Annotation to the seminar №12


Production of dentures in a dental laboratory is carried out on plaster models, which represent a positive imprint of a surface topography of prosthetic bed tissues (hard and soft tissues of the maxillofacial region, located on the prosthetic bed and its borders). Models are produced using impressions – negative imprint of the prosthetic bed tissues surface topography, which is obtained with the usage of impression trays and impression materials.

**IMPRESSION TRAYS**

![Fig. 1. Standard one jaw impression trays for the upper and lower jaws](image)

Impressions are obtained with the usage of impression trays - special devices (tools) designed to be filled with an impression material and introduced into the oral cavity, providing comfortable work when making an impression.

There are standard and individual (baseplate) impression trays. **Standard impression trays** are prefabricated stock trays made of stainless steel, aluminum or plastic. Another two types of trays are trays used for making impressions of one of the jaws (one jaw), and trays used for bimaxillary impressions (obtaining of impressions of the upper and lower jaws dental arches with central occlusion of the teeth). Standard one jaw impression tray consists of a handle (fig. 1.1), dental ledge (fig. 1.2), flanges (fig. 1.3), palatal vault in the upper jaw tray (fig. 1.4), and tongue notch in the lower jaw tray (fig. 1.5).

Figure 2 shows some types of standard one jaw impression trays used for obtaining the impressions.

There are trays for the upper jaw (fig. 2.1; 2.2; 2.5; 2.10; 2.11) and the lower jaw (fig. 2.3; 2.4; 2.6). Depending on the presence or absence of teeth in a jaw, there are manufactured trays for teethed jaws, jaws with missing posterior teeth and toothless jaws. In the presence of free-end edentulous space the tray contains both, a bed for anterior teeth and a narrowed (round-shaped) bed for the alveolar bone in the posterior regions (fig. 2.5; 2.6). Trays for edentulous jaws differ by a round-shaped bed for the alveolar bone instead of dental ledge (fig. 2.2; 2.4). Depending on the number of teeth to be included in the impression, there are standard one jaw trays for the entire dental arch and partial (segmental) trays intended for reflection of anterior (fig. 2.8) or posterior (fig. 2.7; 2.9; 2.12) regions of the dental arch. Perforated impression trays (see. fig. 2) are used for their better connection with alginate and waterless elastomeric impression materials.
Fig. 2. Types of standard one jaw impression trays: 1 – metal with perforations for the upper jaw; 2 – metal with perforations for the upper jaw in the complete absence of teeth; 3 – metal with perforations for the lower jaw; 4 – metal with perforations for the lower jaw in the complete absence of teeth; 5 – metal with perforations for the upper jaw with free-end edentulous spaces (in the absence of posterior teeth); 6 – metal for the lower jaw with free-end edentulous spaces; 7 – metal partial with perforations for posterior regions of dental arch; 8 – metal partial with perforations for anterior regions of the upper and lower jaws’ dental arches; 9 – metal aluminum with perforations for posterior regions of the upper and lower jaws’ dental arches; 10 – metal for children for the upper jaw (for primary dentition); 11 – plastic with perforations for the upper jaw; 12 – plastic partial with perforations for posterior regions of dental arch.

Non-perforated impression trays require special treatment to ensure retention of the material on the tray surface. When working with alginate impression materials tray flanges are framed with an adhesive tape (fig. 3.1), or special alginate adhesives are applied. When working with vinyl polysiloxane or polyether impression materials only special adhesives based on polyethylene are used. They provide good retention of impression materials to the tray (fig. 3.2).
fig. 3. Methods of special preparation of non-perforated impression trays ensuring retention of elastomeric impression materials to their surface: metal standard impression tray for the upper jaw framed with an adhesive tape (1), application of adhesives on the trays (2)

Standard impression trays are available in sets and come in different sizes. The more diverse a set, the greater is the possibility to choose a tray of a size corresponding to the clinical conditions. Sizes of impression trays are determined by the shape of the jaw, the width and length of the dentition, height of crowns of the remaining teeth, and by other factors. Several types of standard trays are produced depending on the width of the tray, its length and flanges height (fig. 4).

fig. 4. The main parameters that determine the size of standard impression trays (1) and a set of impression trays (2)

Standard bimaxillary impression trays are designed for obtaining of impressions of the upper and lower jaws dental arches with central occlusion of the teeth.

