stability, occlusion, masticatory function, phonetics, and oral hygiene status. The treatment outcome was considered successful because the patient reported satisfactory comfort and function without evidence of mucosal trauma or prosthesis instability.

RESULTS AND DISCUSSION

CASE REPORT

A 23-year-old female patient came to Soelastri Dental and Oral Hospital with complaints of discomfort when chewing food, due to the loss of many teeth in the upper and lower jaw. The patient admitted that his teeth were left with root left, felt since 3 years ago. The patient admitted that he had had a tooth filling and pulled out the upper and lower teeth with large holes and the remaining roots. The patient has a history of ulcers, the patient is not under the care of a doctor. The patient admitted that he did not have an allergy to drugs or the weather, but had an allergy to food in the form of shrimp. The patient has a habit of brushing his teeth 3 times a day, and the patient does not have a habit of drinking tea or coffee.

Extraoral examination appeared symmetrical and no abnormalities were found. Intraoral examination found edentulous areas in teeth 18, 17, 37, 36, and 46. In tooth 35 there is a restoration of the crown of the jacket *post* root canal treatment. Examination of soft tissues did not have abnormalities, there was a nodular-shaped palatine torus with an extension from the premolar tooth to the first molar which had a height of 3 mm, a medium frenulum height, no tooth mobility, moderate alveolar bone height, so it was more adequate as a support.

Figure 1A) *Edentulous* teeth of the upper jaw 1B) *Edentulous* teeth of the lower jaw

Figure 2. Panaromic Radiology

Based on objective examination, an *edentulous diagnosis* was obtained in teeth 18 ,17, 37, 36, and 46.

Edentulous in the area of the teeth of the upper jaw is included in the Applegate Kennedy Class II Classification and in the edentulous area of the lower jaw is included in the Applegate Kennedy Class VI Classification modified 1P.

CASE MANAGEMENT

In the initial stage, Communication, Information, and Education (KIE) is carried out on patients by providing information related to missing teeth, it is necessary to carry out treatment in the form of making partially removable dentures with acrylic materials. The creation of partially removable dentures aims to improve stomatognization function and maintain healthy tissue. The patient is then asked to sign *Informed consent* As a sign that the patient agrees to undergo partial denture treatment.

The next stage is to print a study model with mucosatic techniques. The printing materials used for the printing of study models are in the form of *hydrocoloid irreversible*. The result of the mold is then filled with *yellow stone* and positive molds are made *Boxing*. The selection of the color of the dental factor is carried out using *shade guide*. Color selection is carried out under natural light with

the patient's sitting position upright and the oral cavity parallel to the operator's eyes. The selection of the color of the tooth factor is adjusted to the color of the natural teeth in the area *body*. There are three main parameters that need to be assessed, namely *hue, chroma,* and *Value*. *Hue* is the basic color group of the teeth that is determined first by comparing *tab shade* quickly against the natural teeth, while *Chroma* describe the intensity or strength of the color in the group *bottle* selected, where the higher tab number indicates *Chroma* stronger. *Value* is a parameter that describes the brightness level of a tooth regardless of its base color. Based on color selection using *shade guide* obtained an A2 result.

Based on the results of the study model printout, the design of GTSL was carried out through 4 stages. The first stage determines the classification of the area *edentulous*. In this case, the patient has tooth loss in both the upper and lower jaws. In the upper jaw, the missing teeth are teeth 18 and 17, so the Applegate Kenedy Class II Classification was obtained. In the lower jaw the missing teeth are teeth 37, 36 and 46, so the classification in this case is Applegate Kenedy Class VI modification 1P.

The GTSL support chosen in this case is a combination of teeth and mucosa. The selected tooth support includes teeth 16 and 26 for the upper jaw, and teeth 38, 35, 45, and 47 for the lower jaw. The selection of dental support must take into account the position of the *fulcrum line* so that the pressure is well distributed and does not damage the periodontal and mucosal tissue. The main support is located near *the fulkrum* line i.e. on the support teeth that are directly adjacent to the *saddle*, while additional support remains required on the opposite side of the fulkrum line to prevent rotation of the base.

