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CASE REPORT

REMOVABLE PARTIAL DENTURES REGARDING AESTHETICS, PHONETICS, MASTICATORY DISTURBANCES ACCOMPANIED BY TEMPOROMANDIBULAR DISORDER

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ABSTRACT

Introduction: *Tooth loss leads to several undesirable conditions, including the migration of adjacent teeth, tooth rotation, extrusion of opposing teeth, temporomandibular joint disorders, excessive load on supporting tissues, aesthetic dysfunction, and impaired speech function.* ***Case and Management***: *A 47-year-old male presented with a complaint of missing teeth in both his upper and lower jaws, and he sought to have removable dentures fabricated. The patient is having trouble speaking, particularly with certain words, temporomandibular joint sounds and lacks confidence due to the loss of their front teeth. He is also having trouble eating because of difficulty chewing. Management for this patient is by making an acrylic removable partial denture to improve occlusion. Aesthetic and functional improvements in the anterior region of the teeth can be achieved with the use of dentures, including removable partial dentures. The temporomandibular joint and occlusion are functional units, so disturbances in occlusion will affect the mechanism of the jaw joint. Functional disorders of the TMJ include pain and temporomandibular joint dysfunction, such as joint sounds (clicking).* ***Conclusion***: *Patients experienced a significant difference in chewing function between not wearing dentures and using removable partial dentures (RPD), with a decrease in joint sounds and pain. The success of the treatment is supported by proper design planning and correct treatment procedures.*

Keywords: *masticatory disturbance, removable partial denture, temporomandibular disorder, tooth loss*

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INTRODUCTION

Teeth serve many functions in humans, one of which is to chew. Tooth loss leads to several unfavorable conditions, including extrusion of opposing teeth, tooth migration, tooth rotation, temporomandibular disorders, excessive load on supporting tissues, reduced speech and masticatory function, and impaired maxillary and mandibular relationships, all of which necessitate treatment. The causes of tooth loss are varied, including genetic factors, certain diseases, local factors from within the tooth or

oral cavity, and others, such as accidents. Local factors are usually found in teeth with caries or gingival tissue infection due to bacterial activity, which eventually leads to tooth loss.[1,2,3]

Prosthodontic treatment aims to improve and maintain the patient's overall health, restore functions such as chewing and speech, enhance esthetics to boost the patient's confidence, restore and maintain the health of existing teeth and tissues, and prevent further damage to oral structures. A removable partial denture (RPD) is a cost-effective and reliable treatment option for cases of partial tooth loss. Removable partial dentures are prostheses that replace one or more teeth in a dental arch and can be inserted and removed by the patient. Removable partial dentures are supported by the underlying tissues and some remaining natural teeth for retention.[4,5]

Tooth loss, especially in the anterior region, will cause empty spaces that lead to aesthetic dissatisfaction. This space is covered by the tongue, lips, or cheeks, which can disrupt articulation when speaking and often hinder mastication.[4,5] The aesthetic function concerns the appearance of tooth colour and size. Aesthetic success is achieved when dentures become increasingly similar to natural teeth. The success of restoring aesthetic function for denture wearers depends on good cooperation between the patient and the dentist. Losing teeth can cause someone to lose their appetite, which in turn can negatively impact their nutritional intake. Tooth loss and the loss of supporting structures alter the primary mechanisms of articulation and produce noticeable effects on speech patterns. The changes that occur in the primary articulation of speech function are environmental changes that the human body will respond to by adapting. [6,7]

The restoration of aesthetic function in dentistry is described as the harmonious state of the teeth and other oral tissues, characterized by a balanced appearance. In dentures, the aesthetic function is related to improving the appearance of tooth colour, shape, and size. The restoration of phonetic or speech function is a vital form of communication in society that can directly or indirectly impact a patient's quality of life. Dentures can restore phonetic function in the oral cavity, improving letter pronunciation and facilitating verbal communication. Phonetics are crucial for communication with others; the clearer the pronunciation, the better the communication.[8,9,10]

The stomatognathic system comprises three primary components: the teeth and their supporting tissues, the muscles of mastication, and the temporomandibular joint system. For standard and stable function, all three components must be in good condition. In most cases, the loss of posterior teeth causes a change in the jaw movement pattern, which in turn affects the chewing movement pattern, resulting in an imbalance of muscle tone on both sides of the jaw and leading to functional disorders of the temporomandibular joint. The temporomandibular joint and occlusion are functional units, so any disturbance in occlusion will affect the jaw joint mechanism. Functional disorders of the TMJ include pain and temporomandibular joint dysfunction, such as joint sounds (clicking).[11,12]