Fig. 5. Standard bimaxillary impression trays

Standard bimaxillary impression trays differ from the others by short flanges and a thin mesh material (caprone, gauze, etc.). Mesh material separates portions of impression material for the upper and lower jaws and does not interfere with occlusion. Disposable plastic trays (fig. 5.1)
and metal reusable trays (fig. 5.2) are available on the market. Although the gauze in the metal trays should be replaced.

**Individual trays** are made of plastic by a dental technician using the working cast, which was made according to the primary impression, obtained using a standard tray (see the lecture “Technological processes used in the production of dentures and plastic products”).

**IMPRESSION-TAKING PROCEDURE**

Impression-taking procedure includes:
1. Determination of indications for the choice of impression material and impression technique.
2. Selection of impression tray.
3. Preparation of impression material.
4. Filling of impression tray with impression material with possible introduction of impression material directly onto the prosthetic bed tissues.
5. Introduction of the tray filled with the impression material into the oral cavity and its fixation until hardening of the impression material.
6. Removal of the tray with the impression from the oral cavity.
7. Evaluation of the impression.

**Impressions classification**

Depending on the desired ultimate objective of the application, impressions are divided into precision, auxiliary and bite registrations.

Precision impressions are intended for the production of working models, on which dental laboratory technician makes dentures. Classification of precision impressions is shown in Figure 6.

![Classification of precision (working) impressions used in dentistry](Fig. 6. Classification of precision (working) impressions used in dentistry (based on classification of Betelman A.I., 1965; Ebersbuch W., 1974; Gavrilov E.I., 1978; Firla M.T., 1999; Zimbalistov A.V. et al., 2001; Janson C., 1988; Markus T.F., 1999; Ryakhovskiy A.N., 2002).)

Auxiliary impressions intended for the production of a jaw model, opposite to the working model. Model of teeth-antagonists is used in the construction of the prosthesis on the working model with consideration of occlusal relationship with the opposite jaw teeth. Auxiliary impressions include impressions used for the production of diagnostic models in order to clarify diag-
nosis and determine the design features of the future prosthesis (diagnostic impressions), for monitoring of treatment progress and its result (control impressions), for the production of individual trays (preliminary impressions), and for the production of provisional (temporary) prosthesis by matrix technique.

Occlusal registration impression (fig. 7) reflects occlusal surfaces of the teeth of the upper and lower jaws in the position of central occlusion (kind of bimaxillary impression, which is obtained without the use of impression trays). Occlusal registration impressions help the dental technician to put together the working and auxiliary models in the position of central occlusion prior to their fixation in an occludator or articulator.

![Occlusal registration impression](image)

**Fig. 7. Occlusal registration impression**

**Selection of an impression tray for one jaw impression**

Quality of a jaw impression depends directly on the choice of an impression tray. The impression tray is selected using the following criteria:

- jaw;
- dental arch length and shape;
- presence or absence of teeth on the jaw;
- dentition defect topography;
- appointment of the impression, impression technique and impression material being used.

The following parameters have to be considered when selecting a tray:

- dentition has to be located in the middle of the bed intended for teeth;
- tray flanges have to be uniformly spaced from the teeth for at least 3-5 mm (fig. 8);
- the same distance should be between the hard palate and the tray palatal vault;
- impression tray should completely cover the prosthetic bed;
- the height of the tray flanges should be slightly less than the height of the alveolar bone and should be spaced from transitory fold by 2-3 mm.
Fig. 8. Positioning of the tray filled with impression material on the prosthetic tissue: 1 - correct; 2 - incorrect

When selecting an impression tray in the clinic a doctor can use visual assessment of dentition shape and length, as well as instrumental studies. A measuring tool (fig. 9.1) can be used to determine width of the upper jaw dental arch (in a transversal plane) in the region of the maxillary prominence vestibular surfaces or in the last molars region (fig. 9.2). On the lower jaw the distance between the glosal surfaces of the mucous tubercles and last molars is measured. The obtained measurements determine the selection of an appropriate tray (fig. 9.3).

