Non-Metal Clasp Dentures

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Conflict of Interest Disclosure Statement

- Dr. Ahuja reports no conflicts of interest associated with this course. She has no relevant financial relationships to disclose.

Short Description – Non-Metal Clasp Dentures

This course will describe the different types of thermoplastic resins, the advantages, disadvantages, indications, and contraindications of flexible dental prostheses. It will also discuss the design considerations, steps for fabricating a flexible prosthesis as well as maintenance of the prosthesis.

Course Contents

Overview

This course will describe the different types of thermoplastic resins, the advantages, disadvantages, indications, and contraindications of flexible dental prostheses. It will also discuss the design considerations for both flexible partials that lack a metal framework and the flexible partials that incorporate a metal framework, especially critical for distal extension situations. It will detail the procedural steps for fabricating flexible prostheses and also elaborate on the maintenance of these prostheses.

Learning Objectives

Upon the completion of this course, the dental professional should be able to:

- Learn the accepted terminologies and definition of flexible dentures.
- Understand the indications, contraindications, advantages, and disadvantages of flexible dentures.
- Choose optimal prostheses for the patient based on all relevant factors.
- Choose the most appropriate design based on all the relevant factors.
- Learn step-wise procedures for fabricating flexible prostheses with and without a metal framework.
- Learn the techniques for adjustment, placement, and maintenance of flexible prostheses.

Introduction

The treatment options currently available to partially edentulous patients include fixed dental prostheses, removable dental prostheses, and implant-supported prostheses.[1] Since the last three decades, dental implants have played a significant role in the rehabilitation of the majority of patients, however, not all patients are candidates for implant therapy.[2] Removable dental prostheses (RDPs) are still a viable, conservative, and cost-effective alternative for rehabilitation of partially edentulous patients.[2-4] RDP's require minimum tooth preparation and clinical time compared to fixed and implant-supported restorations.[2,3,5] The flanges of the RDP aid in providing optimal support to the lip and facial tissues, thereby precluding the need for further surgical interventions.[6,7] RDP's may also be indicated in medically compromised patients who are unable to sit or keep their mouth open for an extended time and those with a restricted mouth opening.

Traditionally, polymethyl methacrylate acrylic (PMMA) resins were used to fabricate the RDP bases and cast metal frames were incorporated as needed to restore the edentulous areas.[8] However, the inherent problems associated with the PMMA material such as difficulty in insertion in undercut areas (due to lack of flexibility), brittleness, poor esthetics (due to display of the metal clasps), and allergic reactions to methyl methacrylate monomer affected the success of the RDP's.[9]

Thermoplastic denture base materials were introduced in the 1950s to circumvent the problems associated with PMMA resins.8 These materials offer improved esthetics, have superior elasticity, fracture resistance, and flexibility (providing ease of insertion and removal) compared to PMMA resins.[8] As opposed to the metal clasps used with an acrylic prosthesis, esthetic and elastic thermoplastic resin clasps, are used to retain the prosthesis, leading to increased patient acceptance.[5,8,10] The flexibility (of thermoplastic materials), not only aids in providing enhanced retention and ease of insertion and removal of the RDP but also in decreasing the stress on the abutment teeth.[5]

The RDP's fabricated using thermoplastic resin are called metal-free dentures, flexible den-

tures, non-clasp dentures, clasp-free dentures, and/or non-metal dentures, however, the more appropriate term to designate them is "nonmetal clasp dentures" (NMCDs).[11] In vitro studies have shown that the water sorption values of flexible dentures remain within ISO limits.[12-14] Flexible dentures made from thermoplastic materials (polyamides) demonstrate greater dimensional distortion than PMMA but higher impact strength than CAD/CAM-milled resins.[12,15] Despite these promising properties, robust long-term clinical studies and systematic reviews on NMCDs remain limited.

This course will review the indications, contraindications, limitations, advantages, disadvantages, and designing principles of NMCDs to guide the readers regarding the clinical applications of these prostheses. It will also detail the procedural steps for the fabrication of these prostheses.

Indications for Non-metal clasp dentures (NMCD)

NMCDs have been categorized into two types; NMCDs without a metal structure (non-rigid) and the NMCDs with a metal structure (rigid).[11] The NMCDs in combination with a metal framework are indicated in a wide range of partially edentulous situations including those where there is a lack of posterior occlusal support.[11]

Indications of NMCDs without a metal structure (non-rigid) include the following:[11]

1. Interim dentures: NMCDs are often indicated as interim prostheses.[11,16] They are routinely treatment planned following tooth extraction and implant placement. The improved patient satisfaction makes them more popular compared to conventional temporary acrylic-based RDPs. In addition, fractures commonly associated with the acrylic-based RDPs are seldom reported with NMCDs.

2. Desire for superior esthetics: NMCDs with their thermoplastic resin clasps are more esthetic and less objectionable compared to RDPs with metal clasps, hence, are recommended in patients who have a high esthetic demand (Figure 1).

Figure 1 - Esthetic thermoplastic resin clasp of NMCD

3. Missing anterior teeth: NMCDs are recommended in patients with a few anterior teeth missing not only because of their superior esthetics but also because the occlusal forces are relatively low in these areas.

4. Missing posterior teeth: NMCDs may be indicated when a few posterior teeth are missing. However, they should not be planned as definitive restorations when there is occlusal instability due to missing occlusal stops.

5. Tilted teeth: Tilted teeth may develop an associated soft tissue undercut leading to difficulty in insertion and removal of a rigid RDP. Owing to their flexibility, NMCDs are a suitable choice in these situations.