Clicking can be found in patients with an anterior open bite skeletal occlusion, a retruded

contact position, and five or more missing teeth, which can affect the vertical dimension of occlusion and interfere with functional jaw movements.[11] Teeth play a role in the process of breaking down food. Tooth loss will directly impact chewing function. The number of teeth lost will increase disturbances or discomfort. Disruption of the chewing system due to tooth loss will be restored with the use of dentures, including the use of RPDs.[13] This case report will discuss removable partial dentures for the upper and lower jaws in a patient with esthetic, phonetic, and masticatory disturbances, as well as temporomandibular joint disorders.

CASE AND MANAGEMENT

A 47-year-old male presented with a complaint of missing teeth in both his upper and lower jaws for the past 3 years, and wanted to have removable dentures made. The patient experiences discomfort, particularly when eating, due to difficulty chewing. Previously, the patient had been wearing dentures for four months, but they were damaged when their house caught fire, so they had not used them for the past five months.

Extraoral examination revealed an ovoid face with a standard profile, asymmetrical lips, regular mouth opening (35mm), normal glands, and clicking on the right side of the TMJ. The patient reported pain when chewing hard foods and a 3mm deviation to the left. The patient's extraoral images are shown in Figure 1.

The patient's intraoral examination results showed that the patient had lost teeth 18, 17, 16, 12, 11, 21, 22, 23, 27, 28, 38, 37, 36, 35, 34, 44, 45, 46, 47, and 48. Upon radiographic examination, moderate caries was found in teeth 13, 15, and 24, which required filling. The treatment plan for the patient included providing instructions and education on how to maintain oral health, restoring teeth 13, 15, and 24, and creating a removable partial denture (RPD).

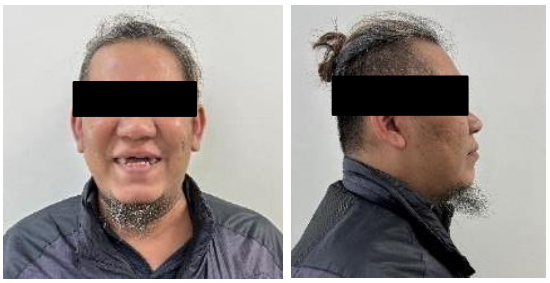

Figure 1. Patient's profile

Figure 2. Patient's intraoral condition

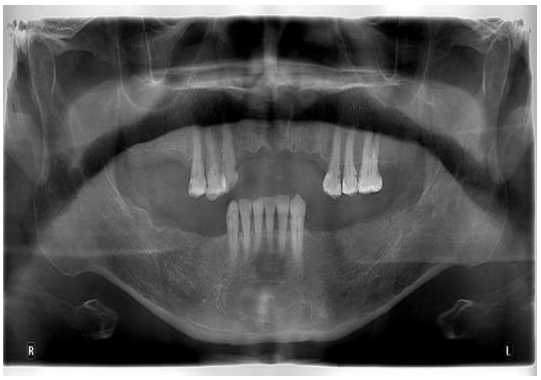

Figure 3. The result of panoramic radiograph

The first procedure is impression-taking; the impression tray used is 4-5 mm larger than the outermost ridge portion to be impressed. Impressions were taken of the patient's maxilla

and mandible using alginate material. Next, the impression was cast within 15 minutes of being removed from the patient's mouth. The first casting result was used as a working model, and the second casting result was used to create a study model based on the seven-sided shape.

After that, individual impression trays (IITs) were made for the mandible, and the IITs were tested on the patient. The IIT was placed in the patient's mouth, and the lower lip and cheek were pulled upwards. The IIT was adjusted to fit snugly in the patient's oral cavity, ensuring it did not easily come loose. The IIT was reduced by 1-2 mm up to the border of the movable and immovable tissues. The image of the patient's individual impression spoon can be seen in Figure 4. The muscle trimming stage on the lower jaw followed this. Peri compound was placed from the buccal frenulum to the distal part of the retromolar papilla on both the right and left sides, softened, and then inserted into the patient's mouth. Then the IITs were placed back into the patient's mouth, and second impressions were taken using a stock tray impression spoon and alginate material.