Fig. 9. Selection of a standard impression tray using measurement instruments

In cases when standard impression tray does not overlap dentition, its edges may be extended with the usage of baseplate wax or thermoplastic impression material (fig. 10).

Fig. 10. Correction of impression tray edges with wax

Preparation of impression material

Impression procedure consists of three main working periods: mixing time, working time and time of binding (hardening) of the material (fig. 11).
Fig. 11. Main stages of work characterizing time for the impression materials preparation and obtaining of impressions

**Mixing time** includes part of the working time necessary for the impression material preparation (preparation of the mixture). **Working time** is considered to be the duration of period including mixing of the impression material components, filling of the tray and its introduction into the oral cavity, i.e. period of time measured since the beginning of mixing and till the beginning of the material binding (hardening). **Time of binding** (hardening) of the impression material combines the entire working period from the beginning of mixing till the complete hardening and reaching a consistency necessary for the removal of the impression from the oral cavity with minimal deformations.

Preparation of impression materials is determined by their composition and presentation.

Mixing of **alginate impression materials** components is carried out using rubber flask and plastic or metal spatula (fig. 12). The tools must be clean, without any traces of other materials. It is advisable to have separate flasks for plaster and alginate materials. When using two-component systems "powder-water", powder composition is mixed with water.

![Figure 12. Alginate impression material (1), rubber flask and plastic spatula (2) for the preparation of alginate impression materials](image)

Time of solidification (gelation) of alginate impression materials significantly depends on the water temperature. The most optimal temperature is considered to be 20-23°C. At this temperature solidification time (gelation) is about 3-4 minutes. Unless otherwise indicated by the manufacturers, it is recommended to use deionized or distilled water for mixing.

**Figure 13** shows the preparation sequence of the alginate impression material. Dosing of powder and water is carried out by means of special measuring tanks supplied as a part of a package (fig. 13.1). For one segmental (partial) impression 1 measuring tank of powder and 1 measuring tank of water should be taken (fig. 13.2; 13.3). For a complete impression of the lower jaw usually 2 measuring tanks of powder and 2 measuring tanks of water are taken. For a complete impression of the upper jaw 3 measuring tanks of powder and 3 measuring tanks of water are used. In all cases individual sizes of the jaws have to be taken into account.

Preparation of alginate materials using wrong ratio of components may degrade the
mechanical properties of the impressions. For example, the compressive strength of the alginate impression material sample at the recommended ratio of 7 g of powder to 21 g of water is 1.16 MPa, while changing of the ratio recommended by the manufacturer upward to 25 ml of water in order to obtain more liquid consistency decreases the compressive strength to 0.5 MPa, i.e. strength is two times reduced, and the impression with such strength usually breaks during removal from the oral cavity.

The material is mixed using 8-shaped intense movements (fig. 13.4; 13.5). The intensity and thoroughness of the manipulation prevents formation of air bubbles inside the material. Time of powder and water mixing should not exceed 1 minute.

Immediately after mixing the material is placed into a tray (fig. 13.6) and introduced into the patient's mouth.

Fig. 13. Sequence of the alginate impression material preparation

Alginate impression materials can be mixed using automatic mixing devices (fig. 14). Mixing is carried out in a rotating rubber flask. The spatula only presses the mixture to the walls of the flask, providing a uniform consistency of the material. Automatic mixing of the alginate impression material is performed in a short period of time and allows to increase the working time when obtaining an impression.

Fig. 14. A device for automatic mixing of alginate impression materials Alghamix II (Zhermack, Italy)

Mixing technique for anhydrous elastomeric materials depends on their chemical composition, viscosity type (see lecture "Impression materials used in dentistry"), and form of presentation.

