

PROVISIONAL RESTORATIONS



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МИНИСТЕРСТВО ЗДРАВООХРАНЕНИЯ РЕСПУБЛИКИ БЕЛАРУСЬ
БЕЛОРУССКИЙ ГОСУДАРСТВЕННЫЙ МЕДИЦИНСКИЙ УНИВЕРСИТЕТ
КАФЕДРА ОБЩЕЙ СТОМАТОЛОГИИ

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PROVISIONAL RESTORATIONS

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Приведены различные материалы и методы изготовления провизорных протезов. Особое внимание обращено на клинические методы изготовления провизорных протезов. Первое издание вышло в 2017 году.

Предназначено для студентов 2–5-го курсов медицинского факультета иностранных учащихся, обучающихся на английском языке.

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INTRODUCTION

Contemporary methods of restoration of tooth tissues pathology, using cast metal, ceramic, metal-acrylic and metal-ceramic dentures, demand significant removal of hard tooth tissues. In these cases, provisional (temporary dentures) are made and used while permanent restoration is manufactured — to protect pulp of the prepared tooth from external factors, maintain space in the dental arch, prevent hypertrophy of gingival margin, prognoses treatment plan, save esthetics etc. (fig. 1).

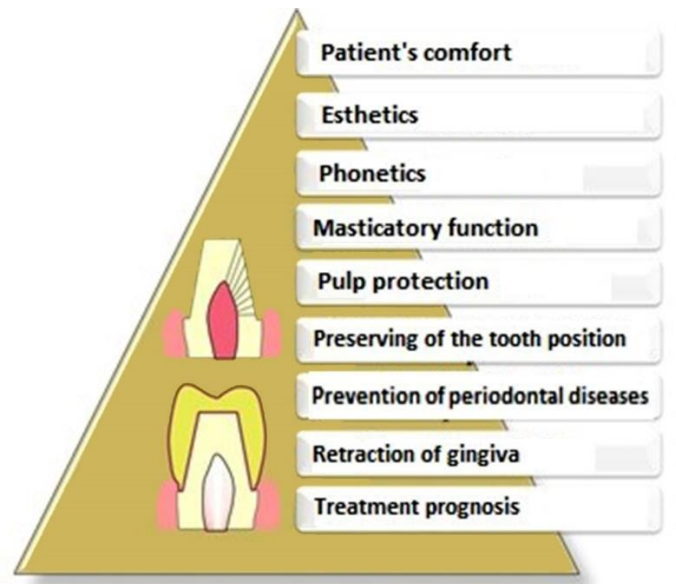


Fig. 1. Functions of provisional: patient's comfort, esthetics, phonetics, mastication, protection of pulp, maintaining of tooth space, prevention of periodontal diseases, gingival retraction, prognosing

Besides, provisionals are used to straighten occlusal surface of dental arches by desocclusion, in cases of TMJ disorders or changing of muscle reflex by I. S. Rubinov (fig. 2).



Fig. 2. Indications for provisional: period of manufacturing permanent prosthesis, gradual desocclusion for straightening occlusal surface of dental arches, changing of muscle reflex, treatment of TMJ disorders

Provisionals can be fabricated by clinical-laboratory and clinical methods (fig. 3).

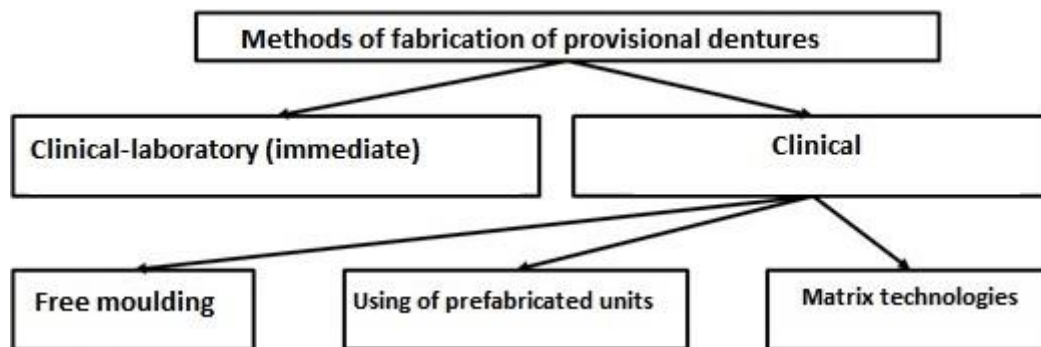


Fig. 3. Methods of provisional fabrication. Clinical-laboratory (immediate denture).
Clinical: – free moulding, – standard preshaped patterns, – matrix technologies

According to the terms of production provisional can be immediate dentures (made before preparation of teeth, using clinical-laboratory method) and early dentures (made in single appointment, right after preparation of teeth, chair side, clinical method).

The main constructional material for provisional is plastic. There are certain requirements to the polymers, used for provisional fabrication:

- no toxic influence onto pulp and surrounding tissues;
- polymerization of the material should occur without exothermic reaction;
- minimal shrinkage during polymerization (not more than 3% by volume);
- compression resistant;
- low viscosity of the original material consistency;
- materials should have long plastic phase;
- smooth glossy surface after polymerization;
- colour should correspond to the tooth tissues;
- easy manipulation (packing, dozing, processability).

CLINICAL-LABORATORY METHOD (IMMEDIATE DENTURE)

In clinical-laboratory method the immediate denture is made of heat-cured acrylic resins («Sinma-M» etc.) in the dental laboratory (fig. 4). Doctor, before preparation of teeth (fig. 4, *a*) receives master (fig. 4, *b*) and antagonist impressions and registrates central occlusion if indicated (when models can't be positioned clearly into central occlusion). With the help of these impressions (fig. 4, *c*) stone models are cast (fig. 4, *d*) and secured into occludator or articulator. On the master stone model teeth are prepared with a sharp cutting instrument (eye scalpel etc.) — shaping of tooth stump as a cone, removal of gypsum layer of the necessary thickness (equal to the thickness of future artificial crown) — imitation of tooth preparation in clinic is performed (fig. 4, *e*). After cutting of teeth on stone

model, the denture construction is modelled from wax (fig. 4, *f*), with the following changing of wax into plastic (fig. 4, *g*) by compression moulding technique.

