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Improved method of complete removable laminar dentures manufacturing for the prosthodontic treatment of patients with completely absent dentition

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Keywords

complete removable laminar dentures, completely absent dentition, prosthetic plane, prosthodontic treatment

Conflict of interest

Konflikt interesów

None

Brak konfliktu interesów

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Summary

A device for the formation of a prosthetic plane of the upper jaw check-bite in the course of the prosthodontic treatment of the patients with completely absent dentition was developed in order to improve the formation of the prosthetic plane during complete removable laminar dentures manufacturing.

The objective was achieved by the fact that the bite plate of the device was made in the form of U-shaped supporting ruler with a fork-like extension on both sides and with a pocket in the central part. The bite plates for the frontal and chewing parts of the upper jaw check-bite were inserted into the pocket. The bite plates were made removable, the frontal plate was T-shaped, and the chewing one was fork-like with rounded forks. The device was additionally equipped with a movable ruler to record strict parallel alignment in relation to the Camper and inter-pupillary lines. The supporting ruler was equipped with two vertical columns of square shape with symmetric millimeter scales, along which the vertical movements of the movable ruler were conducted and its parallel alignment was recorded in relation to the supporting ruler. The movable ruler was additionally equipped with a leveling device fixed in its central part to position the patient's head relative to the horizon line.

The use of bite plates for the frontal and chewing parts of the upper jaw check-bite and the provision of structural elements in the form of the supporting and movable rulers with the possibility of moving the movable ruler on the vertical columns of the supporting ruler provide a fast, comfortable, precise and uniform formation of the prosthetic plane of the upper jaw check-bite parallel to the Camper and inter-pupillary lines in the prosthodontic treatment of the patients with completely absent dentition.

INTRODUCTION

One of the main directions of modern dentistry development is an increase in the effectiveness of the prosthodontic treatment of dental patients, including the ones with completely absent dentition (1, 2). However, neither preventive measures nor the development of new materials, nor the improvement of existing methods and approaches to the treatment have reduced the percentage of the population requiring primary or repeated prosthodontic treatment (3, 4). All this permits the search for new methods of improving the technology of complete removable laminar dentures (CRLD) manufacturing (5, 6). Designing dentitions in CRLD, the prosthetic plane is the main reference point. The correct determination of the prosthetic plane placement affects CRLD fixation and their stabilization in the oral cavity. Generally, the prosthetic plane is defined by a method that involves its formation on check-bites along the Camper and inter-pupillary lines. The correctness of the prosthetic plane along the Camper and inter-pupillary lines is most often controlled by Larin's apparatus (7) or by students' rulers (8). However, the accuracy is lacking when using students' rulers to determine the prosthetic plane, since it is impossible to put the ruler

accurately on the nasal line through the volumetric and prominent facial shape, and the inspection is performed alternately on each side. Parallel alignment is assessed visually which does not guarantee the parallel alignment of the prosthetic plane in relation to the Camper and inter-pupillary lines (9). The method of the prosthetic plane determination on the tomographic image of edentulous jaws is also known. This method involves the formation of a prosthetic plane of the upper check-bite parallel to the Camper and inter-pupillary lines using students' rulers, adjusting the lower check-bite to the upper one, applying of an X-ray contrast medium, obtaining computed tomography scans of edentulous jaws, contacting of the formed surface of the check-bite (10). This method has several disadvantages: a) the accuracy of the Camper line location can only be determined after obtaining computed tomography scans allowing for mistakes at the early stage and requiring to be repeated; b) the using of such expensive method repeatedly exposes patients to additional radiation and takes a long time (11). The method of the prosthetic plane formation using a laser parallelometer is also known. It involves the projection of a prosthetic plane on a check-bite of the upper jaw parallel to the Camper

line, the beam of the immobile fixed to the holder laser module providing lines is guided to the base of wing of nose or along the nasal line and thus the Camper line is formed, and the beam of the mobile module is directed to the previously obtained height of the check-bite and the projection of the prosthetic plane in the frontal area is determined on it (9). The disadvantages of this method lie in the fact that its use involves the presence of a laser parallelometer by which the projection of the laser lines is marked on the check-bite of the upper jaw with a dental spatula, the check-bite is cut off to the level of the laser lines and, thus, imperfections are possible since the prosthetic plane is formed visually (11).

AIM

The objective of the research was to improve the method of formation of the prosthetic plane of the upper jaw check-bite during CRLD manufacturing in the course of the prosthodontic treatment of the patients with completely absent dentition.

MATERIAL AND METHODS

In order to achieve the objective, we have developed a device for the formation of a prosthetic plane of the upper jaw check-bite in the course of the prosthodontic treatment of the patients with completely absent dentition (12).