The mucosal support chosen is the base of an acrylic plate with the expansion of the plates as high as *the cingulum* and *buccal flange*. The retainer used in this case consists of *a direct retainer* in the form of a 3-finger clamer in teeth 16, 26, 38, and 47, clamer C and an occlusal backrest in teeth 35 and 45. *The indirect retainer* used in this case consists of *a buccal flange* on teeth 17, 18, 37, 36, and 46, and an acrylic plate at *the height of the cingulum.* In this case, the major connector is in the form *of an acrylic baseplate* which is part of the GTSL to connect the components on one side of the jaw with the components on the other side of the jaw, so that the dentures become a *rigid unit* and can distribute the chewing load evenly throughout the supporting structure. Minor connectors are small extensions of the acrylic plate that support the retentive element (Takebe, J. 2025). In this case, it is a 3-finger clamer base and a C clamer base which is planted on *an acrylic baseplate*. The factors in this case are teeth 18, 17, 37, 36, and 46.

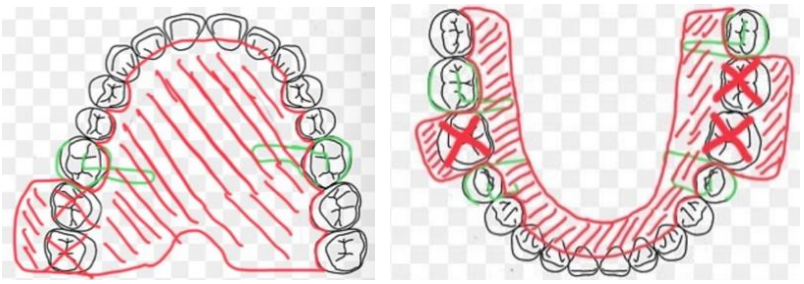

Figure 3. a) GTSL design of upper jaw; B) Lower jaw GTSL Design

The printing of the working model was carried out on the second visit using mucodynamic techniques with materials *hydrocoloid irreversible*. Mucodynamic technique is one of the printing methods with the principle that the patient is asked to actively move the muscles of the face, cheeks, lips, and tongue as long as the printed material is still in a condition that has not hardened in the mouth. In the mucodynamic method, patients perform various muscle movements with the aim of ensuring that physiological boundaries can be printed perfectly so that they can increase retention and stabilization later (Antonelli, et all., 2019).

The mold of the working model is filled with *stone cast,* then in*boxing*. The work model is carried out by model surveys using surveyors. The work model survey was carried out to determine *the path of insertion*, *the path of removement*, and the area *of tooth undercut* as the place of the

retentive arm and the area that must be*blocked out*. The work model survey with the surveyor begins by installing the work model on the surveyor's desk, with the occlusal plane of the working model parallel to the floor, then (observing the *existing undercut area*, measuring the size of the undercut to the same size from the antero-posterior direction and from the lateral direction), do tilting to get the alignment of the work model. tooth slope, and whether or not there is interference of soft tissue or teeth blocking the attachment path. The survey process is followed by analysis and adjustment of the model*'s tilt (tilting).* If the initial survey shows an unbalanced *undercut* between the sides of the jaw curve or interference is found, the model is tilted anterior, posterior, or lateral to get the best compromise between retention, stability, and aesthetics. In this case, *the path of insertion* of the *anterior dextra* direction and *the path of removement* of the *posterior sinistra.* After that, it is necessary to do *tripoding* so that *the path of insertion* that has been selected can be easily rediscovered at the next stage of work. *Tripoding* is done by making three crosses or dots on the boxing area of the working model, at points that are quite far from each other, two marks on the posterior side, and one mark on the anterior side. The *tripoding* mark is made using *a carbon marker* mounted on *a carbon sheet* on the *spindle holder.*