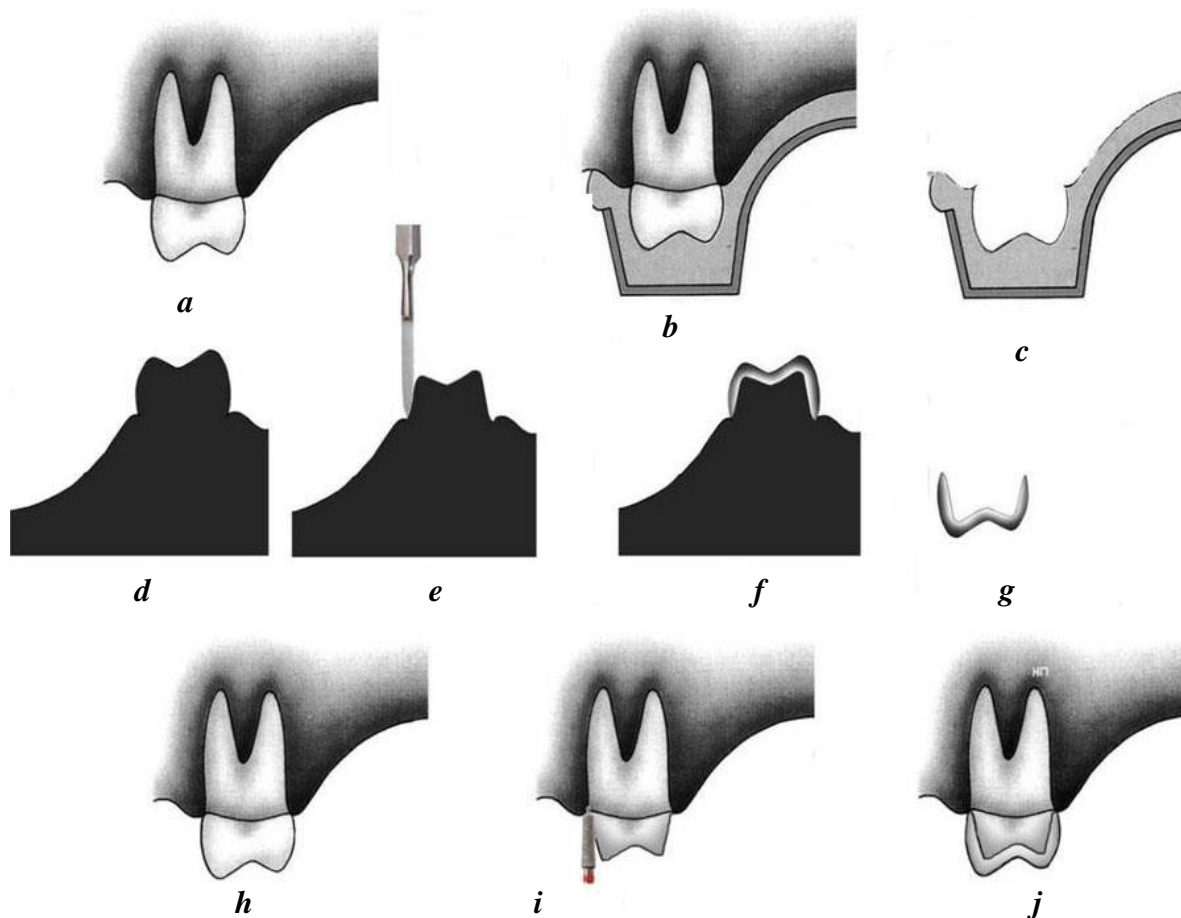


Fig. 4. Sequence of provisional crown fabrication by clinical-laboratory method

The tooth in patients' mouth (fig.4, *h*). After laboratory manufacturing of the provisional, doctor in clinic performs preparation of teeth (fig. 4, *i*), fitting, correction and relining of the previously prepared provisional with the use of self-cured or double-cured plastics (fig. 4, *j*).

This method is favorable in case of large bridge dentures fabrication and dentures which restore occlusal height.

CLINICAL METHODS

Clinical methods suppose fabrication of provisionals chair-side, in the same appointment after preparation of teeth.

METHOD OF FREE MOULDING

In free moulding technique self-cured acrylic resins MMA/PMMA (fig. 5, *a*) and light-cured composite polymers (fig. 5, *b*) are used.



Fig. 5. Polymer material used for provisional fabrication by free moulding technique:
a — self-cured plastic Acryloxide (STOMA, Ukraine); *b* — light-cured composite Revotek LC (GC, Japan)

Free moulding supposes making denture without using any forms. When using self-cured resin Acryloxide (STOMA, Ukraine) after preparation of teeth (fig. 6, *a*), powder (polymethyl methacrylate) is mixed with liquid (methyl ether of methacrylic acid) (fig. 6, *b*), dough-like stage is awaited, and plastic dough is placed onto prepared teeth, previously covered with isolating medium. In plastic stage vestibular and oral surface are formed with a modeling instrument (fig. 6, *c*), on the occlusal surface impressions of antagonist teeth are received with the help of closing the teeth in central occlusion. The anatomical shape is corrected with rotating instruments out of the oral cavity (fig. 6, *d*). provisional restoration is fixed with temporary cement (fig. 6, *e*)

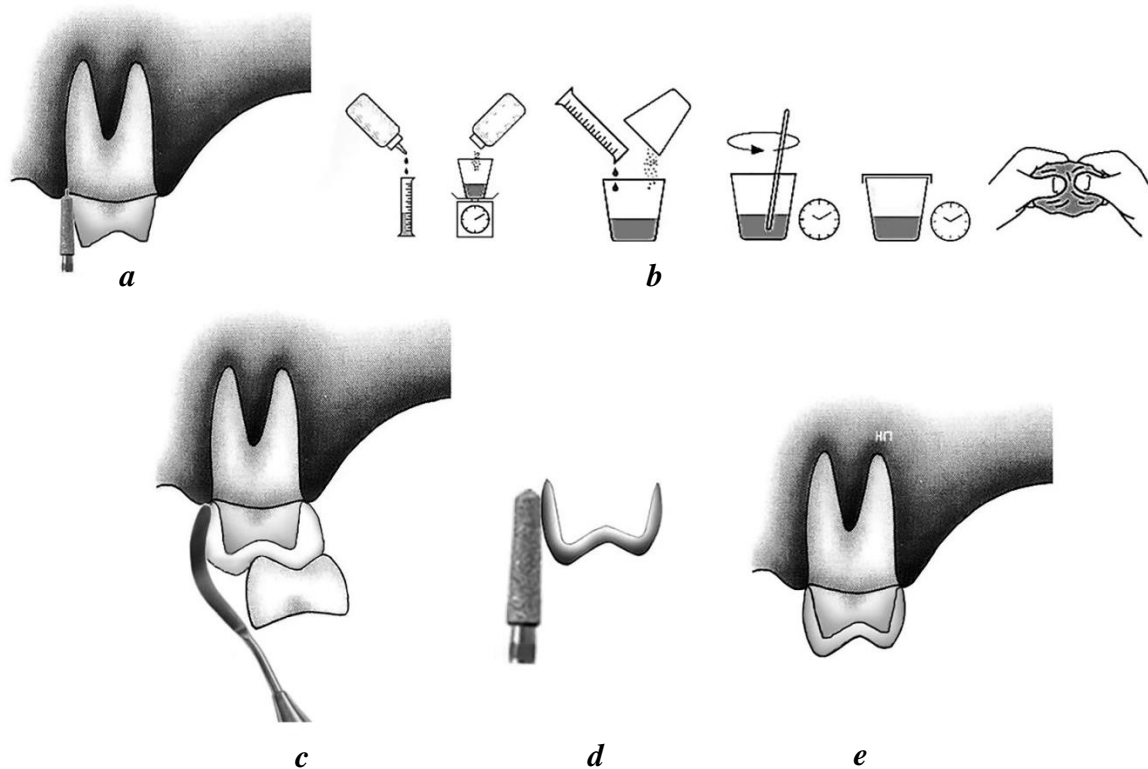


Fig. 6. Sequence of provisional crown fabrication by free moulding

Due to highly exothermic reaction of Acryloxide polymerization (fig. 7, *a*) and significant polymerization shrinkage of the material (fig. 7, *b*) it is recommended to recover provisional from the teeth and set it on them again from time to time during transition of rubber stage into full solidification. After polymerization plastic pattern is given the anatomical shape with the help of cutters, burs, carborundum cups, discs, polished with rubber discs and fixated with temporary luting agents (fig. 6, *d*).