The next step in obtaining the working model of the mandible was beading and boxing. After that, the working model is placed on an adjustable surveyor table for surveying. The image of the patient's mandible survey results can be seen in Figure 6. The upper jaw belonged to Kennedy Class I Modification 1, and the patient's lower jaw belonged to Kennedy Class 1. The type of support was obtained from tooth tissue support a/r 33 and a/r 43. The fulcrum line on the patient's upper jaw runs from the distal of tooth 15 to the mesial of tooth 24, dividing the masticatory load; teeth 16, 17, and 27 have a load of 9, while teeth 12, 11, 21, 22, and 23 have a load of 5 (9:5).

Figure 4. Mandibular individual impression tray

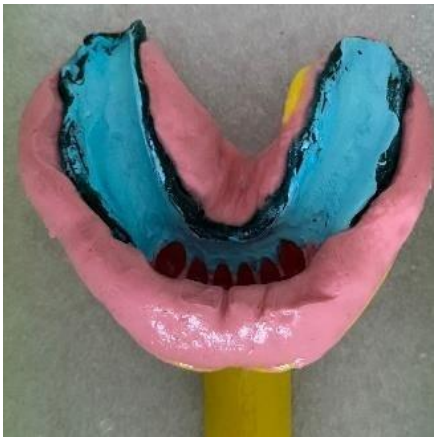

Figure 5. Second impressions on the mandible

On the mandible, direct retainers were made in the form of a C clasp 15 with the direction of the clasp from mesial to distal and a C clasp 24 with the direction of the clasp from mesial to distal. The indirect retainers on the mandible were in the form of a mesial occlusal rest on tooth 13 and a distal occlusal rest on tooth 26. Major and minor connectors connect the rigid parts of the clasp, the acrylic base border to the interdental spaces, and connect the direct and indirect retainers to the abutment teeth. The fulcrum line on the patient's mandible; the line

runs from the distal of tooth 33 to the distal of tooth 43, dividing the masticatory load. Teeth 34-37 have a load of 10, while teeth 44-47 have a load of 10 (10:10). Direct retainers were made on the mandible in the form of a C clasp on tooth 33 with the clasp direction from mesial to distal, and a C clasp on tooth 43 with the clasp direction from mesial to distal. The indirect retainers on the mandible are a lingual rest on the distal side of tooth 33 and a lingual rest on the distal side of tooth 43. Major and minor connectors connect the rigid parts of the clasp, the acrylic base border to the interdental spaces, and connect the direct and indirect retainers to the abutment teeth.

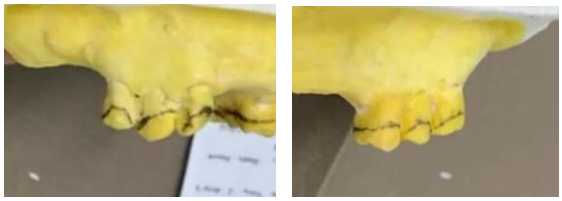

Figure 6. Surveying on maxillary working model

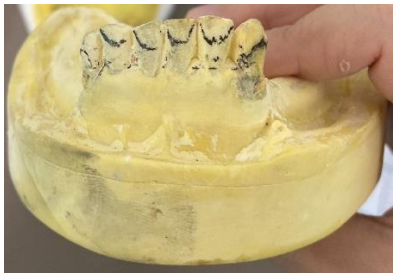

Figure 7. Surveying on the mandible working model

The next step is to create the base and occlusal rim, followed by a trial fitting of the appliance on the patient. During the trial, the fitness, retention, and stability of the base and occlusal rim in the patient's oral cavity were checked. Then, the vertical dimension was checked, with the patient asked to perform opening and closing mouth movements, chewing, and swallowing movements several times until the occlusion was correct. To check the centric relation, the patient was asked to swallow and place the tip of their tongue on the wax circle placed on the midline of the most posterior base of the tongue. The patient assisted in positioning their lower jaw in the most posterior position and pushing the lower jaw when relaxed. After that, fixation was performed between the occlusal rims of the patient's upper and lower jaws. The base and occlusal rim are removed from the patient's mouth, placed on the model, and occlude according to the impression of the opposing teeth. If it is already aligned, fix it with rubber bands and place it on the articulator.