Silicone impression materials of condensation type (C-silicones) are prepared by manual mixing of the base paste with the catalyst. Figure 15 shows the sequence of manual mixing of condensation silicone impression material of 0-type viscosity Zetaplus (Zhermack, Italy).
Fig. 15. Sequence of manual mixing of the condensation silicone impression material Zetaplus, 0 viscosity type (Zhermack, Italy): 1 – base paste with a dosing spoon; 2 – catalyst (gel) for C-silicones; 3 – components dosing; 4 – manual mixing of the base paste and catalyst; 5 – filling of the tray with the impression material

The base paste is dosed using measuring spoons supplied as a part of the package (fig. 15.1). Depending on the area to be imprinted, the doctor dispenses the required paste amount with the measuring spoon. Catalyst is added to the base paste for polycondensation of the material. Gel catalyst is most commonly used (fig. 15.2). Catalyst dosing should be carried out in accordance with the manufacturer's instructions. When working with Zetaplus material, two stripes of gel catalyst are applied on the imprint of each measuring spoon (fig. 15.3). After dosing the components within 30 seconds, the components are manually mixed until a homogeneous color is obtained (fig. 15.4). Hand mixing should be performed in vinyl gloves. The prepared impression material is placed into the impression tray (fig. 15.5).

Condensation type silicone impression materials (C-silicones) of 2nd and 3rd viscosity types are prepared by hand mixing of the base paste with the catalyst on paper pad. Figure 16 illustrates the sequence of mixing of condensation silicone impression material Oranwash L (Zhermack, Italy). The required amount of the base paste (fig. 16.1) is extruded onto the paper pad (fig. 16.2). Then the gel catalyst stripe is extruded in a ratio of 1:1 by length (fig. 16.3). The components are mixed using a spatula (fig. 16.4). The paste and gel catalyst are mixed for 30 seconds until one-color composition is obtained (fig. 16.5). The impression tray is filled with the impression material using a spatula (fig. 16.6). Availability of a special syringe for elastomeric materials (fig. 16.7) to be filled with the mixed material (fig. 16.8) simplifies insertion of the material into the impression (fig. 16.9), and allows to apply the impression material directly onto the prosthetic tissues.
Simple and quick mixing of silicone impression materials is possible using a rotating mixing disc of the Alghamix II device (Zhermack, Italy). Mixing of the base paste and gel catalyst is performed within a shorter period of time and without the formation of air bubbles inside the impression material (fig. 17).

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**Fig. 16.** Sequence of manual mixing of the condensation silicone impression material Oranwash L, 3rd viscosity type (Zhermack, Italy): 1 – base paste; 2 – mixing pad for components dosing; 3 – spatula for mixing; 4 – dosing of the components; 5 – manual mixing of the base paste and catalyst; 6 – filling of the tray with the impression material; 7 – application syringe for the impression material; 8 – filling of the application syringe with the impression material; 9 – filling of the tray with the impression material.
Addition-type silicone impression materials (A-silicons, vinyl polysiloxanes) and polyether impression materials of 0 and 1 viscosity types are prepared by manual mixing of the base paste with the catalyst paste or by automatic mixing in special devices. Figure 18 illustrates the sequence of manual mixing of vinyl polysiloxane impression material Express XT (3M ESPE).

Equal amounts of the base paste and the catalyst paste (fig. 18.2) are taken from the containers (fig. 18.1) with different dosing spoons. Dosage accuracy is provided by measuring of the material by the level of the dosing spoon edges. The pastes are mixed manually within 30 seconds. The mixed paste should be one-colored.

In 1993 the 3M ESPE company created the world’s first system for automatic mixing of impression materials of 0 and 1st viscosity types - Pentamix ™ device. Today’s market has various systems intended for this purpose (fig. 19).