6. Large bony exostoses: NMCDs are a preferred choice when an inoperable large bony exostoses/torus is associated with the ridge because they can engage undercuts below the bony exostoses, thereby offering enhanced retention.[17,18]

7. Radiotherapy: Metal-clasp retained prostheses may cause backscatter of the radiation, hence, radiolucent NMCDs are recommended for rehabilitation in patients planned for radiotherapy following jaw resective surgeries.[16,19]

8. Young children: Pediatric patients with early loss of primary teeth or anomalies such as ectodermal dysplasia may accept and adapt to flexible NMCDs more easily compared to conventional temporary acrylic partial dentures.

9. Allergy: NMCDs are routinely recommended in patients with a history of metal allergy or allergy to acrylic monomers.[17,18]

10. Recurrent denture fracture or special prosthetic needs: NMCDs are suitable for patients with a history of repeated denture fractures and for those requiring obturator prostheses following partial maxillectomy or in cases of palatal cleft.[20]

11. Xerostomia: NMCDs retain more moisture and provide superior patient comfort and accommodation to the denture bearing tissues compared to rigid acrylic RDPs.[21]

12. Systemic diseases: NMCDs are preferred in patients suffering from microstomia, scleroderma, or any other systemic conditions that cause reduced mouth opening.[22]

13. Patients who refuse tooth modification: NMCDs help conserve tooth structure and may be indicated in patients who refuse tooth preparation.

Contraindications for Non-metal clasp dentures (NMCD

There are multiple patient situations where NMCDs are successfully used for replacing missing teeth, however, when inappropriately treatment planned and/or designed, they can lead to increased stresses on the abutment teeth and accelerated resorption of the alveolar ridge.[11] It is critical to understand the clinical situations in which the NMCDs (non-rigid) should not be indicated, they include the following:[11]

Figure 2 - Lack of posterior occlusal stops

1. Lack of occlusal stops: When there is a lack of vertical occlusal stops (Figure 2), rotation and sinking of the thermoplastic denture base towards the tissue may occur; This may lead to accelerated ridge resorption and concentration of excessive forces in the resin clasp resulting in its deformation/ fracture. A deformed clasp may place increased compressive forces on the marginal gingival and cause tissue injury. In such situations, NMCDs (non-rigid) should not be indicated; They should be designed with metal rests and a framework (rigid) to control the displacement of the dentures while in use.

Figure 3 - Lack of vertical restorative space

2. Lack of vertical restorative space: NMCDs are contraindicated when there is insufficient vertical restorative space (Figure 3). Most of the thermoplastic denture base resins do not chemically bond to the prosthetic teeth, hence, diatorics are created to mechanically retain the prosthetic teeth. In patients with limited or inadequate restorative space, the artificial teeth may have to be modified/ shortened to compensate for the lack of restorative space leading to the formation of cracks and ultimately their fracture.

3. Short clinical crowns: NMCDs may also be contraindicated when there are short clinical crowns and inadequate vestibular depth. Abutment teeth with short clinical crowns and

limited vestibular depth or those associated with deep alveolar undercuts can present challenges in designing resin clasps with appropriate shape and width. Inappropriately shaped and/or a narrow resin clasp may lack sufficient retention and strength ultimately leading to its fracture.

4. Lack of oral hygiene: The thermoplastic resin clasp of NMCDs covers the cervical third of the abutment teeth, the marginal gingiva, and a part of the labial/buccal mucosa; Poor oral hygiene may lead to the development/ exacerbation of caries and periodontal disease. Hence, NMCDs should not be indicated in patients with a lack of motivation and/or inability to maintain optimum oral hygiene.

5. Deep overbite: In patients with a deep bite exceeding 4 mm, the use of non-metal clasp dentures may increase the risk of anterior tooth dislodgement during excursive movements.[20]

Advantages of NMCD

NMCDs are becoming increasingly popular and this is attributed to their advantages which include the following:[11]

1. Biocompatibility: NMCDs are more biocompatible compared to conventional acrylic resin partial dentures owing to the absence of residual monomer.[23]

2. Esthetics: The display of metal clasps (used with traditional RDPs) may not only affect the patients' esthetics but also their self-confidence. The resin clasp of NMCDs is hard to discern from the surrounding tissues and is almost invisible in the oral cavity, thereby, offering superior esthetics compared to the metal clasps.

3. Improved patient comfort: Thermoplastic resins have a lower elastic modulus and a softer surface compared to acrylic resins.[8,24] Also, the thermoplastic denture bases can be made thinner and lighter owing to their superior fracture resistance;[8] These factors contribute to the improved patient comfort with NMCDs.

4. Fracture resistance: NMCDs are more durable and have superior fracture resistance compared to conventional acrylic resin partial dentures.

5. Minimum tooth preparation: NMCDs are the most conservative restorations and require the least amount of tooth preparation.[25]

6. Less clinical time: NMCDs are fabricated quickly, require only a few short clinical appointments, and are cost-effective.

7. Low elastic modulus: The flexibility of NMCDs allows gentle, controlled movement against supporting tissues, which may enhance local blood circulation and facilitate dynamic distribution of occlusal forces. This property can help minimize the tissue and bone atrophy often observed beneath rigid saddles, while also enabling excellent adaptation to the functional movements of the oral cavity and supporting structures. [20,26]

8. Enhanced fit: When employed as temporary prostheses, flexible NMCDs demonstrate superior tissue adaptation compared to conventional temporary RPDs.[20,26]

Disadvantages of NMCD

There are also a few disadvantages associated with NMCDs, they include:[11]

1. Staining and degradation: The thermoplastic resin surface loses luster and becomes rough with use making it susceptible to staining and discoloration (Figure 4).[27,28]

Figure 4 - Discolored and stained NMCD

2. Special materials/techniques to finish and polish: NMCDs are challenging to finish and polish chairside.[25] They require special techniques and materials for accomplishing these procedures. Overheating of the thermoplastic resin during finishing and polishing procedures may result in material deterioration and loss of elasticity.