The device for the formation of a prosthetic plane of the upper jaw check-bite in the course of the prosthodontic treatment of the patients with completely absent dentition (fig. 1-4) consists of:

- 1 – the supporting part,
- 2 – the pocket in the central part of the supporting ruler,
- 3 – the bite plate for the frontal part of the upper jaw check-bite,
- 4 – the bite plate for the chewing part of the upper jaw check-bite,
- 5 – a movable ruler to record strict parallel alignment in relation to the Camper and inter-pupillary lines,

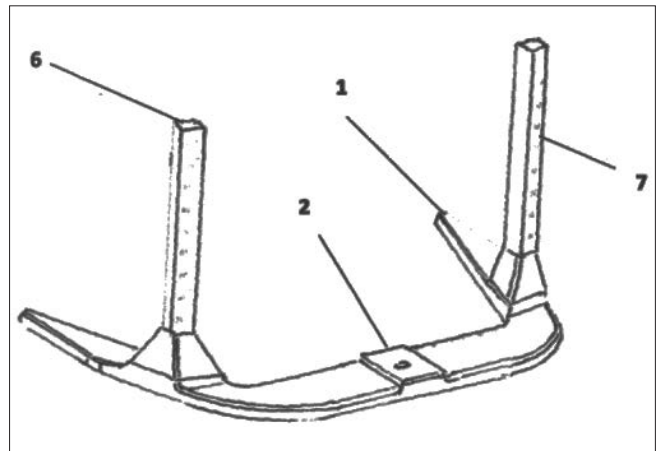


Fig. 2. The supporting ruler (a fragment of the device for the formation of a prosthetic plane of the upper jaw check-bite in the course of the prosthodontic treatment of the patients with completely absent dentition)

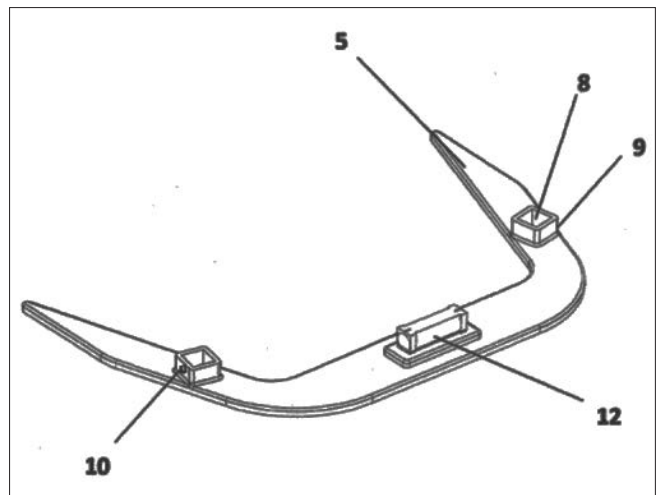


Fig. 3. A movable ruler (a fragment of the device for the formation of a prosthetic plane of the upper jaw check-bite in the course of the prosthodontic treatment of the patients with completely absent dentition)

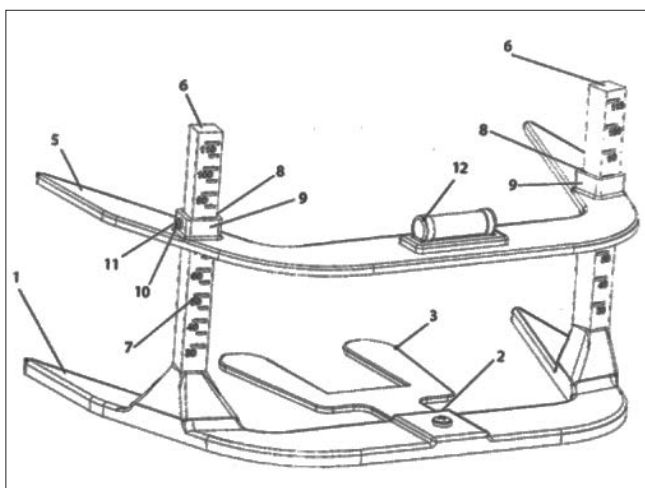


Fig. 1. The device for the formation of a prosthetic plane of the upper jaw check-bite in the course of the prosthodontic treatment of the patients with completely absent dentition assembled with a removable bite plate for the chewing part of the check-bite