Undercut depth measurements are carried out using *an undercut gauge,* on the buccal surface of the abutment tooth, which aims to determine the exact clammer design of the abutment tooth. The *next stage* is *blocking out* the unwanted *undercut* area, which aims to cover the undercut area, so as not to become an obstacle to the *path of insertion* and *remove of insertion* of the prosthesis. *Blocking out* starts from the survey line of the unwanted *undercut* area to the cervical tooth *abutment*. The material used is plaster plaster because it is easy to shape, thickness controlled, able to harden and dimensionally stable. The results *of the blocking out* are smoothed and tidied using *a wax trimmer.*

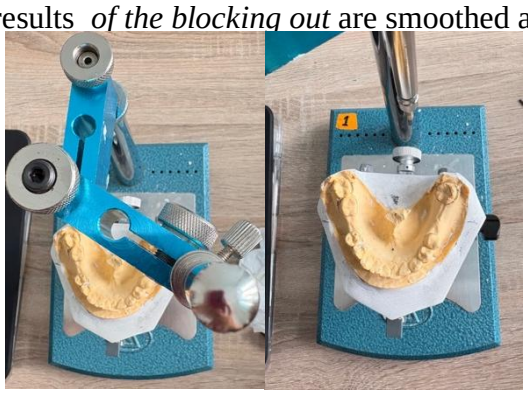

Figure 4. *Surveying* work models

The *bite record* is made using a softened red night, then the patient is asked to bite, this aims to determine the key occlusion of the upper jaw and lower jaw working models. The work model that has been *surveyed has been carried out,* followed by the manufacture of klamer and *red night baseplate*. The next stage is the *processing* and *try in* of the acrylic baseplate. At the *try-in baseplate stage, a* subjective examination is carried out, including patient comfort. Objective examinations were carried out to examine the retention, stabilization, occlusion, and phonation function of the baseplate. The adjustment of the *red night rim bite* was made on the *baseplate* and the alignment check and *height adjustment of the Vertical Dimension Occlusion* was carried out.

Vertical *Dimension Occlusion* (VDO) measurement in the manufacture of Partially Removable Dentures is carried out by physiological method, namely the Willis method. First, the distance from the glabela to the chin (*gnathion*) was measured when the patient's jaw was in a physiological resting position, so that the *Vertical Dimension Rest* (VDR) value was obtained. This resting position is usually obtained by asking the patient to relax or swallow first, because after swallowing the jaw tends to return to its natural resting position. The VDR value obtained is then reduced by *the Free Way Space* (FWS) of 2–4 mm, so that *Vertical Dimension Occlusion* (VDO) is obtained, which is a reference height for denture bites.

The next stage is *articulator mounting* and continued with the manufacture of clamers as denture retention. The clamour design on the upper jaw uses a three-finger clammer on teeth 16 and 26. The design of the clamer on the lower jaw uses a three-finger clamer in teeth 38, 37, 47 and a modified clammer C *oclusal rest* in teeth 35 and 45 then continued with the installation of dental factors.

The arrangement of the three molar teeth of the upper jaw pays attention to the angle of mesiodistal inclination of about 10°–15° in the mesial direction of the vertical line. The installation of the second molar of the upper jaw observes the mesiobuccal and mesiopalatinal protrusions more hanging about 1 mm than the mesiobuccal protrusion and the mesiopalatinal protrusion of the first molar tooth of the upper jaw. The first molar of the lower jaw is placed upright (0°) as the main reference for the arrangement of the posterior teeth, the crown of the tooth is slightly tilted towards the lingual (tilting lingual), the lingual inclination is about 5° from the vertical line, the mesiobuccal cups of the upper jaw are in contact with *the buccal groove* of the first molar of the lower jaw as the key to occlusion. The arrangement of the second molar teeth with the position of the crown of the tooth has a greater mesial inclination than the first molar, the mesial inclination is about 10°–15° from the vertical line, the occlusal surface is placed slightly below the occlusal plane of the first molar. Other examinations that need to be done include tooth occlusion, *protusive movement*, and *lateral movement*.