Figure 8. Wax base trial and occlusal rim

The next step is the selection and arrangement of teeth. Things to consider are tooth colour, tooth shape, mesiodistal size, and buccopalatal size. The anterior teeth are arranged according to the inclination of the supporting teeth. The artificial teeth are arranged on the ridge. The incisal height of the artificial teeth is arranged according to the incisal height of the

supporting teeth adjacent to the edentulous area, and the cervical portion of the teeth is ground to achieve a harmonious relationship with the natural teeth. For posterior teeth, the mesiodistal and buccopalatal dimensions must be considered in relation to their opposing teeth. Posterior teeth should not extend beyond the anterior retromolar border or the maxillary tuberosity in free-end cases, and posterior teeth must be in contact with all opposing teeth to prevent extrusion. Next, the denture trial was conducted with examinations of adaptation, retention, stabilization, aesthetics, vertical dimension, phonetics, occlusion, and articulation.

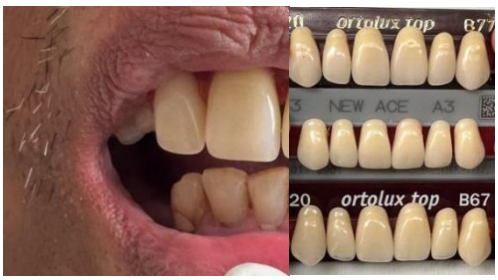

Figure 9. Anterior tooth shade selection, tooth arrangement, and try-in on the patient.

The image of the tooth arrangement performed on an articulator is shown in Figure 10. A trial of the denture was conducted to observe the adaptation, retention, stabilization, esthetics, vertical dimension, phonetics, occlusion, and articulation. Once everything is satisfactory, the process continues to the stage of gingival contouring and the base of the removable partial denture.

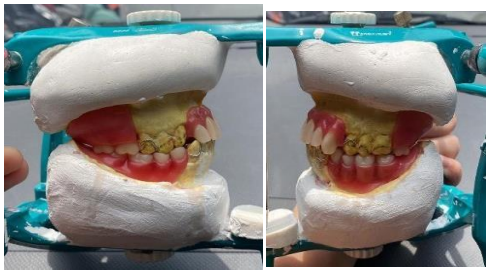

Figure 10. Teeth arrangement on articulator

Artificial teeth are ensured to fit nicely on the base. Then the model was submerged in a cuvette and boiled out. After that, packing, processing, deflasking, finishing, and polishing were carried out. Before inserting it into the patient, the denture is placed onto a tooth model and checked to ensure its base fits nicely against the model. The surface is checked and confirmed to be free of rough areas, and any remaining plaster is cleaned from the denture.

When inserting a removable partial denture for a patient, the adaptation, retention, stabilization, esthetics, phonetics, occlusion, and articulation are checked. The checks are performed by ensuring good adaptation of the base to the supporting tissues, that it does not come loose easily when inserted, remains stable when the tongue is raised, when the lower jaw is moved forward, right, and left there is no rocking, the color match of the denture teeth is checked, the patient is instructed to pronounce the letters f, v, s, d, o, m, r, a, t, and the fit is checked using articulating paper. After inserting the removable partial denture, the operator demonstrated how to wear and remove it. The patient was positioned in front of a mirror, and the operator inserted the denture and asked the patient to practice putting it in and taking it out himself.

The patient was educated that wearing dentures requires approximately three weeks to adapt and that dentures are not as efficient as natural teeth. Therefore, it was explained that the patient should not expect to chew as well as with natural teeth. The patient was instructed to chew on both sides to ensure even pressure on the dentures. The patient was also informed that if

their speech feels stiff when they first wear dentures, they should perform exercises (such as repeating difficult words or letters). The patient was educated on how to clean their dentures. Patients are informed that if they experience complaints such as tissue irritation or pain in the oral cavity due to the denture pressing on their teeth within 1-3 days after insertion, they should consult the operator immediately. The patient's condition before and after wearing dentures is shown in Figure 11.