3. Difficult to repair/reline: Some of the thermoplastic materials (Polyamides) do not adhere to self-curing resins and are difficult to repair and reline.

4. Periodontal disease: The thermoplastic resin clasp of NMCDs covers the cervical third of the abutment tooth, the marginal gingiva, and a portion of the attached gingiva. If the area between the clasp and the dental tissues is not regularly and optimally cleaned it may lead to the development/exacerbation of caries and periodontal diseases.

5. Teeth displacement and ridge resorption: Selecting a non-rigid NMCD in situations where it is not indicated may lead to the displacement of the abutment teeth and resorption of the alveolar ridge.

6. Poor thermal conductivity: Unlike metal frameworks, non-rigid NMCDs do not efficiently conduct heat or cold, diminishing temperature perception during food and beverage consumption.[20,26]

7. Higher laboratory cost: Fabrication costs of NMCDs are slightly higher than those for conventional acrylic dentures.

8. Microbial colonization: Nylon-based NMCDs have been shown to exhibit greater Candida adhesion than PMMA, potentially increasing the risk of denture stomatitis.[26]

Types of Thermoplasic Resins

Properties desirable in thermoplastic denture base resin include high flexural strength, low elastic modulus, and, high impact strength. Various types of thermoplastic resins have been approved for dental use; they include:[25]

1. Acetyl or acetal resin:[29] Acetyl resin also known as polyoxymethylene (POM), is an aesthetic denture base and denture clasp material used since the late '80s. They are indicated in patients allergic to nickel and chromium alloys.[30] They have optimal resilience, modulus of elasticity, impact strength, and resistance to organic solvents, oils, and hot and cold water making them a suitable material for the fabrication of retentive clasps, connectors, and support elements for RDPs (Figure 5).[31,32]

Owing to its lower modulus of elasticity compared to chromium-cobalt alloys, acetal resin can engage larger and deeper undercuts, providing greater flexibility and reducing stress on abutment teeth. These properties offer clinical advantages in cases where aesthetics and periodontal health are paramount. However, retention is generally lower than that achieved with chromium-cobalt clasps.[33]

Figure 5A - Acetyl resin NMCD

2. Polyetheretherketone (PEEK): Polyetheretherketone (PEEK) is a ketone-based semicrystalline thermoplastic material valued for its high mechanical strength, chemical resistance, and biocompatibility. It may be indicated for the fabrication of crowns, implant superstructures, fixed partial dentures, and removable partial denture (RPD) frameworks.[34,35]

Compared with cobalt-chromium (Co-Cr) alloys, PEEK frameworks (Figure 5B) are lighter, metal-free, and more esthetic, with reduced cervical coverage and favorable periodontal compatibility, although shade matching remains limited.[36] Its low elastic modulus (~4 GPa)[37] allows engagement of deeper undercuts and reduces stress on abutment teeth, which may benefit periodontally compromised teeth;

however, adequate retention requires increased clasp thickness and width. Vadaamanu et al., have reported that PEEK clasps demonstrated less deformation than Co–Cr clasps while maintaining comparable retention forces.[38] Fabrication options include CAD/CAM milling, heat-pressing, and additive manufacturing, enabling high precision.[39] Patient-reported outcomes generally favor PEEK over metal frameworks, particularly for comfort and esthetics.[40] Nevertheless, limitations include reduced clasp retention compared with metals clasps, challenges in polishing and adjusting retention, higher cost of fabrication and limited long-term clinical evidence.[36] While PEEK offers high resistance to bending and functional stresses, bonding to artificial teeth can be suboptimal, and fracture risk remains in some applications, warranting further material refinement and reinforcement strategies.[41]

3. Polyamide: The first polyamide-based flexible partial denture system (Valplast) was introduced in 1953. The three popular polyamides are detailed below:

a. **Valplast®**: Vaplast is a nylon-based material containing 99.9% polylaurolactam. It is semitransparent pink, odorless, non-allergenic, and has a low elastic modulus.[29] Its flexural strength and flexural modulus are lower compared to other thermoplastic resins, however, only 33% (approximately) higher than PMMA resins, rendering it soft, elastic, flexible, and fracture resistant.[29] Its high elasticity permits its usage in teeth and/or ridges with a large undercut.[29] Its flexibility reduces the likelihood of fracture even when increased occlusal forces or stresses are applied to it. Due to its high fracture resistance, denture bases can be made thinner and lighter, thereby, aiding in improved patient comfort.[23,24] Its disadvantages include discoloration and staining, increased surface roughness with use, difficulty in grinding, polishing, clasp adjustment, relining and repairing; and, loss of fit when used to cover a wide area.[23,29]

b. **Lucitone FRS:** Lucitone FRS is a high-grade microcrystalline polyamide. Lucitone FRS is an esthetic and stable material usually recommended for replacing anterior teeth.[29] This denture base material is generally indicated in areas where the occlusal forces are light and only a few teeth are missing.[29] Its indications can be expanded by incorporating a metal framework in the design of the prosthesis.[29] It is available in a range of flexibility from firm (2mm) to super flexible (1.5mm). Five shades of Lucitone FRS are available including original, light, light reddish pink, dark pink, and clear. It is elastic and fracture-resistant. It is softer than polyester and polycarbonate resins (resulting in