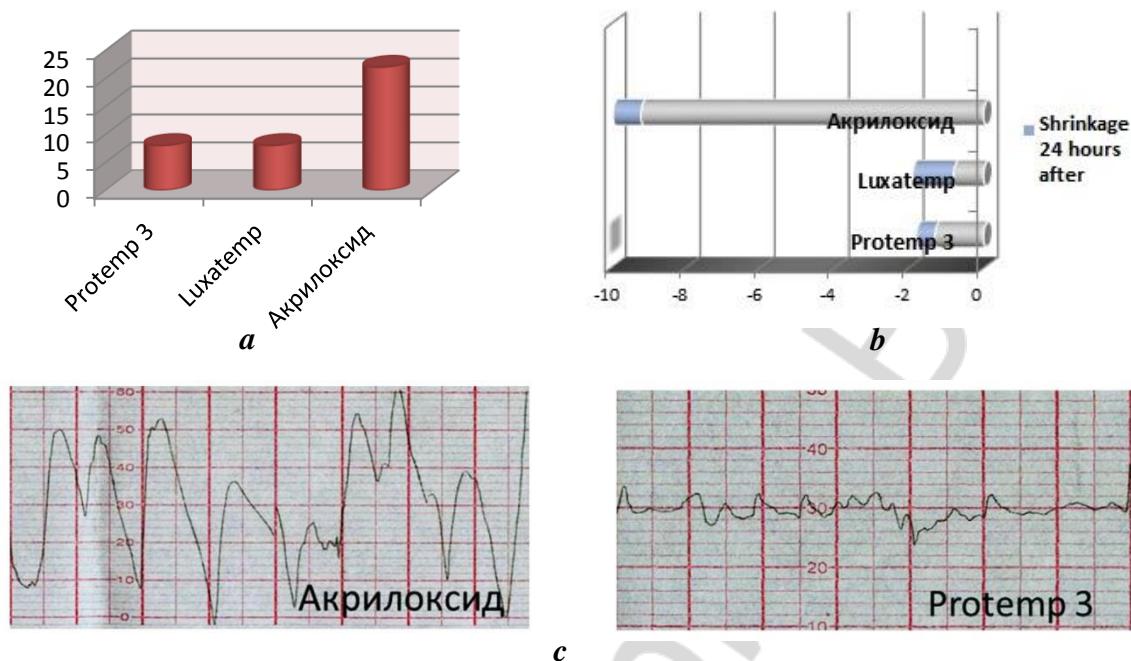


Fig. 7. Comparative evaluation of properties of self-cured resin «Acryloxide» and self-cured composite materials Luxatemp and Protemp: *a* — value of exothermic reaction during polymerization (°C); *b* — characteristic of shrinkage (%); *c* — profilograms of Acryloxide and Protemp 3 (O.G. Malkovets)

Free moulding with the use of self-cured resins (Acryloxide etc.) demands too much time, to give to the pattern anatomical shape. Highly exothermic reaction of PMMA during polymerization is dangerous for pulp tissues, periodontum and oral mucosa. Shrinkage is up to 9–10 %. Structure of the material is highly rough, what is proved by profilograms (fig. 7, *c*). Besides, there is around 5 % of residual monomer in PMMA dentures, which didn't enter reaction of polymerization, and there is a big amount of pores and voids on the denture surface (fig. 8).

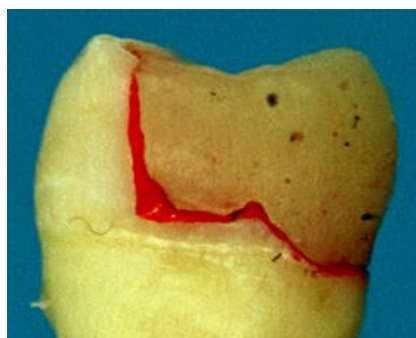


Fig. 8. Provisional denture from self-cured resin «Acryloxide»

Alternative material for free moulding of provisional is light-cured composite resin Revotek LC (fig. 5, *b*).

The material is manufactured as ready to use paste, packed in a box, which protects it from light. Doctor takes necessary amount of the material for free moulding. Manipulation is similar to the free moulding of PMMA, but there is no limit in working time, as there will be no polymerization until light curing occurs (blue part of spectrum with the wave length of 460–480 nm).

Only after modeling work is done, doctor performs preliminary polymerization by light during 6–10 seconds, recovers denture out from the mouth and finishes polymerization by light exposition for 40–60 seconds. Temporary fixation of the denture ends the procedure (fig. 9).



Fig. 9. Provisional crown on the tooth 1.6, made by free moulding method with the use of light-cured composite resin Revotek LC (GC, Japan)

Fabrication of provisional dentures with the use of prefabricated crowns

3M ESPE company (USA-Germany) set up industrial production of pre-formed crowns, produced from polycarbonate, alloys of metals and composite light-cured materials for the fabrication of single provisional crowns (fig. 10).

Polycarbonate crowns for incisors, canines and premolars are produced in the form of a set consisting of 60 or 120 species (fig. 10, *c*).



Fig. 10. Standard kits of preformed provisional crowns by 3M ESPE company: *a* — Stainless Steel; *b* — on the base of tin and silver alloy (Iso-Form); *c* — polycarbonate crowns; *d* — composite light-cured provisionals (Protemp™ Crown)

Sequence of making crowns with the use of preformed standard blanks (fig. 11) includes the tooth preparation, selection of a standard blank (fig. 11, *a*) and its correction with the use of abrasive tools (fig. 11, *b*). After fitting the crown its rebasing is done with the use of chemical or dual-cure resins (fig. 11, *c, d*), removal from the mouth for preventing polymerization of resin excesses in undercuts (fig. 11, *e*); finishing (fig. 11, *f*). and temporary fixation (fig. 11, *h*), removal of fixation material excesses (fig. 11, *i*).