The next stage is a *dental tri-in*, occlusion contact examination using *articulating paper* with *selective grinding techniques* followed by examination of stomatognization function consisting of mastication, phonation, and aesthetic functions. *Partial removable* denture processing is carried out if the results of the stomatognization function examination are good.

The next visit was a partial removable denture insertion. Partially removable dentures are inserted based on the *path of insertion* from the *anterior dextra direction.* Retention checks are carried out on the baseplate, *direct retainer* in the form of the location of the clameric arm is right in the *undercut area*, the location of *the occlusal rest*, the location of *the reciproccal arm* attached to the abutment tooth arm. The *indirect retainer examination* was carried out by examining the attachment of the base plate with the mucosa and obtained good retention results. Stabilization checks are performed to ensure that the prosthesis does not come loose when functional movements of the jaw are performed and remains in a balanced position. Occlusion examination uses *articulating paper* with *selective grinding technique*, if there is an area of color thickening in the factor, a reduction is made. Examination of stomatognation function is carried out by examination of mastication, phonation, and aesthetic functions. Patients are given instructions on how to install and remove the prosthesis according to *the path of insertion* from the front right and *the path of removement* from the left and back, education is also carried out on how to use the prosthesis for 2x24 hours for adaptation and removal when cleaned, and the tool is cleaned using running water.

Figure 5. a) Upper jaw GTSL insertion; b) GTSL insertion of the lower jaw; c) Labial Visible GTSL Insertion

Patient control was carried out 1 week after insertion, with subjective examination, the patient felt comfortable during the use of dentures, no complaints of pain or swelling during use. Objective examination of partial removable dentures at the base of the tooth plate there is no trauma to the mucosa, retention examination in the form of *direct* and *indirect* Good retainers. Stabilization check at the time of use, the prosthesis does not come off easily. Occlusion examination using articulating

paper did not have color thickening in the dental factor. Examination of mastication function and phonation function in good condition. The OHI examination obtained a good result, namely 1.1.

Discussion

Partial tooth loss is a condition that can significantly decrease the patient's chewing function, aesthetics, and quality of life. Partially removable dentures (GTSL) are indicated in patients who have lost part of their original teeth, with the aim of restoring chewing, aesthetic, and speech functions, while helping to preserve the remaining teeth and correct occlusion. GTSL made of acrylic resin has the advantage of affordable cost, easy to repair if damage occurs, has good aesthetics. According to Haddad et al. (2020), since 1940 until now, acrylic resin dentures are still a widely used choice because of their excellent aesthetics, easy manufacturing process, repairable so that they are more economical, with *polymethyl methacrylate* as the main component of the denture base (Sianturi et al., 2025).

The retentive element used in this case is a modified C clamour of an *occlusal rest* implanted on an acrylic base. C-clamer is a commonly used type of clamer and provides retention through the wire that surrounds the contour of the support teeth. However, the C clamer has a weakness that can cause *wedging* forces between the support teeth and the next teeth, so, to prevent *wedging*, a modified *occlusal rest is added. Occlusal rest* also functions to distribute the occlusal load axially, so that the mastication load can be evenly distributed on the support teeth, thereby preventing periodontal tissue damage (Mao et al., 2025; Almuratova et al., 2021).

One of the *abutment* teeth in this case is a tooth that has received root canal treatment (PSA) and restored with a jacket crown, so it requires more detailed clinical considerations. Teeth that have been treated endodontically and used as *abutments* will experience horizontal and torsional forces, both when used as a support for dentures and partially removable dentures (Alhamdan et al., 2024). This condition is a major concern considering that teeth that have been treated endodontically are generally more prone to fractures than teeth with vital pulp. This is because post-PSA teeth experience loss of tooth root structure due to endodontic and restorative procedures. The risk of tooth fracture can increase further when the tooth is used as a GTSL *abutment*, as stated by Intaraprasong et al. (2024), that the risk of fracture increases if the *abutment tooth* has been treated endodontically and has pegs, because the tooth has weakened during the preparation of the root canal (Hafez et al., 2025).

