The Fabrication of Maxillary and Mandibular Dental Prostheses for a Patient with Rapidly Progressive Periodontitis

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Key Words: Rapidly Progressive Periodontitis, Metal-Ceramic Crown, Co-Cr RPD, Dental Prostheses, Gum tinting.

Summary:
The fabrication of maxillary and mandibular dental prostheses for a patient with rapidly progressive periodontitis is presented in this article. Rapidly progressive periodontitis refers to a kind of serious oral disease with occurs in human periodontal tissues. The result of that the supporting tissues of patient’s teeth are rapidly destroyed. Taking into
consideration that dentist will dealing with a clinical treatment for maxillary and mandibular arch by dentist, the dental laboratory may restore lost dentition and appearance with a maxillary cobalt-chrome removable partial denture supported on remaining teeth such a RPD is prepared as a precision attachment for a better stability of supporting and retaining the framework of the denture, along with a mandibular full acrylic denture with gum tinting for improving the aesthetics.

**Introduction**

The patient was 35 year-old male, who complained of bleeding gums when brushing teeth, he felt pain during chewing and some of his teeth were drifting. After an oral examination by a dentist, he was diagnosed as have rapidly progressive periodontitis caused by poor oral hygiene\(^1\). His mandibular lateral incisals, canine, premolar and molar (3·2, 3·3, 4·2, 4·4 and 4·6) had severe mobility; and the maxillary lateral incisal, premolar (1·4 and 2·2) and mandibular central incisal, premolars and molar (3·7, 3·4, 4·1 and 2·5) had marginal mobility.

**Case History**

This patient was diagnosed with Rapidly Progressive Periodontitis. This refers to a kind of serious oral disease which occurs in human periodontal tissues and can rapidly destroy the supporting tissues of teeth,\(^2,3\) it usually presents between the ages of 15 and 35, and it will seriously damage the oral health of involved juveniles. It always causes
rapidly periodontal attachment loss, which results in mobility of the teeth.\textsuperscript{2}

Lowered immune competency and depression can cause a rapidly progressive periodontitis.\textsuperscript{3, 4} Pain is usually absent, unless an acute infection forms in one or more of the periodontal pockets. Impaction of food in the pockets can cause pain at meals. Gums are tender and bleed easily, and the breath is foul. Abundant plaque along with redness, swelling, and exudates are characteristic.\textsuperscript{5}

Clinically, there was widespread tooth mobility in this case; masses of microbial plaque on all the teeth, and the alveolar bone had been resorbed.\textsuperscript{6}

Radiographic evidence indicates severe rapidly progressive periodontitis in a 35 year-old male patient who claimed to have normal masticatory function. He had a bad tooth arrangement and occlusal relationships. The mandibular central incisal, lateral incisals, and premolar (3·2, 3·4, 4·1 and 4·2) are outstand in maxillary teeth. However, as seen, two mandibular molars and maxillary molars had been extracted, almost all the bone had been resorbed on the mandible and some bony deterioration had even extended beyond the root apices on the lower first molar, canines, lateral incisals and premolars.\textsuperscript{2, 3, 7}
Clinical treatment process

For maxillary arch, the first phase of treatment was extraction of all the unsaveable teeth: the right lateral incisor, the left lateral incisor, the right canine, the left canine, the right first premolar, the left first premolar, the right second premolar and the left first molar (1·2, 1·3, 1·4 and 1·5, 2·2, 2·3 2·4 and 2·6). The right first molar and the left second molar (1·6 and 2·7) were extracted about 2 years ago. Such extraction is often necessary in cases of advanced further disease.

The second phase of treatment was extensive oral hygiene treatment and education to enhance the healing process.  

Existing disease was revealed during the clinical examination. The disease process can usually be arrested by identification and reduction of the initiating factors, identification and improvement of the resistive factors, or both. For example, oral hygiene instruction helps reduce the amount of residual plaque, an initiating factor, and thus helps reduce the likelihood of further dental caries. It also helps improve gingival health, and the resulting healthy tissue is more resistant to disease.

Additional fluoride intake (e.g., mouth rinses) is also recommended in a patient with a caries problem. Restorative care replaces damaged or missing tooth structure, but additional treatment is essential for controlling the disease that caused the damage.
The treatment consists of thorough scaling and root planing to remove plaque and calculus deposits on the right central incisal, the right second molar, the right third molar, the left central incisor, the left second premolar and the left third molar (1·1, 1·7, 1·8, 2·1, 2·5 and 2·8). The right second molar and right third molar (1·7 and 2·8) were prepared for fabricating two full metal crowns, and the left central incisor (2·1) was prepared for fabricating a porcelain fused metal crown including labial ceramic shoulder.

The first phase of treatment for the mandibular arch is extraction of all the teeth, because the extraction is often necessary in advanced further disease.

The second phase was extensive oral hygiene treatment and education to enhance the healing process, and reveal existing disease is during the clinical examination is also be taking. 