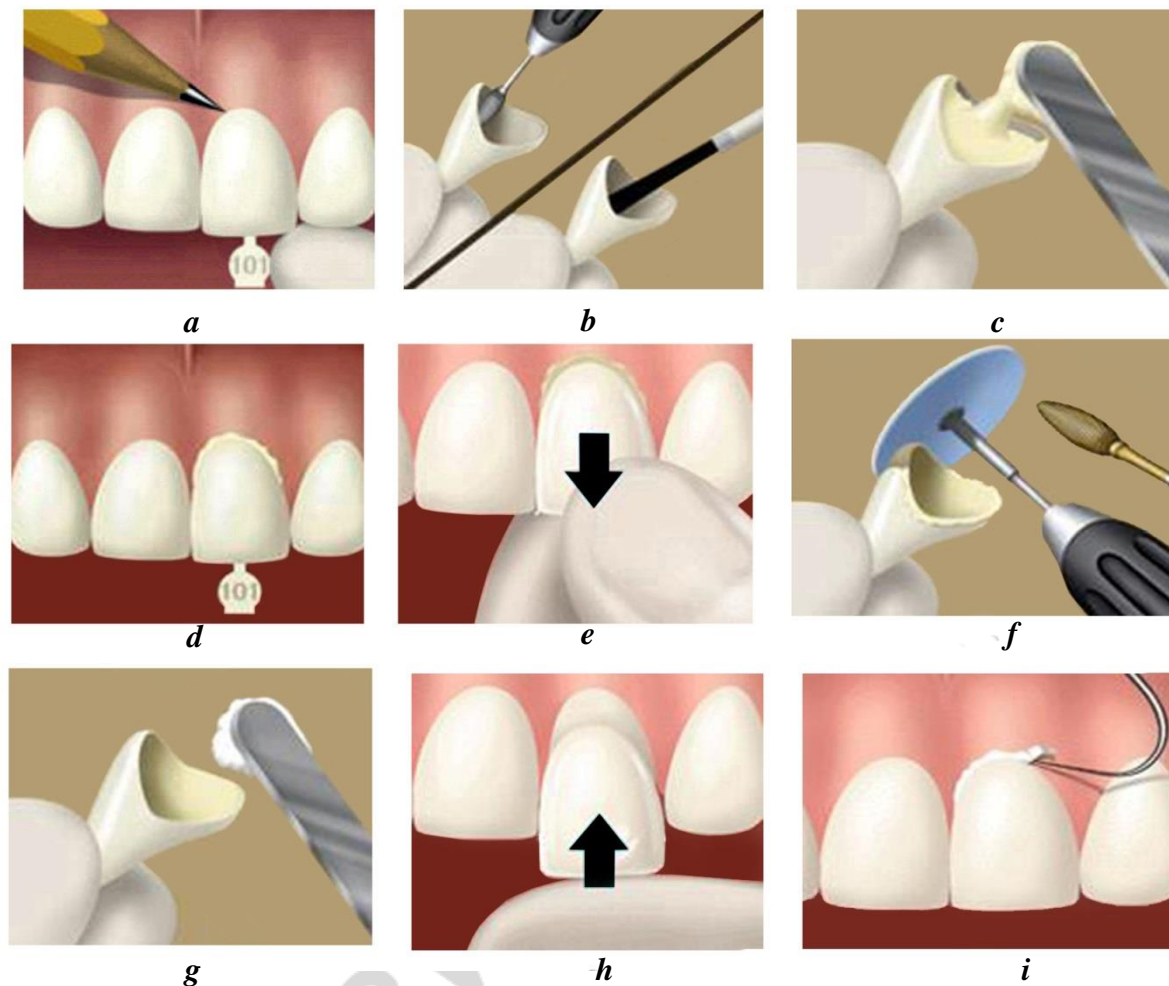


Fig. 11. Sequence of provisional crown fabrication with the use of polycarbonate preformed blank

Sequence of fabrication of provisional from metal alloys is presented on the fig. 12. After tooth preparation a standard blank is selected and corrected (fig. 12, *a, b*). To specify the internal structure of the construction relief in accordance with the shape and size of the stump of the prepared tooth the rebasing of metal crown on the prepared tooth is performed using chemical or dual-cure resins (fig. 12, *c, d*). After the rebasing the crown is removed (fig. 12, *e*), excess of resin is deleted (fig. 12, *f*), light-curing of the rebasing material is carried out (indicated if dual-cured composite material was used for rebasing) (fig. 12, *g*), processing of crown edges (fig. 12, *h*) and its temporary fixation take place (fig. 12, *i, j*).

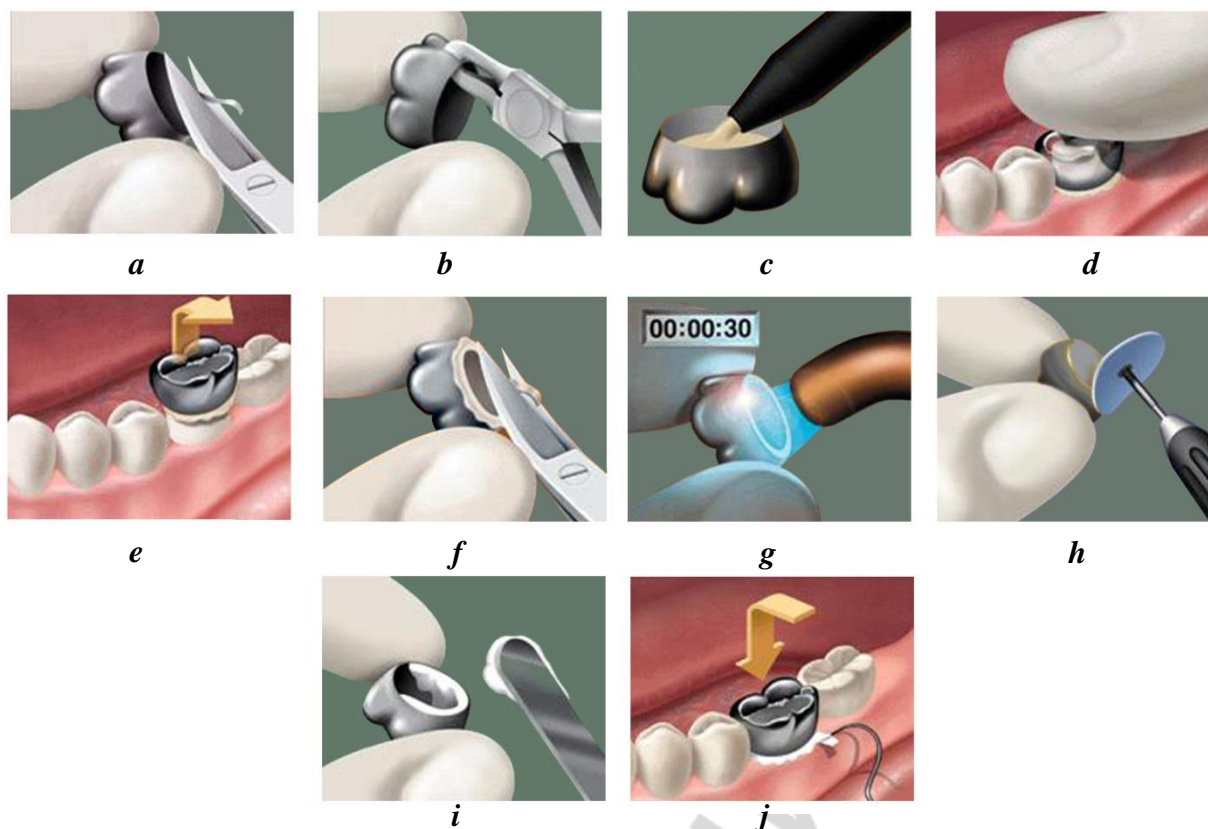


Fig. 12. Sequence of fabrication of provisional crown with the use of metal preformed crown

Considering the increasing demands on the aesthetics of provisional dentures by 3M ESPE in 2008 technology of manufacturing provisional crowns using standard preformed crowns from light-cured material Protemp™ Crown (fig. 13, *d*) was first introduced to the dental products market. Protemp™ Crown is an industrially produced prefabricated blanks from light-curing composite material. Composite material includes two main components — the organic matrix and filler. The filler with an average particle size of 0.6 microns (particle size range from 0.04 to 3 microns) is dispersed in an organic matrix. Specific weight of the filler is 78 %.