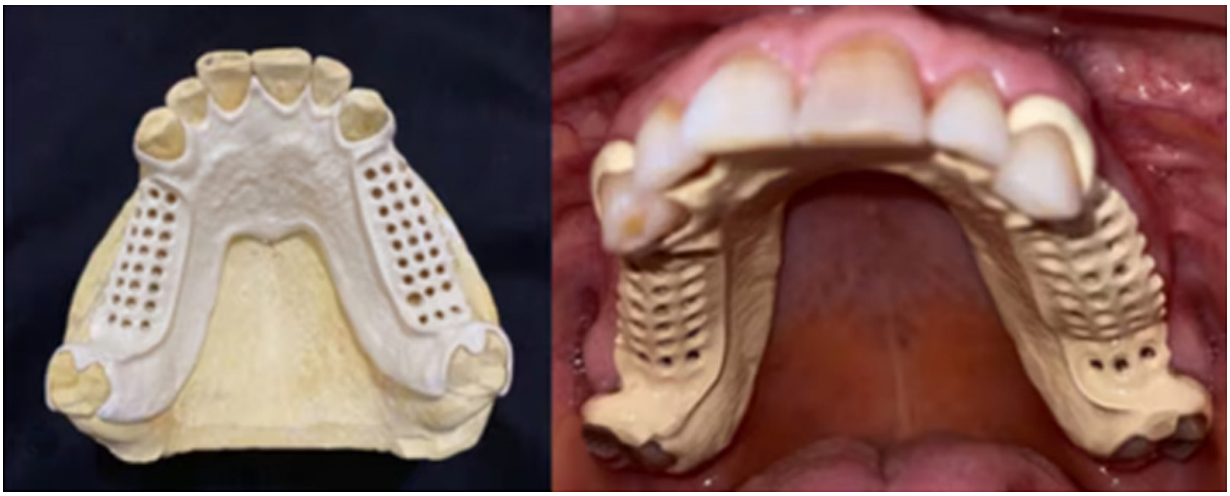


Figure 5B – (left) PEEK framework tried on the master cast. (right) PEEK framework tried in the mouth
Picture courtesy: Dakhli R et al./CC-BY-4.0

improved patient comfort), but harder than Valplast® (making it more durable.) It provides an optimal fit and is highly resistant to abrasion, stains, and calculus and easy to grind and polish.[29] However, Lucitone FRS® has a few disadvantages including the risk of fracture if the denture base is made too thin,[42] color instability,[43] loss of fit with long-term use, and inability to bond to self-curing resins (repair and reline difficultly).

c. **Ultimate:** Ultimate is a soft, elastic, and durable thermoplastic material.[29] It permits the fabrication of thin and light denture bases. Incorporation of a metal rest or metal major connector, and wires in the design of the prosthesis improves its hardness, fracture resistance, and permits clasp adjustments.[29] It is not indicated in patients with inadequate restorative space and shallow vestibular depths.[29]

4. Polyester resin: EstheShot1 (ES 1) and ES Bright are the new polyester-based thermoplastic resins.[29] They provide the most superior fit,[44] and are safe and esthetic. Repair and relines are easily accomplished because they bond to self-polymerizing resins.[24] They have moderate absorbency and are susceptible to discoloration. Their resilience and Rockwell hardness are less than the polycarbonate and polyamide resins making them susceptible to surface roughness and fractures.[45]

5. Polycarbonates: The ability of polycarbonates to bond to self-polymerizing resins, their fit, feel, and the risk of discoloration post immersion in curry is similar to that of PMMA resins.[29] They are indicated in areas where the occlusal forces are light and only a few teeth are missing.[29] Repairs and relines are easy to accomplish chairside because they bond to self-polymerizing acrylic resins.[24,29] A metal framework should be incorporated to provide optimal support and prevent fracture of the resin clasp. The two common polycarbonate-based thermoplastic resins include Reigning® and Reigning N®. Reigning N® is an improvised thermoplastic resin with flexural strength and flexural moduli greater than polyamides and polyesters. Its fit is inferior to the polyester resins, but, superior to the polyamide resins.[29]

Note: The polyester and polycarbonate resins are stiffer (due to their high elastic moduli) than the polyamide resins.[46] In the presence of a deep undercut, a stiff clasp may exert increased stresses on the abutment tooth or

Table 1 - Comparison of Thermoplastic Resins

	POLYAMIDE	POLYESTER	POLYCARBONATE
Elastic Modulus	Low	Moderate	High
Flexural Strength	Low	Moderately High	Moderately High
Impact Strength	Varies	Low	Moderate
Wear Resistance	Moderate	Low	High
Flexibility	Highest	Moderate	Moderate
Water Sorption	Highest	Moderate	Low

may fracture during the insertion and removal of a prosthesis.[46] Hence, in addition to the factors described above, it is also critical to consider the retentive areas and the depth of the undercut of the abutment teeth when selecting the thermoplastic denture base resin for NMCDs.[46]

Prosthesis Design

All NMCDs should have designs that conform to the standard RDP principles.[11] The dental practitioner (and not the laboratory technician) should design the prosthesis. For the partially edentulous patients with high esthetic demands, the entire framework and essential components can be fabricated using the flexible denture base resin. Unfortunately, these designs do not have metal rests and rely on the soft tissue for support which may lead to abutment teeth displacement and ridge resorption especially in situations where occlusal stops are missing (Figure 6).[11] Optimal vertical support can be provided by fabricating a conventional metal framework supported RDP with thermoplastic denture base/s and clasps.[11] This combination of thermoplastic resin denture base and clasps with a metal framework improves the esthetics and provides the desired rigidity and vertical support.[11] The metal framework is designed and fabricated as per the standard RDP principles. The metal clasps are eliminated and replaced with thermoplastic resin clasps during denture processing. The thermoplastic resin clasps (with the exception of those made from acetyl resin and PEEK) are designed such that they cover the cervical third of the abutment teeth, the marginal gingiva, and a part of the labial/buccal mucosa.