The impression material is prepared using special plastic or metallic cartridges, into which the base paste and the catalyst paste packaged in foil are installed. The operation of the devices is based on a mechanical pressure of two plungers on the basic paste and the catalyst paste packaged in foil. Under the pressure the pastes move into the mixing tip, where they get mixed and delivered into the impression tray. Figure 20 illustrates the procedure of operating the Pentamix 2 device (3M ESPE).
Fig. 19. Devices for automatic mixing of anhydrous elastomeric impression materials of 0 and 1st viscosity types: 1 – Pentamix 3(MESPE); 2 – Dispenser (Dentsply); 3 – Dispenser Plug&Press (Kettenbach); 4 – Flextime Dynamix (Heraeus); 5 – Mixstation (Cosmedent); 6 – MixStar Motion (DMG); 7 – Volume Mixer (Kerr); 8 – Modulmix (Zhermack)

Foil packages are installed into the unclosed cartridge. Alignment tabs provide the correct fitting (fig. 20.1). The cartridge is latched down by pressing its locking lever (fig. 20.2). With the device lid open the plungers are moved into the top position by turning the flywheel clockwise until it stops. After retraction of the plungers the cartridge is installed into the device (fig. 20.3). Contact of the plungers with the foil is provided by turning the flywheel counter clockwise (fig. 20.4). The device can be operated only when the plungers are advanced up to the foil packages. A mixing tip has to be installed before the start of the mixing. To do this, the operator should open the lid of the device and release the fixing mechanism (fig. 20.5). The mixing tip should be aligned with the axis of the mixing shaft and outlet openings of the foil packages (fig. 20.6). After installing the mixing tip the locking lever is descended until it clicks. To start mixing of the material the operator should close the device lid and press the Start button (fig. 20.7). When using new foil packages, it takes 15-25 seconds for pressure to be established. After that the packages will open automatically. Once the packages have opened, one of the two pastes (they have different colors) can flow first, forming a non-uniform mixture. For this reason, it is necessary to observe the flow of two pastes, getting rid of non-uniform mixture until the mixture color becomes homogeneous (fig. 20.8). The device carries out mixing as long as the Start button is pressed. The impression tray is filled with the material with constant immersion of the mixing tip into the impression tray (fig. 20.9).
The devices provide a high-quality mixing of polyether and vinyl polysiloxane (A-silicone) impression materials of 0 and 1st viscosity types, providing their complete homogeneity without pores and streaks. Precise dosing of the material provides economical expense of the impression material. Filling of the tray with the impression material directly from the device reduces time expenditure of a doctor or assistant and ensures hygienic mixing procedure.

Devices for automatic mixing of materials can be used for filling of the application syringes (fig. 21). Open side of the syringe cylinder is installed directly on the mixer, and the syringe is filled with the required amount of impression material (fig. 21.1). After installation of a plunger, the syringe may be used for the application of the material directly on the prosthetic tissues (fig. 21.2).
In recent years polyester and vinyl polysiloxane impression materials of 2nd and 3rd types of viscosity have been produced in plastic cartridges (3M ESPE company patent, 1983). The cartridge includes two separate cylinders filled with the base paste and the catalyst paste in an amount of 50 ml. The outlet openings of the cartridge are closed with a removable cap. Movable plates (plungers) are located at the base of the cylinders. The impression material is prepared using a hand mixer (dosing gun, dispenser). Fig. 22 shows vinyl polysiloxane impression material in cartridges (3rd viscosity type) and general appearance of hand mixer for cartridges.

Fig. 23 shows the sequence of preparation for work and operation of the hand mixer for cartridges. Pressing the lock button (1) draws back the pressure plunger to the maximum (2). After opening the lock (3) the cartridge is installed into the mixer grooves (4). After installation of the cartridge the lock (3) is let back to its original position. After that the cap on the cartridge is replaced with a mixing cannula (5), which is fixed by clockwise rotation of the lock by 90°. An applicator (6) can be put on the mixing cannula in order to apply the impression material directly onto the prosthetic tissues. After installation of the cartridge and the accessories, the coupled pressure plungers are brought into contact with the cartridge, and the lever (7) is pressed in order for plungers to press the movable plates in the cartridge, causing outflow of two pastes from the openings and their mixing in the mixing cannula. It is recommended to leave the used mixing cannula on the cartridge or to put a cap on the outlet openings.
Along with the hand mixers (dispensers), there are disposable intraoral mixing syringes for vinyl polysiloxane impression materials. Intraoral syringes Express™ (fig. 24) are used for mixing and application of vinyl polysiloxane impression materials of 2nd or 3rd types of viscosity directly on the prosthetic tissues (on the prepared areas of teeth).