The sequence of provisional crown fabrication includes tradition of preparation of the tooth, selection and adaptation of the blank, primary and final light-curing, polishing and temporary fixation (fig. 13).

After tooth preparation the size of provisional is selected with the help of template for measuring mesio-distal sizes (fig. 13, *a*) and a table attached to the kit. The blank which correspond to the tooth group and previously determined size, is extracted from the individual sealed box (fig. 13, *b*) and separated from the film (fig. 13, *c*). The height of the crown is easily adjusted by cutting the excess considering the preparation border (fig. 13, *d*, *e*). After the primary adjustment crown is installed onto the stump of the tooth and adjusted to prosthetic tissues, proximal contacts and occlusal surface due to its originally plastic phase (fig. 13, *f*–*i*). If necessary crowns can be adjusted and corrected with the help of conventional flowable composite material. Light-curing of crowns is held in 2 steps. First light-curing (in «tacking» mode) is performed in the oral cavity for 2–3 seconds

from each surface of the crown (fig. 13, *j-l*). After the first light-curing it's necessary to remove the crown from the prepared tooth and install it back several times, to verify the accuracy of the crown fitting (pic. 13, *m*). Final polymerization of the crown is carried out outside the mouth for 60 seconds (fig. 13, *n*). The crown should be grinded, finished and polished (fig. 13, *o*) evaluation of occlusal contacts (fig. 13, *p*). The prosthesis is fixed in the oral cavity with temporary cement (fig. 13, *q-s*).

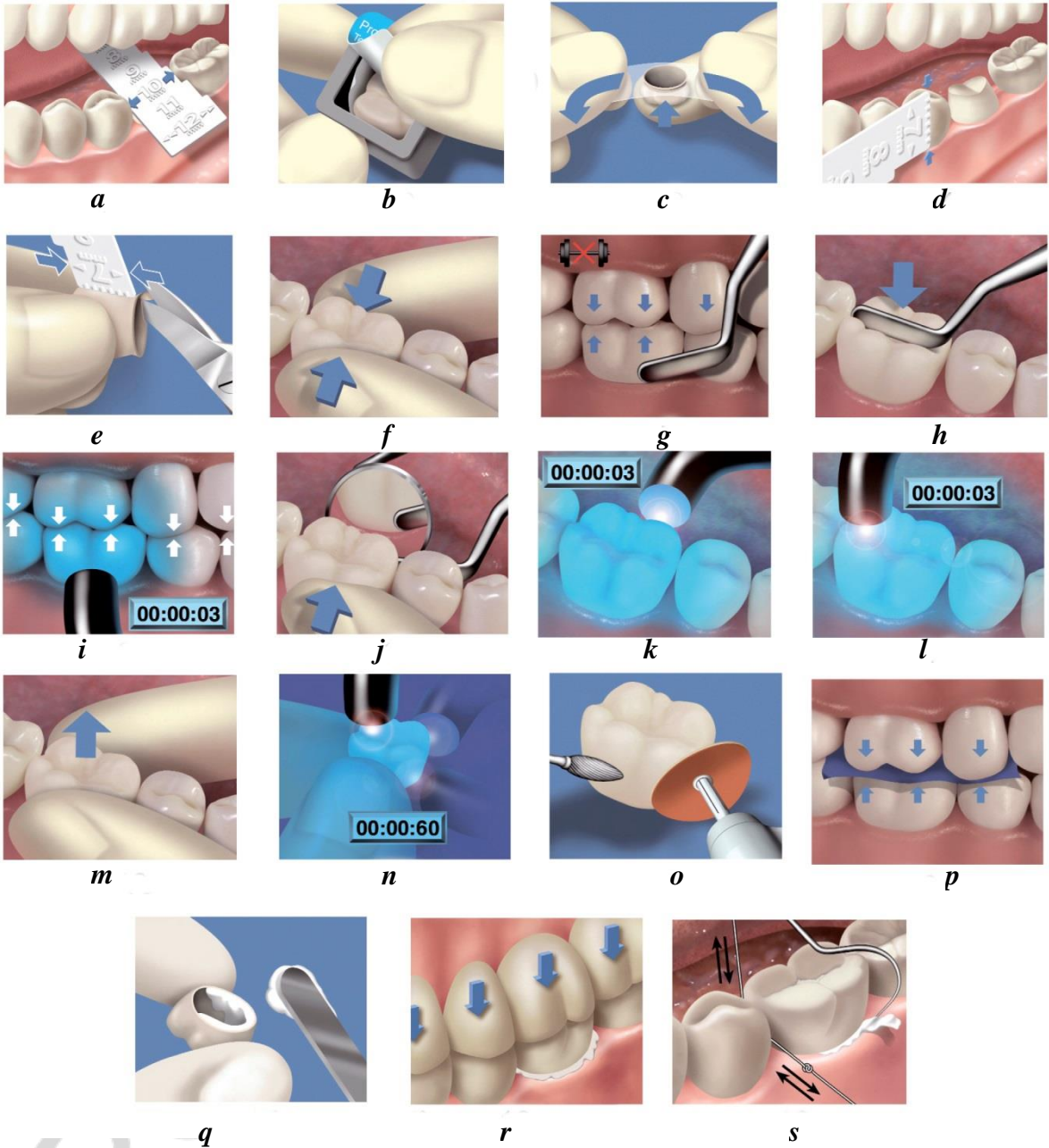


Fig. 13. Sequence of fabrication of provisional crown with the help of standard preformed composite blank Protemp™ Crown

Protemp™ Crown has high strength characteristics. The shape and size of crowns corresponds to the form of molars, premolars and canines of the upper and lower jaws (fig. 14). The material has minimal polymerization shrinkage, easy processing and is well polished. Making a provisional prosthesis using Protemp™ Crown requires minimal work time of a dentist.