Figure 6 - Poorly Designed NMCD

Clasp Designs

There are three commonly used clasp designs for NMCDs.[16]

1. Standard clasp: The "standard" or the "main" clasp is the most common and efficient clasp design (Figures 7, 8A). An improper clasp design will lead to the fabrication of a large and/or bulky clasp. Few millimeters of the tooth (1-2mm) and tissue contact are all that is required for achieving optimal clasp retention and stability.[16]

Figure 7 -Standard clasp

2. Circumferential clasp: It is commonly indicated for a free-standing mesially-tipped distal abutment tooth. This claps design helps in eliminating the broad flat cantilever and strengthens itself by encircling the tooth (Figure 8B). When the circumferential clasp encircles multiple teeth, it is termed as a "continuous circumferential clasp" (Figure 8C). The continuous circumferential clasp design helps in improving its rigidity.[16]

3. Combination clasp: A circumferential clasp

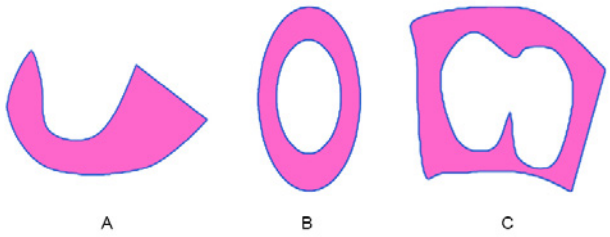


Figure 8 - Animations depicting the standard clasp, circumferential clasp, and the continuous clasp (from left to right)

used along with a standard clasp is termed a combination clasp.[16] A clasp should passively fit on the tooth surface without exerting excessive stresses on the abutment tooth.[2] Occasionally, minor reshaping of the tooth in the area of the survey line and/or guide planes may be required to accomplish the same.[2] Tapered diamonds followed by fine finishing diamonds (with copious amounts of water) may be used to prepare and finish the tooth preparations (Figure 9).[2]

Clasp thickness recommendations:

Figure 9 - Tapered diamond point may be used to prepare the tooth surfaces

Recommendations for the thickness of the clasp are based on the depth of the undercut and the material used for its fabrication.[47] A 1.0 mm thickness Estheshot clasp is indicated when a 0.25 mm undercut is present, however, a 1.0 mm thickness Valplast clasp is indicated when a 0.5 mm undercut is present.[47] A 0.5 mm thickness Reigning clasp is recommended for a tooth having a 0.5 mm undercut.[47]

Fabrication of NMCDs (Non-rigid)

The procedural steps for the fabrication of NMCDs (non-rigid) are essentially the same as those used for the fabrication of an acrylic partial denture with orthodontic clasps. In addition, NMCDs may be fabricated digitally using an intraoral scanner and computer-aided design and computer-aided manufacturing (CAD-CAM) technology.

Fabrication of NMCDs (Rigid)

Most of the steps/procedures for the fabrication of an NMCD are similar to those used for fabricating a conventional cast partial denture. Few exceptions include the incorporation of thermoplastic resin claps, thermoplastic resin denture base, and the creation of diatorics in the prosthetic teeth.

The clinical and laboratory steps for the fabrication of an NMCD (rigid) are outlined below:

Polyamide resins are challenging to repair or reline as they do not bond to self-polymerizing resins, and usually, an impression is made and sent to a laboratory to accomplish the same employing reinjection. NMCDs made from polyester or polycarbonate resins can be repaired and relined using the same techniques/procedures that are used for RDPs made from heat-polymerized acrylic resins.

Complications

The complications of NMCDs are usually associated with poor design, the two most common complications are:[29]

1. Difficulty during mastication: NMCDs may cause difficulty during mastication if they are improperly designed.

2. Fracture: Resin clasp and/or major connector fracture may be attributed to tooth crown morphology, denture design, and technical errors in laboratory procedures.

Conclusion

It is critical to understand the properties of various thermoplastic resins so that we can choose the optimal material based on the needs of the patient. Methods of relining and maintenance should be understood with reference to the properties of the different materials used. NMCDs should conform to the standard RDP design principles. When combined with rigid components, NMCDs offer greater planning flexibility compared with conventional RPDs, particularly in determining the insertion–removal axis and in preparing anterior axial surfaces. NMCDs should not be prescribed indiscriminately for all patients seeking improved aesthetics. NMCDs (non-rigid) are contraindicated when multiple teeth are missing and/or there is an absence of vertical occlusal stops. However, NMCDs with a metal framework are indicated in most situations and they provide the desired retention, stability, and support while improving patient aesthetics.

The procedure for the fabrication of a conventional interim NMCD is outlined below:

1. Make impressions of the maxillary and mandibular arch (Fig. 10) (using alginate or Vinylpolysiloxane (VPS) in stock trays. Pour the impressions in type III stone and generate casts. Fabricate a record base with a wax occlusal rim and register the interocclusal records.	 Fig. 10 - Mandibular alginate impression
2. Mount the casts on the articulator using the interocclusal records. Verify the presence of adequate vertical restorative space (Fig. 11).	 Fig. 11 - Vertical restorative space assessed with a periodontal probe
3. Survey the cast and determine the extent of the undercut on the abutment teeth (which will aid in thermoplastic resin selection) (Fig. 12).	 Fig. 12 - The cast is surveyed to determine the extent of the undercut
4. Perform the mouth preparation, if needed. A new impression will be required following the mouth preparation (Fig. 13). Pour the impression in type III stone and generate the master cast. Fabricate a record base with a wax occlusal rim and register the interocclusal records and mount the cast on the articulator using the interocclusal records.	 Fig. 13 - Master impression

5. Select the shade and mold of the prosthetic teeth using the natural teeth as a guide, make diatorics, and set the prosthetic teeth on the trial denture base (Fig. 14).