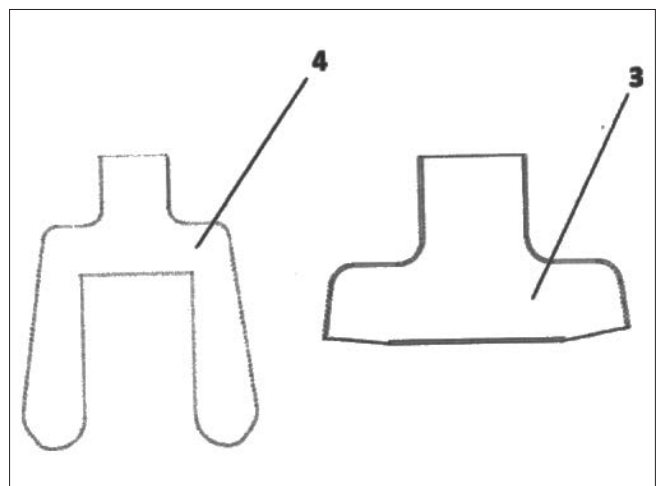


Fig. 4. Removable bite plate for the frontal and chewing parts of the check-bite (a fragment of the device for the formation of a prosthetic plane of the upper jaw check-bite in the course of the prosthodontic treatment of the patients with completely absent dentition)

- 6 – two square columns which are fixed and perpendicular on the fork-like extensions of the supporting ruler,
- 7 – symmetrical millimeter scales drawn on the square columns,
- 8 – two openings in a movable ruler similar to those of the square columns,
- 9 – two extension-projections of square openings,
- 10 – two round openings with the internal thread on the external walls of the extension-projections,
- 11 – two screws twisted into the round openings of the extension-projections to fix the parallel alignment,
- 12 – a leveling device fixed in the central part of the movable part of the ruler.

The device for the formation of a prosthetic plane of the upper jaw check-bite in the course of the prosthodontic treatment of the patients with completely absent dentition, as an example, was made of biocompatible polymer (ABS plastic or nylon) according to the method of rapid prototyping. However, any biocompatible material of suitable hardness able to be sterilized may be used for the manufacture. In our work we used 2% solution of disinfectant ID 212 with 60 minutes exposure for sterilization (1).

RESULTS AND DISCUSSION

During the prosthodontic treatment of the patients with completely absent dentition, the proposed device was used to form the frontal part of the prosthetic plane of the upper jaw check-bite. For this purpose, the bite plate for the frontal part 3 was inserted into the pocket 2 of the supporting ruler 1 and placed to the frontal part of the occlusal surface of the check-bite. The bite plate 3 was placed in the patient's mouth on the upper jaw and the parallel alignment of the prosthetic plane was checked with a movable ruler 5 to register parallel alignment in relation to the inter-pupillary line. The parallel alignment fixed with the screws 11 and visually controlled with the millimeter scales 7 indicated the correct formation of the frontal prosthetic plane. If the parallel alignment was not detected, it was created by removing or adding wax to the check-bite. Then, in order to form the chewing part of the prosthetic plane of the upper jaw check-bite, the bite plate 3 was removed from the device and the bite plate for the chewing part 4 was placed into the pocket 2 and put to the chewing part of the check-bite which was placed in the patient's oral cavity on the upper jaw, and the parallel alignment was checked with the movable ruler 5 to register the parallel alignment in relation to the Camper line. A leveling device 12 was used to position the patient's head relative to the horizon line (fig. 5, 6).

The objective of improving the method of forming the prosthetic plane of the upper jaw check-bite during CRLD manufacture was achieved by the fact that the bite plate of the device was made in the form of U-shaped supporting line with a fork-like extension on both sides and with a pocket in the central part. The bite plates for the frontal and chewing parts of the upper jaw check-bite were inserted into the pocket. The bite plates were made removable, the frontal plate

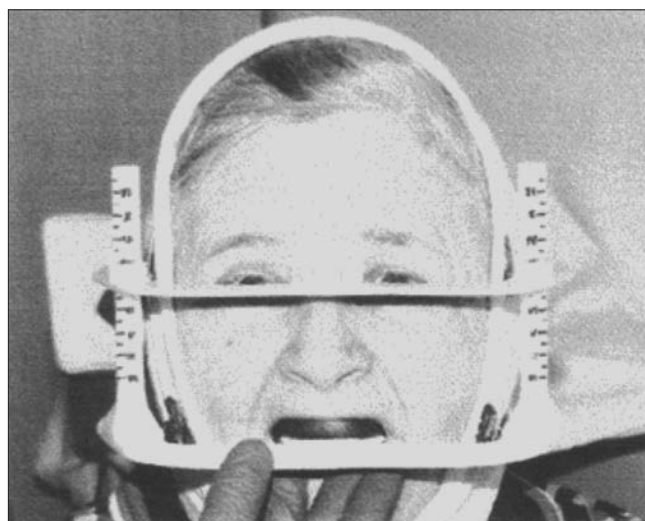


Fig. 5. The formation of the prosthetic plane of the check-bite in the process of parallel alignment recording in relation to the inter-pupillary line in the patient N., 74 years of age