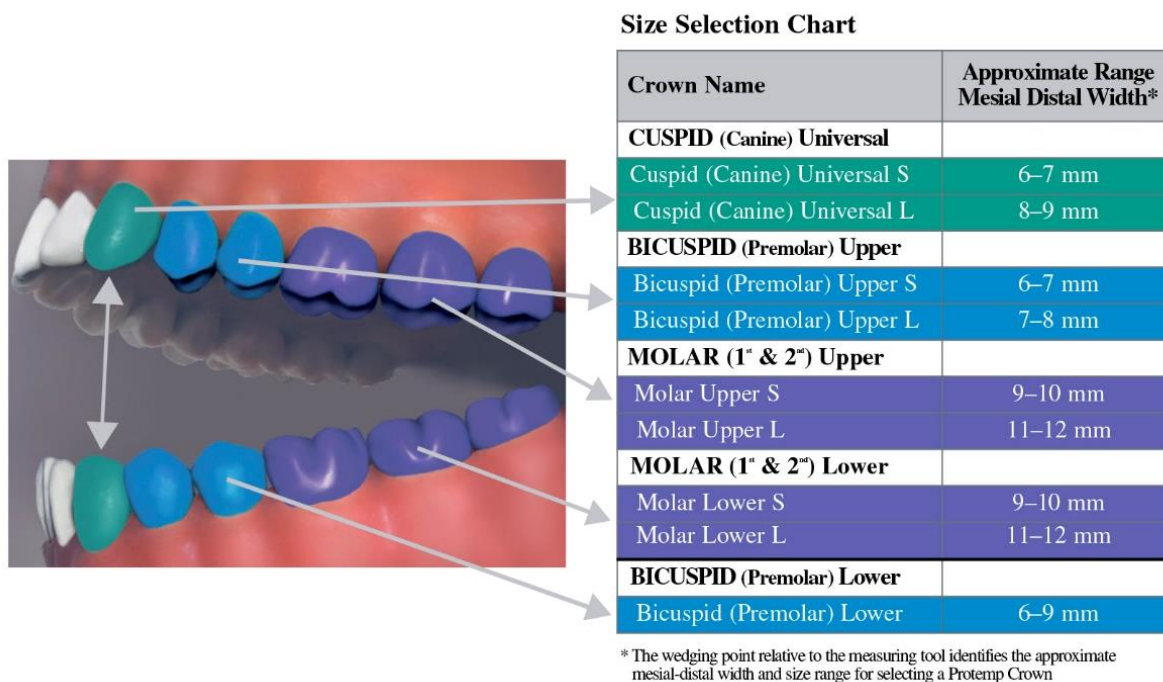


Fig. 14. Size Selection Chart

FABRICATION OF PROVISIONAL DENTURES WITH THE USE OF COMPOSITE MATERIALS OF CHEMICAL CURING MECHANISM (SELF-CURED COMPOSITE, COMPOSITES OF COLD POLYMERIZATION) AND MATRIX TECHNOLOGIES

The most common class of polymer materials used for the manufacturing of provisional prosthesis is Bis-acrylic composites (fig. 15).



Fig. 15. Self-cured composite materials, used in dentistry for fabrication of provisional dentures: *a* — Protemp™ 4 Garant™ (3M ESPE, Germany); *b* — Luxatemp® (DMG, Germany)

Self-cured composites are used for manufacturing direct restorations by clinical method in a single appointment. These materials are composed of an organic component (Bis-GMA, TEGDMA) and inorganic fillers (see Lecture «Polymeric materials used in dentistry»). The inorganic fillers comprise about 40 % of paste (by weight).

Modern composite materials for provisional dentures are packaged in cartridges and are meant for automatic mixing. The cartridge is designed as two tubes connected, one of them (large diameter) contains a base paste and the other — the catalyst paste. The principle of operation of the mixer-applicator (dispenser) is similar to the mixer for impression materials (see Lecture «Methods of Making Impressions»). Compared with mixers for impression materials, where the mixing is carried out in a ratio of 1 : 1, the automatic mixer for mixture of composites supplies mixing of base paste and catalyst paste in a ratio of 10 : 1. Mixing of pastes occurs under pressure of pistons in a mixing cannula, at the exit polymer material ready to use is obtained. The technology of provisional prosthesis manufacturing with the use of bis-acrylic composites involves application of so-called matrix — forms, which can carry on its surface relatively flowable composite paste.

The following materials are used as matrices in the manufacture of prostheses:

- silicone impression materials;
- alginate impression materials;
- thermoplastic materials («LuxaForm», DMG, Germany);
- celluloid caps.

Provisional crowns fabrication with the help of impressions (matrix technology)

In cases when the anatomical shape of the tooth is not ruined (discolouration of tooth) or is rebuilt with a filling material, it is convenient to use silicone or alginate impressions as a matrix.

To do this, before preparation, an impression of this tooth or teeth is received with silicone or alginate impression material (fig. 16, *a*), the «matrix» is removed (fig. 16, *b*) and then preparation is carried out (fig. 16, *c*). When tooth is prepared, the impression is filled with polymer material (fig. 16, *d*) and again introduced into the oral cavity for the time, given in the manufacturer's instruction (fig. 16, *e*). After removal of the impression from the mouth (fig. 16, *f*), the denture is recovered from the impression or taken off the prepared tooth and is processed. correction and polishing (fig. 16, *g*) and fixed with temporary luting agent (fig. 16, *h*).

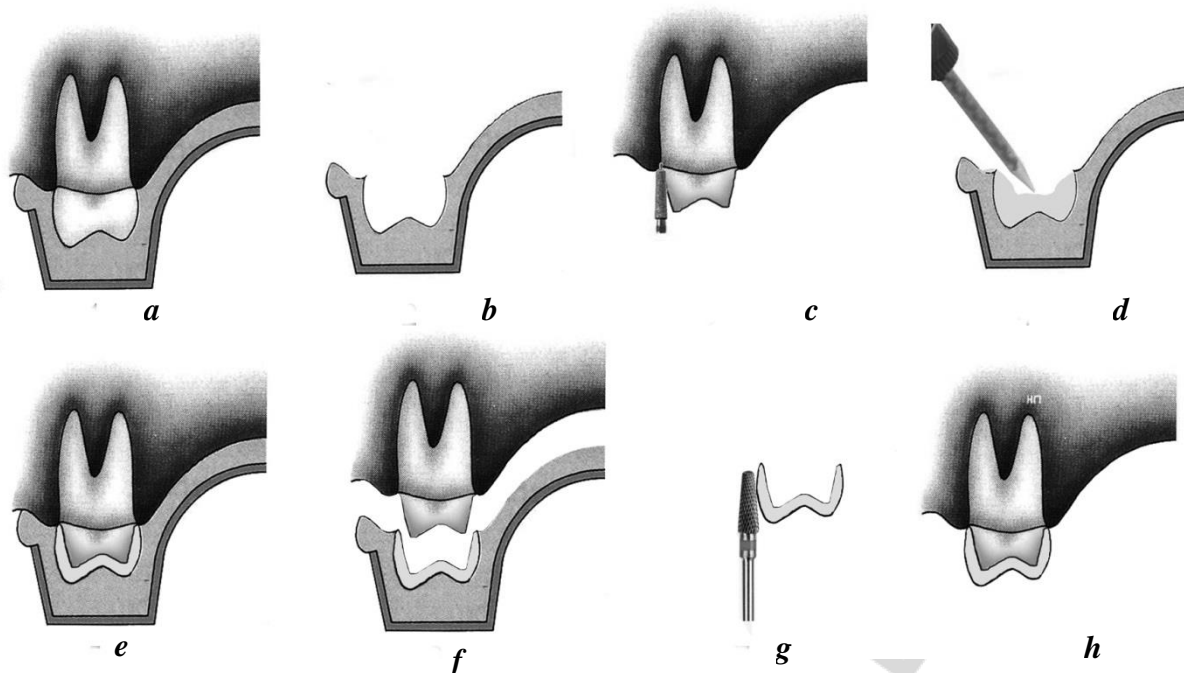


Fig. 16. Sequence of provisional denture fabrication with the use of composite material and an impression matrix

Provisional crowns fabrication with the use of matrices from thermoplastic materials

Thermoplastic materials (LuxaForm, DMG, Germany) may be used as matrices for manufacturing provisional crowns as well.

Standard blank of LuxaForm is softened by immersing it into 60–70 °C water, whereby the material acquires plastic state and may be used for forming matrix (fig. 17). After necessary form is given to the material, it can be used as a matrix (mould) to be filled with polymer materials and applied onto prosthetic tissues.



Fig. 17. LuxaForm (DMG, Germany)

Provisional crowns fabrication with the use of celluloid caps

Celluloid caps or strip-crown are used as standard matrices for the fabrication of single artificial crowns from polymeric materials.