After clinical process by the dentist, the prepared maxillary and mandibular models are prepared. As shown in Fig. 2, the maxillary model is a classification of Kennedy Class III, modification 2, and mandibular model has a full arch without any remaining of teeth.
Fig. 1 Prepared maxillary and mandibular models after clinical treatment process. The maxillary model is a Kennedy Class III with modification 2.

**Technical treatment options**

There are three technical treatment options for the maxillary model. They are: the implant–supported fixed prosthesis,\(^9\) the removable partial denture,\(^10\) and a metal–base removable partial denture retained with two metal–crowns on 1·7 and 2·8 and a porcelain fused metal crown on tooth 2·1.\(^10\)–\(^14\)

Technical treatment options for the mandibular model are: the implant–supported fixed bridge,\(^9\) the implant–supported overdenture,\(^9\) and a conventional acrylic denture with gum tinting.\(^10\)

To make the best choice for the patient, the advantages and disadvantages for each
technical treatment option are compared, according to the follow questions or even other criteria characteristics: which option is usable for this 35 year–old with rapidly progressive periodontitis; which option will have the longer lifespan; which restoration is much more strong than others; which denture is more stable than others; which prosthesis is economically affordable for this patient; which design can be less resorption of the alveolar bone; and which restoration is easy to fabricate and takes less time to healing.

◆ **Implant-supported fixed prostheses**

They have advantages of preventing alveolar bone resorption; a longer lifespan, they have the compared with the removable denture; they have excellent stability; best masticatory function; and they have superior aesthetics which improve patient confidence.\(^9\)

Disadvantages are: they are extremely costly compared to the conventional denture, which is about 10 times more costly than the acrylic denture; they are time-consuming to fabricate resulting in them rarely being used compared to the conventional denture; and the implant surgery only be under-taken on a patient with good oral hygiene and a good alveolar bone support. Therefore, the patient can not afford this option, because in this case the rapidly progressive periodontitis had affected the alveolar bone and had seriously resorbed; and he had bad oral hygiene.\(^9\)
◆ Acrylic removable partial denture

It has advantages of: when it is compared with metal removable partial denture, it is simple and easy to fabricate; and its cost less than a Removable metal Partial Denture.\textsuperscript{10}

Disadvantages of the acrylic RPD are that it may cause resorption of the alveolar bone; may damage supporting-teeth when removing the denture if not designed correctly; and it is not as stable and strong as a Removable metal Partial Denture.\textsuperscript{10}

◆ Removable metal partial denture retained with metal crowns

It has these advantages: the metal base is strong and stable;\textsuperscript{10} it has a longer lasting lifespan compared to the acrylic base;\textsuperscript{11} it can resist tarnishing after a long period of wear; the denture retained with milled metal crowns adds even more support advantage; and the milled metal crowns support and retain the framework.\textsuperscript{12}

Disadvantages are: because the density of metal is much higher than acrylic, the patient may feel uncomfortable wearing a maxillary denture as it is too thick and heavy;\textsuperscript{12} it is time consuming to fabricate; and toxic fumes given off during the laboratory fabricating process can cause the technician to develop cancer.\textsuperscript{11}

◆ Metal-ceramic crown

There are four different advantages of metal-ceramic crown and they are: it has
excellent aesthetics, which improves patient confidence; the patient is a 35 year–old, so the aesthetics is very important; it is more stabiles compared with removable denture; it also has a longer lifespan compared with removable denture; and it is very strong and combines the functions of both metal and porcelain.\textsuperscript{14}

Disadvantages are: it is time consuming to fabricate during the laboratory process; and it is more costly, compared to the full metal crown.\textsuperscript{13}

\textbf{Conventional acrylic denture}

Advantages are: it is used widely by patients with different backgrounds; it can take less time to fabricate compared with fixed prostheses; it can easily be removed for cleaning; it is lower cost than the fixed prostheses; and it can easily be modified by reline or rebase after a long period of wearing.\textsuperscript{10}

There are three disadvantages of wearing a conventional acrylic denture: wearing the acrylic denture for a long period will result with a resorption of the alveolar bone; it can also lose masticatory sensitivity; and the denture is not as strong and stability as a fixed prosthesis.\textsuperscript{10}

\textbf{Implant-supported overdenture}

Advantages are: the implants provide a fixed support for the overdenture. This result in better stability for the denture compared with the conventional acrylic denture. The
retention of implants also results in less bone preservation, which leads to better denture function. Horizontal occlusal forces are then tolerated better because of fewer teeth and the preserved alveolar bone\(^9\)

The main disadvantage of the overdenture is that healing time following clinical procedures is long compared with that for a conventional acrylic denture. There are also higher expenses compared with those associated with a conventional acrylic denture; and encroachment of the interocclusal distance occurs. This is because, when an overdenture is fabricated, especially one which has some form of internal attachment, the available interocclusal distance of a standard denture usually cannot be compromised and so a struggle ensues to place the entire overdenture within its proper dimension. The implant surgery can only be under-taken on a patient with a good oral hygiene and good alveolar bone support. Therefore, the patient of this case could not choose this option, because the rapidly progressive periodontitis had affected the alveolar bone which had seriously resorbed; and he also had bad oral hygiene.\(^9\)