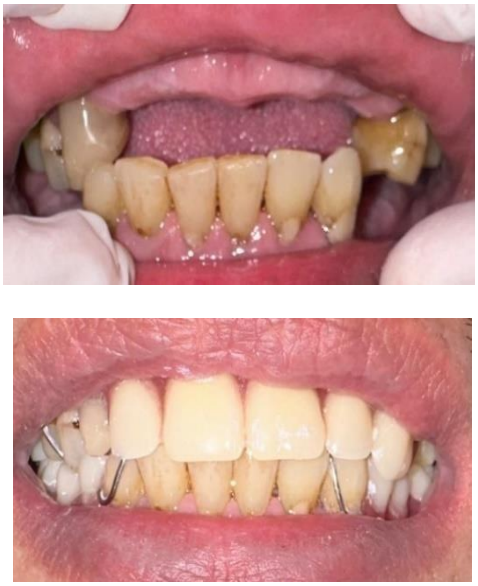

Figure 11. Condition before and after insersion of RPD

DISCUSSION

Dentures are artificial devices used to replace one or more missing natural teeth, restoring the changes in tissue structure that occur due to tooth loss. There are various types of dentures, including complete dentures (CDs), removable partial dentures (RPDs), fixed partial dentures (FPDs), and implant prostheses.[14] In this case, a removable partial denture (RPD) was used as a prosthodontic treatment alternative that is more affordable for most patients with tooth loss. A removable partial denture is a prosthesis that replaces one or more missing teeth in the upper or lower jaw and can be easily removed and inserted by the patient. This denture is supported by the underlying tissue and the remaining teeth that serve as anchors. In the case of removable partial dentures, the issues of support and retention become more significant if additional teeth are lost and the edentulous areas become wider. Damage to the coronal structure or reduced periodontal support makes it impossible to use these teeth as abutments for conventional dentures.[2,15]

The primary benefits of using an RPD are to improve chewing function, enhance aesthetics, maintain speech, promote tissue health, correct occlusion, and preserve any remaining oral soft tissue.[2] Based on the base material used, removable dentures are divided into two types: acrylic resin removable dentures and metal framework removable dentures. The base material used in this case is acrylic resin. This material offers several advantages, including aesthetic appeal, improved chewing ability, enhanced fracture resistance, a relatively low cost, and ease of repair.[16] In this case, the patient has lost teeth at 18, 17, 16, 12, 11, 21, 22, 23, 27, 28, 38, 37, 36, 35, 34, 44, 45, 46, 47, and 48. The patient's condition falls under Kennedy Class I Modification 1, characterized by tooth loss at the posterior region (free end) bilaterally in the upper jaw, and Kennedy Class I in the lower jaw.[17]

Tooth loss in the anterior region (teeth 12, 11, 21, 22, 23) can cause patients to experience speech difficulties and a loss of self-confidence. Artificial teeth are a crucial component of

removable partial dentures from both aesthetic, functional, and phonetic perspectives. Matching anterior artificial teeth to natural teeth requires careful attention to colour selection, characterisation, and tooth contour to align them with the natural teeth and the correct position of the artificial teeth. The patient's natural teeth or old prosthesis serve as a valuable guide for selecting and arranging teeth in the new prosthesis. It is essential to assess the patient's smile line and the amount of gingival papilla visible during smiling to determine the selection and position. This is important because a smile is essential for appearance and is highly valued by some people as a source of confidence. [9,18,19] The gingival configuration is another important factor to consider when making a prosthesis. The location and contour of the gingival margin created on the denture and the length of the interdental papillae must perfectly match the adjacent natural teeth. Colour selection plays an important role in enhancing the aesthetics of prostheses. A dentist must have a definite colour guide based on the gradations of Hue, Value, and Chroma. This issue is particularly unique to removable partial dentures compared to fixed or complete dentures. This is because there is little change in translucency and colour on the shade guide, whereas fixed dentures offer the advantage of custom-stained porcelain teeth to match adjacent natural teeth.[15,19]

In the issue of phonetic function, the interaction between the tongue, palate, lips, teeth, and jaw is an integral part of the valve and articulation process that modifies airflow to produce sound when speaking. The use of dentures can significantly alter tooth position or palatal contour, which can affect or interfere with speech articulation and clarity.[5] Incomplete speech tools can affect a patient's voice, for example, in patients who have lost their upper and lower front teeth. Speech difficulties can arise even if they are only temporary.[4] The function of speech causes the pronunciation of letters that require contact between the tongue, lips, and front teeth to become difficult, such as the pronunciation of the letters s, sh, t, f, d, n, z, and v, which makes the person's speech less clear. Bilabial sounds ("p," "b"), labiodental ("f," "v"), linguodental ("th"), and linguopalatal ("s") also require contact between the tongue, lips, and front teeth. The "s" sound is produced by contact between the tip of the tongue and the roof of the mouth, with a small space created for air to escape. If this space is too small, a whistle is usually heard. If the space is too broad and thin, the "s" is replaced with "sh," which sounds like a lisp. Therefore, sounds formed in the labiodental, linguodental, and linguoalveolar regions are a concern to dentists.[18]