Maximum capacity of the syringes is 1.5 ml of the impression material. Contents of one syringe is enough for application of the impression material on 2-4 preparation areas, depending on the amount of the material applied on each of them.

Disposable intraoral syringes are filled with a hand mixer directly from 50 ml cartridges.

Intraoral syringe without a plunger is installed into the outlet openings of 50 ml cartridge with the base and catalyst pastes, which is located in the hand mixer. Mixing cannula, which is fastened to the syringe with a hinge, is placed at an angle of 90 degrees (fig. 25.1). The operator holds the syringe, fills it with the pastes without exceeding the line 1 cm below the attachment of the mixing tip (fig. 25.2). After that the plunger is installed into the intraoral syringe, and the paste is pushed to the level of the attachment of the mixing tip. Intraoral syringe prepared by the method described above can be stored for 12 hours. In case of a large prosthetic work scope, it may be necessary to prepare a few intraoral syringes in advance. It depends on the amount of prepared sections to be covered with the impression material. Immediately prior to application of the material, mixing tip of the intraoral syringe is turned all the way to the angle of 90°, with the longitudinal axis of the syringe coinciding with the axis of the mixing cannula (fig. 25.3). Under the plunger pressure the impression material is mixed in the mixing cannula until a homogeneous consistency is obtained, and then it is applied on the prosthetic tissues (fig. 25.4).
Intraoral mixing syringe is easy to use. Its size is 2-fold less than the hand mixer size, and the weight is 30 times less than the weight of the dispenser. Disposable mixing syringe is economical in operation. The residue of the material in the mixing cannula of the disposable mixing syringe is 0.29 ml, which is 3 times less than the residue of the material in the mixing cannula of the manual dispenser (0.88 ml). The cost of the disposable mixing syringe does not exceed the cost of the disposable mixing cannula for manual mixer (dispenser).

Introduction of a tray with impression material into the oral cavity (impression procedure itself)

Impression procedure may vary depending on the number of introductions of a tray with the impression material into the patient's oral cavity (number of stages), on the number of used impression materials (number of layers of one group material with different viscosity), and on the number of jaws included into the impression (one - or two-jaw impressions).

Depending on the number of stages there are one stage and two stage impressions. When obtaining one stage impression, a tray with the impression material is applied on the prosthetic tissues once. When obtaining a two stage impression, the impression taking procedure consists of two sequential stages: during the first stage the impression is obtained using only base impression material, after its hardening the impression is removed from the oral cavity and the light body (corrective) material is added in order to obtain more detailed prosthetic bed, after that the tray is imposed on the prosthetic tissues one more time (second stage).

Impression obtained using one type of impression material are called monophase impressions. Impression techniques using impression materials of two viscosity types are known and widely used in the dentistry. Such impressions are called two-phase impressions.
Monophase one-stage one-jaw impression technique

The selected tray is filled with the impression material prepared during the mixing time and introduced into the oral cavity (fig. 26). For tray introduction the operator should retract the mouth angle with the forefinger or using an intraoral mirror (fig. 26.1). The tray is introduced with the right hand at an angle (fig. 26.2), and imposed on the prosthetic tissues with its handle aligned with the midline (fig. 26.3). When obtaining an impression from the upper jaw, the tray is first pressed in the distal region, and then - in the anterior region of the upper jaw. This prevents overrunning of the excess material distally beyond the tray. When taking an impression of the lower jaw, the tray is first placed in the anterior region and pressed in the distal region of the jaw. In order to form the vestibular edges of the impression, the doctor takes the patient's lip and cheeks with the fingers, retracts them and then forces them against the side of the tray (fig. 26.4). Introduction of the tray and formation of the impression edges is performed during the working time of the impression material. After forming the impression edges, the tray with the impression material is held in the oral cavity without pressure and displacement (fig. 26.5) until the completion of the solidification time (within the time specified by the manufacturer of the impression material).