Note: Acrylic resin teeth do not form a chemical bond with flexible denture base resin. Instead, they are secured mechanically by creating T-shaped diatoric holes (retento-grip technique), allowing the denture base resin to flow into and lock the teeth in place.[48]

Fig. 14 - Prosthetic teeth waxed to the trial denture base

6. Verify the esthetics, occlusal vertical dimension, and centric occlusion during the wax-try-in procedure. Once the try-in is approved by the dentist and the patient the design cast (Fig. 15), mounted maxillary cast, and the mandibular cast with the teeth set up are sent to the laboratory for the fabrication of the NMCD (Fig. 16).

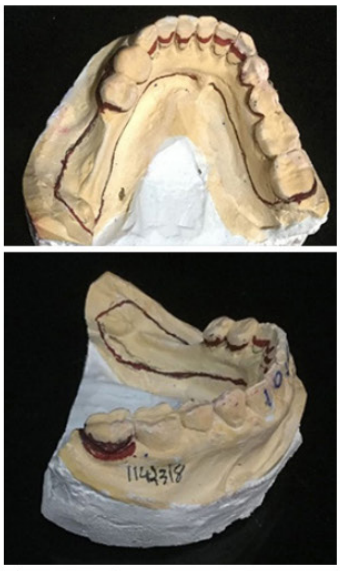


Fig. 15 - Design cast

7. Laboratory Fabrication of the NMCD (Fig 16)

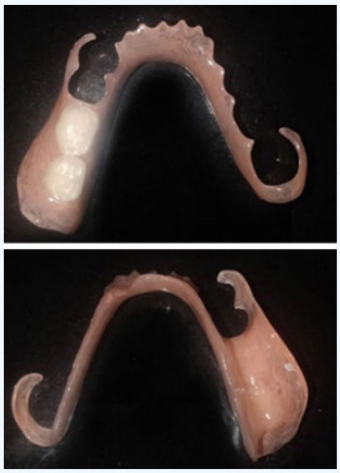
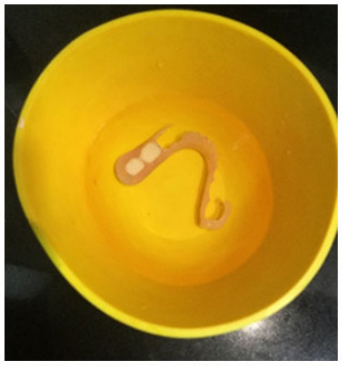
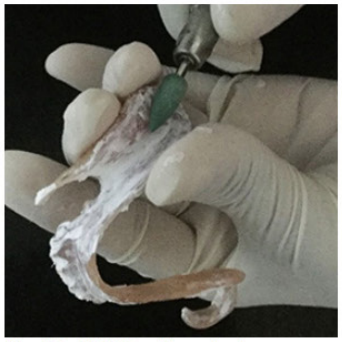


Fig. 16 - Interim NMCD

8. During the NMCD placement appointment, immerse the prosthesis in hot tap water for 60 seconds before inserting it in the patient's mouth (Fig. 17). This may help in achieving the same flexural modulus as the NMCD would have at body temperature and thus aid in improved patient adaptation (information from vaplast.com.)	 Fig. 17 - NMCD placed in hot water for 60 seconds
9. If a clasp fits too tightly in the patient's mouth, place the resin clasp in hot tap water for approximately 30-60 seconds (Fig. 18), then bend the clasp outwards and cool it in cold water. If a clasp is too loose, follow the same procedure except, bend the clasp inwards.	 Fig. 18 - Clasp placed in hot water for 60 seconds
10. Use pressure indicating paste and VPS (vinyl polysiloxane) to determine pressure areas on the denture base and borders respectively. Make adjustments as necessary, however, it is always advisable to use manufacture specified materials for finishing and polishing thermoplastic materials (Fig. 19). A constant motion of the bur aids in achieving a smooth surface that usually does not require repolishing. (Information from valplast.com.). Evaluate the occlusion and make adjustments as necessary.	 Fig. 19 - NMCD adjusted using manufacturer recommended materials
11. Oral and prosthesis hygiene instructions should be given to the patient. Patients should clean their prostheses daily to remove any tartar or stains using specially formulated cleaning solutions. A soft bristle brush should be used to clean NMCDs.(Fig.20).	 Fig. 20 - Soft bristle brush used to clean NMCD

The clinical and laboratory steps for the fabrication of an NMCD (rigid) are outlined below:

1. Make diagnostic impressions with alginate (Alginate impression material, 3M ESPE) in stock trays (Fig. 21) and pour them with type III dental stone.

2. Evaluate the restorative space intraorally (Fig. 22). Register the interocclusal records and mount the casts on a type III semi-adjustable articulator (WhipMix 2240, WhipMiz corp). Verify the presence of adequate vertical restorative space using the mounted casts.

Fig. 22 - Restorative space evaluated intraorally

3. Survey the cast, determine the extent of the undercut on the abutment teeth, and design the framework (Fig. 23). The mouth preparation for an NMCD (rigid) usually involves the preparation of rest seats for support and indirect retention. Occasionally, minor reshaping of the tooth in the area of the survey line and/or guide planes may be required.

Fig. 23 - The cast is surveyed to determine the extent of the undercut and design the prosthesis

4. Following the mouth preparation, make master impressions with alginate/VPS impression material (Fig. 24) and pour the impressions using a type III dental stone (Microstone, WhipMix).