Sequence of crowns manufacturing with the use of celluloid caps includes tooth preparation, selection and adjustment of cap margin. In order to prevent the formation of pores in the polymeric material is conducted a perforation in incisal or occlusal surface of the cap using a hot probe (fig. 18, *a*). It is recommended to create holes on proximal sides of the cap at the level of contact points (fig. 18, *b*), which prevents appearing of gaps between teeth. The ready cap is filled with polymer material (fig. 18, *c*) and applied to the prepared tooth (fig. 18, *d*). After 2 minute contact between polymer material and tooth tissues the cap together with the polymer crown is recovered from the oral cavity (fig. 18, *e*). After full polymerization the crown is detached from the cap (fig. 18, *f*), processed (fig. 18, *g*) and fixed with temporary luting agent (fig. 18, *h, i*).

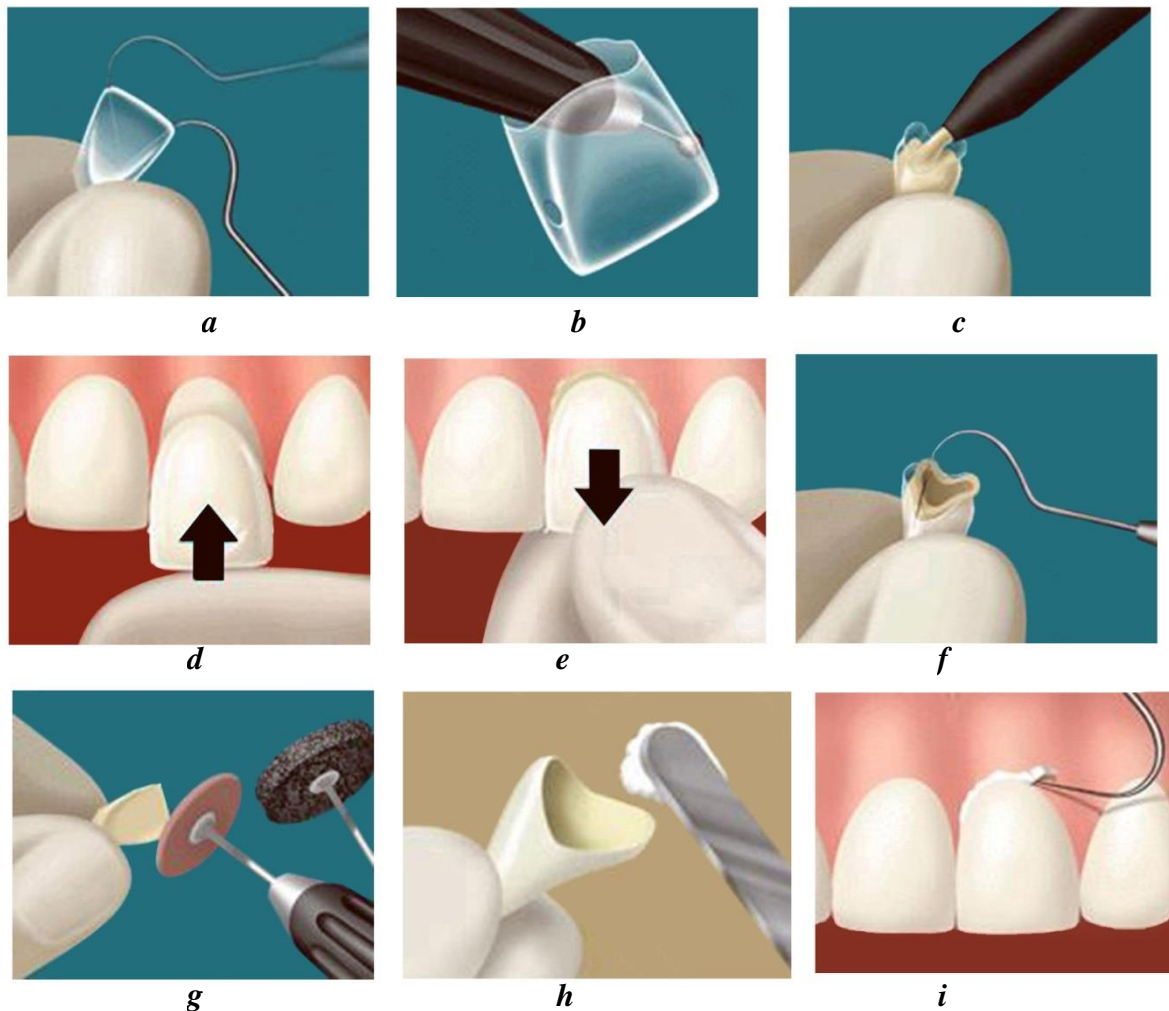


Fig. 18. Sequence of provisional crown fabrication with the use of celluloid caps

Provisional bridges fabrication with the help of impressions

In the cases when the tooth is absent, convenient use of silicone or alginate impressions as a matrix is impossible. We rebuilt the dental row with artificial tooth and wax up (mock up) (fig. 19).