**Chosen technical treatment options**

After comparing all the advantages and disadvantages of each technical treatment options, four restorations had been choose for both maxillary model and mandibular model.
On maxillary arch: a metal-ceramic crown on 2·1 including labial ceramic shoulder, the main function for this patient is improving the aesthetics; milled metal crowns on 1·7 and 2·8, they will improving the stability to the denture and support and retain the framework of the denture. The aesthetics on molars is not very important, so the metal – crown can be the good choice; and a cobalt-chrome removable partial denture supported on 1·7 and 2·8, teeth 1·7 and 2·8 are prepared as a precision attachment for a better stability of supporting and retaining the framework of the denture.

On the mandibular arch: A conventional acrylic denture with gum tinting was the best choice for this 35 year – old patient, as he requested to take a natural looking denture for his mandible restoration because the smiling of this patient will show the mandibular tissue. The denture with gum tinting compared with the denture without the gum tinting as shown in the Fig. 2, the one with the gum tinting has a darker redness around the gingival area, and it looks much more natural than the one without the gum tinting.

Fig. 2 Comparing the normal denture and the denture with gum tinting.
Dental Laboratory procedure

◆ Preparing the model and fabricating the metal-ceramic crown on 2·1

Firstly, prepare the model. Pouring the final impression with vacuum-mixed die stone, cement pins in each removable section, then trim each die carefully to expose the finish line. Now the model is ready to be mounted, a mandibular record block is used for bite registration. Placing die spacer and waxing a coping on 21 with collar, spruing and investing the wax pattern. Casting produced using direct spruing, placing the attached sprue former on the middle of the casting ring, and the wax pattern on the upper 1/3 of the casting ring (placing on as far as heat center) that will be less porosity during cooling process. Divesting and sandblasting the coping, preparing the coping ready to use for build up the porcelain, continuous with building up the porcelain according to the shape and color of tooth 1·1. After trimming to the correct shape, stain and glaze the porcelain surface, then finishing and highly polishing metal-ceramic crown with collar.

◆ Fabrication of gold metal crowns

Waxing up full anatomy crowns on 1·7 and 2·8 with different color wax, the fitting layer wax I used yellow color and top with blue color. After the wax up is finished, milling of wax patterns on lingual side for both 1·7 and 2·8 by using a milling machine. Those different color waxes were helping me to measure the thickness of milled crowns. The crown is being invested with phosphate-bonded investment, placing into the furnace with 550 degree for about two and half hours, and then casted with gold alloys
Divesting, final milling, finishing and highly polishing two gold crowns.

**Fabrication of Co-Cr RPD**

Follow the standard methods of making maxillary Co-Cr RPD as pouring refractory model, wax up the framework, spruing, casting and polishing the metal base. As shown in Fig. 3, the finished maxillary prostheses.

![Fig. 3 The completed maxillary prostheses. A cobalt-chrome removable partial denture retained with two metal-crowns on 1·7 and 2·8 and a metal-ceramic crown on tooth 2·1.](image)

**Fabrication of mandibular full acrylic denture**

Following the standard methods, wax up the full mandibular denture, opening the flask, placing 2 layers of cold mould seal. Different color acrylic stains for gum tinting now can be placed. Along the margin area with darker red, lighter color on the middle gingival area, and near the sulcus is accumulating many fibers. And then, mixing the
normal acrylic bit soft and packing the denture with labial gum tinting by placing the pressure on the flask, figure 4 shows the different between the denture with gum tinting and the denture without the gum tinting. Curing the denture in the boiling water about 1 hour and finishing and highly polishing the mandibular denture.

After finished whole protheses of both maxillary and mandibular restorations, mounting these maxillary and mandibular model back to the articulator to checking the changing of dimension and currency, and correcting them by grinding occlusal surface of teeth.

**Problems experienced**

During the laboratory process, I failed on some parts of fabrication stage and then I redid and modified them by my own technique. The one problem which I experienced is I felt that was difficult to control the thickness of wax pattern of crown during the milling process. So instead use plastic sleeve, I used different color wax to wax up the crown, so that I can be clear on how far I should mill; The another one is unsatisfied gum tinting, the reason being that the acrylic stains and fibres used for tinting came out with excess acrylic when the pressure was applied to the flask. So I added more stains and fibres, and than I cold cured the denture by using pressure curing unit.


Conclusion

If in future all the remaining teeth become mobile and are lost in the future, and this patient has improved his oral hygiene such that the alveolar bone become available to support implants, the following three treatment options maybe possible: full acrylic denture, it is economically affordable; implant-supported overdenture; and a 14 unit porcelain bridge with implant-retained fixed prosthesis.

Clinically, the 14 unit porcelain bridge with implant–retained fixed prosthesis is the best choice because it has advantages of excellent masticatory functions, a longer lifespan, the best aesthetics and it is comfortable, compared to other dentures.\textsuperscript{15, 16}
References