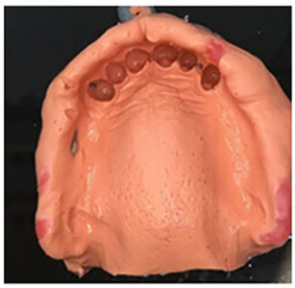


Fig. 24 - Master impressions

5. Send the definitive casts and the design casts (Fig. 25) to the laboratory along with detailed instructions for framework fabrication (with metal clasps.) The metal claps will help retain the framework during the subsequent clinical procedures. They will be eliminated following the wax-try-in appointment.

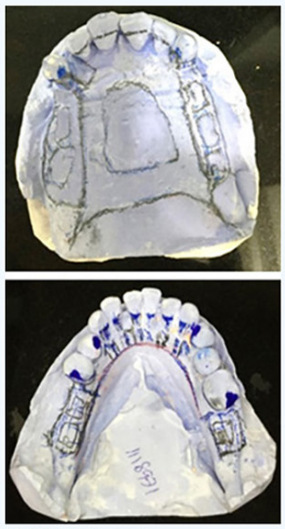


Fig. 25 - Design casts

6. Evaluate the maxillary and mandibular frameworks on the casts for passivity and fit (Fig. 26). Verify complete seating of the rests in the rest seats, intimate contact of the lingual and palatal plating with tooth surfaces, the rigidity of the major connector, and correct finishing and polishing of the framework.

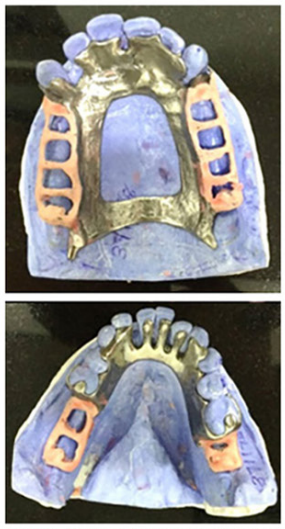
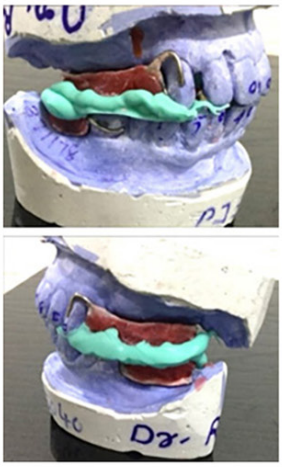


Fig. 26 - Maxillary and mandibular metal framework

7. Try the metal frameworks in the mouth (Fig. 27). Identify the area of binding/interferences using a disclosing medium (Disclosing Wax, Kerr). Care must be excised when evaluating interferences, areas where disclosing medium has thinned out are not interferences, but, guiding surfaces, and must not be adjusted.

Fig. 27 - Framework try-in

8. An altered cast impression should be made as per the current prosthodontic principles, if the mucosa is loose and unhealthy or if it is not accurately recorded on the mandibular master cast.	
9. Fabricate wax rims and attach them to the framework/s, register interocculsal records using a vinylpolysiloxane(VPS) bite registration material and select the shade for the prosthetic teeth (Fig. 28).	 Fig. 28 - Shade selection
10. Mount the definitive casts on a semi-adjustable articulator using the interocclusal records (Fig. 29). Select the mold of the prosthetic teeth based on the size and shape of the existing natural teeth.	 Fig. 29 - Interocclusal records used for mounting the casts in an articulator
11. Create diatorics in the prosthetic teeth (to aid in mechanical retention) and then wax them to the frameworks (Fig. 30).	 Fig. 30 - Prosthetic teeth waxed to the metal frameworks

12. Verify the esthetics, phonetics, occlusal vertical dimension, and centric occlusion during the wax-try-in procedure. Once the try-in is approved by the dentist and the patient send the wax-up, master casts and the design casts to the laboratory for fabrication of the NMCDs. The laboratory is instructed to eliminate the metal clasps and incorporate flexible thermoplastic resin clasps in the NMCD design. If deep alveolar undercuts are present cervical to the abutment teeth, the resin clasp may be extended to the tooth adjacent to the abutment teeth, to provide the desired rigidity and strength to the clasp (Fig. 31). Note the clasps are designed such that they cover the cervical third of the abutment teeth, the marginal gingiva, and a part of the alveolar mucosa

Fig. 31 - Final wax-up
*Note: metal clasps are eliminated and will be replaced with resin clasps

13. During the NMCD (rigid) (Fig. 32) placement appointment, immerse the prosthesis in hot tap water for 60 seconds before inserting it in the patient's mouth. This may help in achieving the same flexural modulus as it would have at body temperature and aid in patient adaptation (information from vaplast.com.)

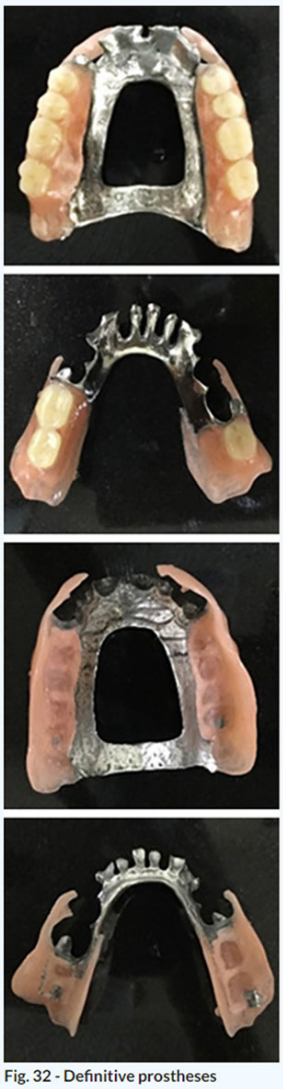


Fig. 32 - Definitive prostheses

14. Place the prostheses in the patient's mouth (Fig. 33). If a clasp fits too tightly in the patient's mouth, place the resin clasp in hot tap water for approximately 30-60 seconds, then bend the clasp outwards and cool it in cold water. If a clasp is too loose, follow the same procedure except, bend the clasp inwards.