Monophase one-stage one-jaw impression technique is used when working with alginate impression materials.

When using anhydrous elastomeric materials of one viscosity type (type 1 or 2), the material can be placed into the tray (fig. 27.1) and applied to the prosthetic tissues with an application syringe (fig. 27.2). Tray filled with the material is placed on the prosthetic tissues (fig. 27.3) and removed from the mouth cavity after the material hardening (fig. 27.4).
One-stage two-phase one-jaw impression technique

Only anhydrous elastomeric materials of one group with different types of viscosity are used for this type of impressions. Condensed type silicone materials (C-silicones), vinyl polysiloxane impression materials (additive type silicones, A-silicones) or polyether impression materials are most commonly used for these purposes.

In two-phase impressions one of the listed materials of 0 or 1st viscosity type is used as a base layer, and the corrective layer is represented by a material with the same composition but of 2nd or 3rd viscosity type.

One-stage two-phase impression technique is represented in figure 28. Material of high or very high viscosity (type 0 or 1) is used as the base layer, and material of medium or low viscosity (type 2 or 3) is used as the corrective layer. Preselected tray is filled with base layer - impression material of 0 or 1 viscosity type (fig. 28.1). A groove is made in the base layer, where relief clarification is required, and filled with the corrective material or 2nd or 3rd type (fig. 28.2). For the application of corrective impression material directly on the prosthetic tissues, a manual mixer with an applicator, intraoral mixing syringe or application syringe for impression materials are used (fig. 28.3). Impression tray with two types of impression material is applied on the jaw and held for the time of polymerization of the impression material (fig. 28.4). Assessment of the impression is performed after its removal from the oral cavity (fig. 28.5).
The double mixing technique is considered to be difficult because it requires strict timing of the process of simultaneous preparation of two types of material and participation of an assistant. The advantage of this method is good penetration of corrective material into the gingival pocket under the pressure of the base layer, absence of deformation of the base layer and time saving. Application of the double mix technique is recommended in obtaining of impressions for production of inlays, single artificial crowns and small bridges.

**Two-phase two-stage impression technique**

Two-stage two-phase impression taking procedure is shown in figure 29. As in the one-stage technique, the base layer is represented by the material of very high or high viscosity type (type 0 or 1), and the corrective layer is represented by the material of medium or low viscosity (type 2 or 3). Preselected tray is filled with impression material of 0 or 1 viscosity type (fig. 29.1), and the impression of the prosthetic tissues is obtained (fig. 29.2). After the base layer material has hardened, the operator removes the impression from the oral cavity. One of the mandatory conditions for obtaining the two-stage two-phase impression is preparation of the base layer, which includes removal of interproximal partitions and undercut areas, preventing precise reposition of the impression on the prosthetic bed tissues. In addition, in order to reduce compression pressure of the corrective material, it is recommended to create grooves on the base impression. These grooves facilitate outflow of the corrective material excess (fig. 29.3). To remove interdental spaces and undercuts dentists use various tools and accessories: special tools for engraving, ophthalmic scalpel, scissors, pointed dental spatula, etc. These tools are also used for creation of diverting channels (grooves).