The phonetic aspect of dentures should be considered equally with aesthetics and mechanics. It should be checked during the wax try-in when the palatal contour can be modified to accommodate speech articulation. In this case, the patient had difficulty pronouncing the letters s, f, and v, so appropriate examination was needed to restore phonetic function with dentures:[18] (1) Posterior border of the denture; when the patient says "ah," the boundary between the immobile and mobile palate is formed, and the posterior extent of the denture is determined. (2) The height of the anterior teeth and thus the occlusal plane; during the wax try-in test, if the

patient cannot pronounce the "v" sound clearly, then the anterior teeth are either too far above or below the functional occlusal plane. (3) Overjet, can be confirmed by using the "s" sound. (4) Labiolingual position of the mandibular anterior teeth; a lisp on the "s" sound indicates that the teeth are positioned too far lingually. (5) Thickness of the anterior palatal region; can be assessed by asking the patient to say "t"; if the patient lisps, it shows excessive thickness. (6) Thickness of the post-dam; difficulty pronouncing "g" indicates excessive thickness at the base of the denture in the post-dam area.

After the procedure is performed correctly, the patient is re-examined to ensure the restoration of the phonetic function of the denture by conducting a speech test:[18] (1) The patient was asked to speak randomly, which is best achieved by engaging the patient in conversation and obtaining subjective speech as well as pronouncing specific sounds. The best way to do this is to have the patient say six or eight words that contain the sounds (f, v, s, d, o, m, r, a, t) and then combine those words into a sentence. (2) The patient is asked to read a short paragraph containing many s, sh, and ch sounds.

In most cases, the loss of posterior teeth causes a change in the jaw movement pattern, which in turn affects the chewing movement pattern, resulting in an imbalance of muscle tone on both sides of the jaw and leading to functional disorders of the temporomandibular joint. The temporomandibular joint and occlusion are functional units, so any disturbance in occlusion will affect the jaw joint mechanism. Functional disorders of the TMJ include pain and temporomandibular joint dysfunction, such as joint sounds (clicking).[1,2,6,14] Oral health-related quality of life is a multidimensional construct that relates to the impact of oral health on functional, social, and psychological impairments. Additionally, it impacts the overall well-being and quality of life of everyone.[15,16] Individuals with posterior tooth loss can experience a direct impact on their quality of life, as it can affect chewing function and even lead to psychosocial problems. Individuals tend to choose softer foods due to difficulty eating, and harder foods can cause pain.[6,20]

Temporomandibular joint examination is performed by palpation and auscultation. The operator placed a finger on the patient's ear-ear line, 11-12 mm in front of the tragus, and then instructed the patient to open and close their mouth slowly several times. During the examination, a clicking sound was heard in the right temporomandibular joint, and the patient reported occasional pain in the area in front of the ear when opening the mouth. The operator then examined the patient from the front and instructed the patient to open and close their mouth several times slowly. The operator observed a deviation of approximately 3 mm to the left in the movement. The patient experiences symptoms including discomfort, pain, and a clicking sound.[17]

In this case, the loss of posterior teeth occurred on both the left and right sides, so the impact on masticatory function will be greater. The number of missing teeth also influences the effectiveness of chewing. The more teeth that are lost, the more difficult it becomes to chew food. Losing three or more posterior teeth can disrupt the mastication process.[20] In this case, the patient

is experiencing difficulty chewing, which makes it harder to swallow food and also causes discomfort while chewing. The large number of missing teeth also impacts the time required to grind food, making it longer. The patient experienced a significant difference in chewing function between wearing and not wearing a denture. After using the removable partial denture, the patient no longer had trouble chewing, reported a reduction in pain while chewing, had less difficulty swallowing food, the clicking sound when opening and closing the mouth decreased, and there were fewer complaints related to the time needed to chew food.[21]

CONCLUSION

Aesthetic and functional improvements to the anterior teeth can be achieved using dentures, including removable partial dentures. Dentures not only aim to restore function and phonetics but must also place special emphasis on aesthetics, with long-term benefits that require careful attention during fabrication. In this case, the treatment yielded positive results, with the patient's confidence level increasing and their speech function improving using removable partial dentures. Mastication improved, and the pain and clicking of the temporomandibular joint decreased.

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