The selection of tooth 35 *post* PSA as the *abutment* in this case, is based on the consideration that tooth 35 is the tooth closest to the *edentulous* area of teeth 36 and 37, so that it has the best prosthesis retention power. The risk of fracture fractures or damage to periodontal tissue in teeth 35 can be prevented by adding *abutment* teeth in teeth 38, 45, and 47 as *direct retainers* and expanding the base plate in the form of *buccal flange* as *an indirect retainer*. The retention of partially removable dentures can be strong with the support of the four abutment teeth. The fulcrum point formed from the abutment tooth keemoat forms a rectangular plane, so that the mastication load is evenly distributed throughout the prostheses, so that the prosthesis becomes more retensive and stable. This is in accordance with the legal reference statement of class IV miler (Oliveira et al., 2025).

The installation of the jacket crown on gear 35 as *a post PSA abutment*, is an important step before the GTSL insertion. The *abutment* teeth 35 were restored with a *full coverage* crown design, which required preparation with attention to proper contours. Post/*core build-up applications* are performed to support the structure of the crown of teeth 35. The crown of the jacket functions to protect the rest of the tooth structure that has been weakened due to PSA, while providing *the contour of the undercut* necessary for the retention of the C-clamer. The contour of the crown of the abutment teeth needs to pay attention *to the rest seat, guide plane,* and *adequate undercut* area to support the retention and stability of the prosthesis so that the clam can adapt properly (Alhamdan et al., 2024; Gündüz et al., 2025). Regarding the use of pegs and cores in non-vital teeth as *abutments*, it can increase resistance to tooth fractures. According to Intaraprasong et al. (2024), teeth that are endodontically treated and restored with core pegs can be used as GTSL *abutments*, with better long-term results than teeth that have been treated with composite restoration treatments (Hinz et al., 2023).

The success of the treatment of acrylic GTSL with a modified C-clamer *occlusal rest* on the dental *abutment* 35 post PSA and the crown of the jacket, is largely determined by the planning of the proper denture design, precision in the manufacturing stages, patient education regarding prosthesis maintenance, and periodic control. Patient education includes the importance of maintaining the cleanliness of the prosthesis and oral cavity, avoiding excessive chewing load in *the abutment* region, and periodic radiographic monitoring to detect early signs of complications such as: alevolar bone resorption, secondary caries, and root fractures of *the abutment* tooth. GTSL acrylic resin with clammer C modified occlusal rest can be an effective and affordable treatment option, even though *the abutment* teeth are non-vital teeth that have been treated with PSA and the crown of the jacket (Dawid et al., 2023; Gonçalves et al., 2022).

CONCLUSION

Management of acrylic resin partially removable dentures (GTSL) with *occlusal rest* modified C clamer on *abutment* teeth 35 that have been subjected to root canal treatment (PSA) and jacket crown restoration, requires appropriate and gradual clinical design planning. This case shows that *the restored post-PSA non-vital* tooth with a crown jacket, can still function as *an abutment*, provided that the condition of the periodontal tissue is healthy, the crown-root ratio is adequate, and there are no signs of periapical pathology. The GTSL design with the support of a combination of teeth and mucosa in this case has been proven to be able to distribute the functional load more evenly, thereby minimizing the risk of periodontal tissue damage to the support teeth.

The long-term success of this treatment is highly dependent on patient education and compliance in maintaining the cleanliness of the prosthesis and oral cavity, avoiding the burden of excessive chewing, and discipline in conducting periodic controls. Periodic radiographic monitoring is also needed to detect early possible complications such as alveolar bone resorption, secondary caries, and root fractures.

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