After preparation of the base layer it is filled with corrective material of 2nd or 3rd type (fig. 29.4). For the application of corrective impression material directly on the prosthetic tissues dentists use hand mixer with an applicator, intraoral mixing syringe or application syringe for impression materials (fig. 29.5). Impression tray with two types of impression material is applied repeatedly on the jaw and held for the time of polymerization of the impression material (fig. 29.6). Assessment of the impression is performed after its removal from the oral cavity (fig. 29.7).
Two-jaw impression technique

Along with one-jaw impressions dentists also use impressions, which simultaneously reflect prosthetic bed and tooth prints of antagonistic teeth. Application of this technique is acceptable in the manufacture of inlays, single artificial crowns and small bridges. The advantages of the two-jaw technique are significant saving of time and no need for registration of occlusion. Two-jaw impressions are mostly obtained using one-phase or two-phase one-stage technique.

These impressions require application of special trays, which are selected based on the localization of the defect and its length (fig. 30.1). The tray is treated with the adhesive for better fixation of the impression material. Upper and lower tiers of the tray are filled with the material using a mixer, and the material is also applies on the prosthetic bed tissues. Two-jaw tray with the material is introduced into the mouth and imposed on the prosthetic bed tissues. After that the doctor asks patient to close the jaws in the position of central occlusion under the control of the remaining teeth contacts. After completion of the material polymerization, the patient is asked to open his mouth. After that the doctor removes the tray with the impression and performs its assessment (fig.30.2).

Two-jaw impression (fig. 30.3) allows fixation of both working and auxiliary models in occludator or in articulator in the position of central occlusion.
Occlusal registration technique

Occlusal registration is one of the types of two-jaw impression technique. It is performed using special highly filled addition-type silicone materials and polymer composite materials of chemical curing. No impression trays are used for this purpose. After automatic mixing, the material is applied from a mixing canula directly on the mandibular occlusal surfaces of the teeth (fig. 31.1), and then under the doctor’s control the patient is asked to close his dentition in central occlusion position (fig. 31.2). After polymerization is completed, the doctor removes the impression from the oral cavity and performs its assessment (fig. 31.3).

Removal of the impression from the oral cavity

Removal of a tray from the oral cavity is always accompanied by impression material deformation (fig. 32). All elastomeric materials have the ability to recover after deformation, but this rate depends on the properties of the impression material and the amount of deformation.

Ideally, when you remove impression from the undercuts, it must immediately and fully recover after deformation, which occurs during this process. All elastomeric impression materials are characterized by viscoelastic behavior, so it is important to remove an impression from the mouth with rather energetic and single-step movement. Then a doctor can be sure that the tension experienced by the material is temporary and has only elastic deformation nature. Slow removal of the impression, accompanied by its wobbling may lead to flowing deformation in the material, and it won't be able to fully recover after the deformation.

According to the recovery index of impression materials after deformation, they can be put in the following sequence (R. Nurt, 2002):

\[ A > PS > PE > CS > VPS \]

Alginate impression materials (A) have minimal recovery indicators after deformation and occupy the first place in this list. Polysulfide materials (PS), polyether materials (PE) and silicone materials of condensed type (CS) have better performance, but they are inferior in this re-
spect to vinyl polysiloxane (VPS) materials (additive type silicones, A-silicones), which actually have no residual deformation.

![Fig. 32. Deformation of impression material during removal of the impression, and its recovery after the deformation](image)

One of the objectives of the doctor performing the impression procedure is exclusion of the impression material deformation. This depends on the direction of the impression removal. Direction of impression removal is determined by the teeth inclination. If there is no pronounced inclination of teeth, the tray may be removed in vertical direction, with energetic momentary movement in the direction of the common longitudinal axis of the teeth (fig. 33.1). With pronounced teeth inclination, the impression should be removed in the direction, which can reduce deformation of the impression material in the prepared teeth area (fig. 33.2).

![Fig. 33. Methods of impression removal from the prosthetic tissues depending on inclination of the teeth](image)

**Assessment of the impression**

After the removal of the impression from the oral cavity, the doctor performs its assessment. Assessment is based on the following criteria:

- clear display of all the teeth, gingival grooves, alveolar bone and surrounding soft tissues up to transitory fold;
- absence of pores in the impression;
- good adhesion of the impression material to the tray;
- the inner surface of the impression should not contain thinned or bowed areas;
- the impression should be free of saliva and should not contain traces of blood.