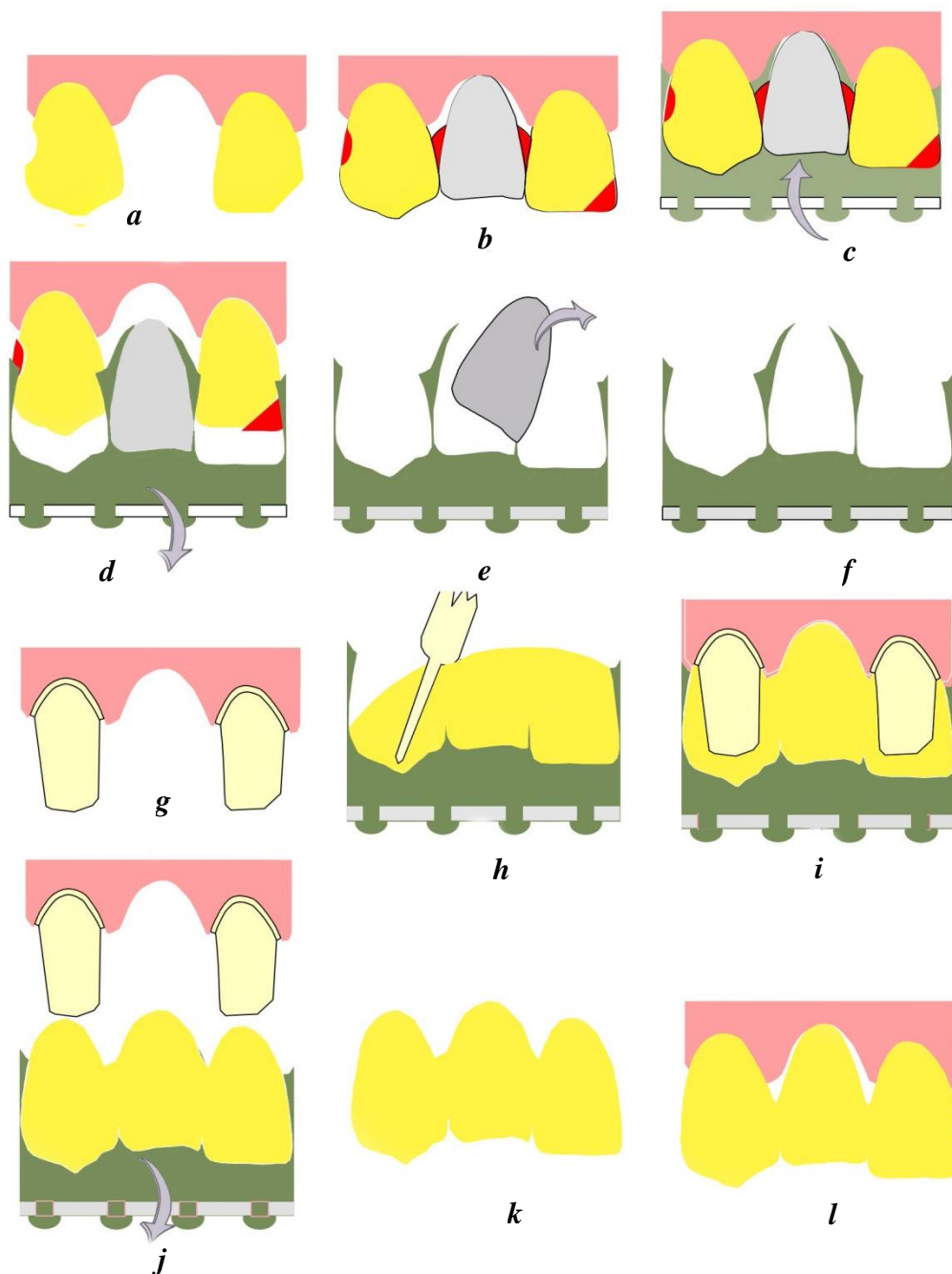


Fig. 19. Matrix technology sequence of provisional crown fabrication, using mock up and artificial tooth for reconstructing dental row:

a — defect of a tooth row, *b* — artificial tooth reproduced in wax (wax up), *c* — impression, *d* — recovery of impression, *e* — removal of artificial tooth, *f* — matrix, *g* — preparation of teeth, *h* — filling of matrix with polymer material, *i* — introduction into the oral cavity for the working time recommended by manufacturer, *j* — recovery of the construction, *k* — separating the provisional (mock up) from the matrix, *l* — temporary fixation

Chair-side fabrication of provisional bridge-like dentures differs from the previous technologies of provisional crowns fabrication by its further requirement of space for the constructional material in the intermediate part of the bridge. For this purpose, before teeth preparation a master and auxiliary impressions are received, stone models are cast and set in central occlusion (fig. 20, *a*). Then on the stone model artificial teeth are modelled in wax (fig. 20, *b, c*). After modelling works an impression of stone model is made (fig. 20, *d*). After teeth preparation doctor uses the impression as a matrix for manufacturing provisional denture by the above-mentioned technology (fig. 20, *e*). Finishing, polishing and temporary fixation complete the work (fig. 20, *f*).

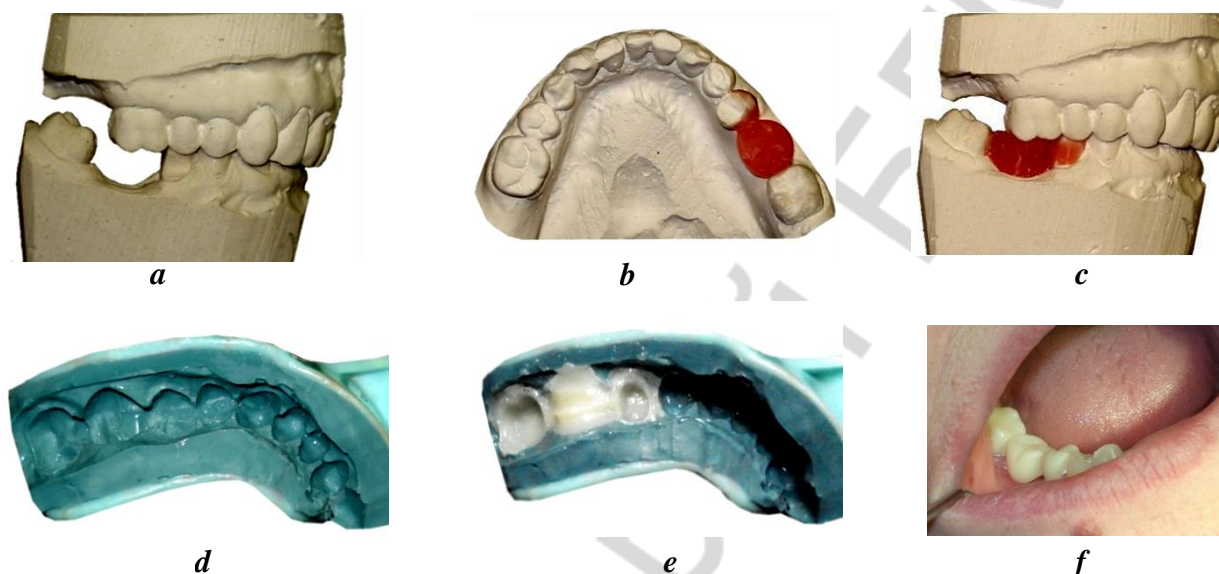


Fig. 20. Manufacturing provisional bridge denture supported by 4.5 and 4.7 abutment teeth: *a* — stone models, received before teeth preparation, fixed in central occlusion; *b* — modelling of artificial tooth 4.6 (occlusal aspect); *c* — modelling of artificial tooth 4.6 (vestibular aspect); *d* — silicone impression of a stone model after modelling works; *e* — provisional bridge denture in the silicone impression, manufactured after teeth preparation with the help of composite resin Protentp™ 4 Garant™ (3M ESPE, Germany); *f* — provisional denture supported by 4.5 and 4.7 abutment teeth, fixed temporarily in the oral cavity

Elimination of teeth alignment defect on stone model may be done by arrangement of artificial teeth from standard plastic sets (fig. 21).

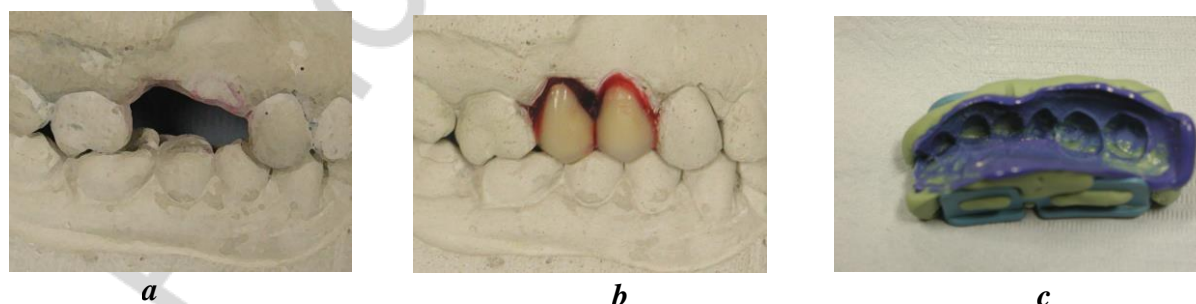


Fig. 21. Preparing of stone model for fabrication of provisional bridge supported by 1.6 and 1.3: *a* — stone models, set in the position of central occlusion; *b* — arrangement of artificial plastic teeth; *c* — silicone impression of the stone model, used afterwards as a matrix for making provisional bridge denture

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