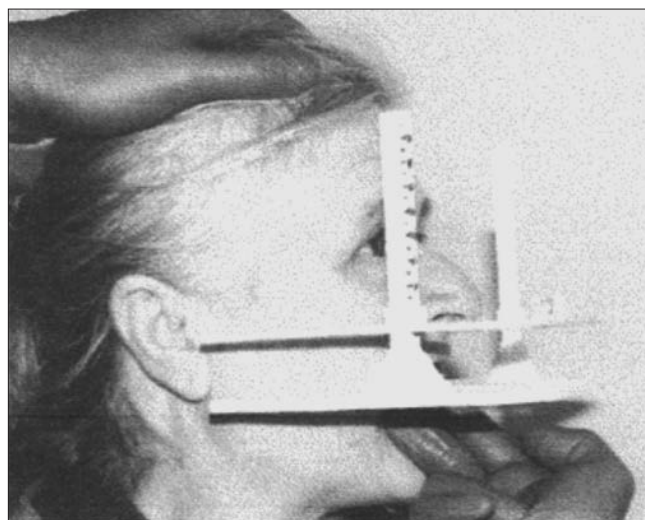


Fig. 6. The formation of the prosthetic plane of the check-bite in the process of parallel alignment recording in relation to the Camper line in the patient N., 74 years of age

was T-shaped, and the chewing one was fork-like with rounded forks.

The device was additionally equipped with a movable ruler to record strict parallel alignment in relation to the Camper and inter-pupillary lines, the ruler was U-shaped similar to the supporting ruler with a fork-like extension on both sides, however, the supporting ruler was equipped with two vertical columns of square shape. The columns were fixed and perpendicular to the ruler on its lateral fork-like extensions, parallel to each other, and had symmetric millimeter scales, along which the vertical movements of the movable ruler were conducted. The parallel alignment of the movable ruler was formed and recorded in relation to the supporting one, for that purpose two openings of the same (square) shape as the columns were made in the movable ruler for its movement along columns and adjustment of the device to the individual size of the patient's face. The square openings had square extension-projections

the external walls of which had round openings with the internal thread with twisted in screws to fix the parallel alignment. The movable ruler was additionally equipped with a leveling device fixed in its central part to position the patient's head relative to the horizon line.

Currently, the most rational technical solution to the parallel alignment of the prosthetic plane is the Larin's apparatus (7). It consists of an internal occlusal plate with a handle and a carriage with external bars which are parallel to the occlusal plate and have pointers of the ear and nose points providing an opportunity to install the external bars along the Camper line. However, the formation of the prosthetic plane using the Larin's apparatus requires a lot of time (the deformation of the check-bite base plate occurs when pressing on the heated check-bite and thus errors are possible during a prosthetic plane formation requiring multiple repetition of these manipulations). The Larin's apparatus does not provide an opportunity to account for the ratio of the occlusal surface of the upper check-bite in the frontal part relative to the inter-pupillary line during the prosthetic plane formation. This narrows the limits of its practical use in the prosthodontic treatment of the patients with completely absent dentition (14). In addition, when forming a prosthetic plane on the frontal area with the use of the Larin's apparatus, inaccuracies are possible due to the fact that the prosthetic plane is deflected upwards from the plane formed at the level of the inter-pupillary line by an average of 5.2° on the right and 5.9° on the left (11).

CONCLUSIONS

The use of bite plates for the frontal and chewing parts of the upper jaw check-bite and the provision

of structural elements in the form of the supporting and movable rulers with the possibility of moving the movable ruler on the vertical columns of the supporting ruler provide a fast, comfortable, precise and uniform formation of the prosthetic plane of the upper jaw check-bite parallel to the Camper and inter-pupillary lines in the prosthodontic treatment of the patients with completely absent dentition and adjustment of the proposed device to the individual patient's facial dimensions. Moreover, millimeter scales on the columns facilitate the provision of parallel alignment and a leveling device of the movable ruler promotes the positioning of the patient's head relative to the horizon line.

The device developed by us for the formation of a prosthetic plane of the upper jaw check-bite in the course of the prosthodontic treatment of patients with completely absent dentition provides an opportunity to improve the quality of their prosthodontic treatment, namely to improve the stabilization and to increase the functional efficiency of CRLD.

PROSPECTS FOR FURTHER RESEARCH

One of the important stages of CRLD manufacturing for the prosthodontic treatment of patients with completely absent dentition is to determine the occlusal vertical dimension. We consider further improvement of the proposed device with additional elements in it allowing determination of the occlusal vertical dimension to be promising. In particular, we consider the use of the parts of the Goeringer compass as additional elements to be promising.

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