Fig. 33 - Initial placement of the definitive prostheses

15. Use pressure indicating paste and VPS to determine pressure areas on the denture base and borders respectively (Fig. 34 A). Make adjustments as necessary (Fig. 34 B), finish and polish the prostheses; It is always advisable to use manufacture specified materials for adjusting, finishing, and polishing thermoplastic materials. Divide the appliance into sections and finish/polish one minute per section. A constant motion of the bur aids in achieving a smooth surface that usually does not require repolishing. (Information from valplast.com.)

Fig. 34A - Pressure areas identified using pressure indicating paste
Fig. 34B - NMCD adjusted using manufacturer recommended armamentarium

16. Evaluate the occlusion and adjust it as necessary. Educate and train the patient regarding the removal and the insertion of the prostheses and place the prostheses in the mouth (Fig. 35).	 Fig. 35 - Definitive prostheses placed in the mouth
17. Oral and prosthesis hygiene instructions should be given to the patient. Patients should clean their prostheses daily to remove any tartar or stains using specially formulated cleaning solutions. A soft bristle brush should be used to clean NMCDs.	
18. The patient should be asked to return in a week for a recall appointment. In addition, the patient should be informed that over a few years, the partial denture may require refinements and adjustments including replacement of worn acrylic teeth and relining procedures due to changes in the denture bearing tissues.	

Course Test Preview

To receive Continuing Education credit for this course, you must complete the online test. Please go to: *www.dentalcare.com/en-us/ce-courses/ce650/test*

1. Which prosthesis is contraindicated for Kennedy Class I and Class II arches?

A. Non-rigid NMCDs
B. Rigid NMCDs
C. Conventional cast partial dentures
D. Both rigid NMCDs and Conventional cast partial dentures

2. Staining and degradation of thermoplastic resin are associated with:

A. Non-rigid NMCDs
B. Rigid NMCDs
C. Conventional cast partial dentures
D. Both rigid NMCDs and Non-rigid NMCDs

3. All of the following are contraindications of non-rigid NMCDs EXCEPT for one, which is the exception?

A. Poor oral hygiene
B. Short clinical crowns
C. The desire for superior esthetics
D. Lack of vertical restorative space

4. Which of the following is an advantage of NMCD (non-rigid)?

A. Easy to repair/reline
B. Easy to finish and polish
C. Maintains the position of the abutment teeth
D. Fracture resistance

5. Which prosthesis will most likely be indicated in patients with metal and monomer allergy?

A. Non-rigid NMCDs
B. Rigid NMCDs
C. Conventional cast partial dentures
D. Both rigid NMCDs and Non-rigid NMCDs

6. All of the following are polyamides EXCEPT for one, which is the exception?

A. Valplast
B. Lucione FRS
C. Ultimate
D. EstheShot1

7. Which prosthesis will most likely be indicated in patients with tilted teeth and associated soft tissue undercuts?

A. Non-rigid NMCDs
B. Rigid NMCDs
C. Conventional cast partial dentures
D. Both rigid NMCDs and Non-rigid NMCDs

8. Poorly designed NMCD's may lead to:

A. Increased stresses on the abutment teeth.
B. Accelerated resorption of the alveolar ridge.
C. Increased stresses on the abutment teeth and accelerated resorption of the alveolar ridge.
D. Occlusal instability.

9. NMCDs retain more moisture and provide superior patient comfort and accommodation to the denture bearing tissues compared to rigid acrylic RDPs. NMCDs are contraindicated in patients suffering from microstomia, scleroderma or any other systemic conditions that causes reduced mouth opening.

A. Both statements are true.
B. Both statements are false.
C. The first statement is true, the second statement is false.
D. The first statement is false, the second statement is true.

10. All of the following are true for NMCD's when compared to PMMA resins EXCEPT for one, which is the exception?

A. Superior elasticity
B. Improved esthetics
C. Superior fracture resistance
D. Superior bond strength between the denture teeth and the denture base

11. Which of the following is true regarding the flexural strength of polyamide, polyester and polycarbonate thermoplastic resins?

A. Low, moderately high, high
B. High, moderately high, low
C. High, low, moderately high
D. Low, moderately high, moderately high

12. Which of the following is true regarding flexibility of polyamide, polyester and polycarbonate thermoplastic resins?

A. Low, moderately high, high
B. High, moderately high, low
C. Highest, moderate, moderate
D. Low, moderately high, moderately high

13. Which clasp design is indicated for a free standing mesially tipped distal abutment tooth while fabricating a NMCD?

A. Standard clasp
B. Circumferential clasp
C. Combination clasp
D. Wrought wire clasp

14. A 1.0 mm thickness Estheshot clasp is indicated when a 0.25 mm undercut is present.

A 1.0 mm thickness Valplast clasp is indicated when a 0.5 mm undercut is present.

A. Both statements are true.
B. Both statements are false.
C. The first statement is true, the second statement is false.
D. The first statement is false, the second statement is true.

15. Which of the following steps is not performed while fabricating a non-rigid NMCD?

A. Master Impressions
B. Interocclusal records
C. Framework try-in
D. Wax-Try-in

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Additional Resources

- No Additional Resources Available

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