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STUDY REGARDING THE TECHNOLOGIES FOR COMPLETE DENTURES REALIZATION

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Abstract

The materials frequently used for partial and full dentures are represented by acrylic resins, offering to those prosthetic constructions sufficient strength and a proper aesthetic appearance.

The question that arises related to the practical aspects is whether conventional technologies remain the method of choice for getting full dentures and whether digital technologies can be implemented to obtain these prosthetic constructions.

In recent years, CAD / CAM technologies for complete dentures realization became better known and more available, working flow and materials becoming more efficient, allowing to gain prosthetic constructions that satisfy the highest functional requirements. These procedures offer significant benefits to the dentist, dental technician and also to the patients.

The present study analyzes the opinion of dental technicians regarding these modern methods of getting mobile prostheses and notice the percent of use of the digital technologies into the dental laboratories.

Keywords: full denture, conventional technologies, digital technologies

INTRODUCTIONS

Complete edentulous therapy continues to concern specialists everywhere, being considered as a domain of particular difficulty, because it is not limited to the design and fabrication of a full denture, because it is related to one of the most complex pathology, generating imbalances of all the elements of the dento-maxillary system [1]. The installation of a full edentulism should be seen as the beginning of an involution process of disturbing the physiological balance, generated by the constant depreciation of the anatomical structures of the whole body, with implications on the stomatognathic system, which can trigger permanent stresses, that places the elderly, in a state of psycho-somatic lability [2].

An important role in the satisfaction of the patients wearing a removable denture has the realization of a prosthetic construction that adapts perfectly to the oral cavity and completely restores the altered functions; also, a balance must always be maintained between the patient's wishes and the objective possibilities of the clinical situation [3].

In order to obtain removable prosthesis that satisfies all these requirements, the material has to be very carefully chosen; the resin must sum up a series of characteristics: to have a color close to the oral tissues and a translucency that allows the optimal reproduction of the physiognomic function, not to change color over time, to present volumetric stability, not to alter its shape during mechanical processing or in the oral environment, to have an elasticity and abrasion resistance adequate to any demands in the oral cavity, to be waterproof for fluids in the oral cavity, to have a smooth and glossy surface, which does not allow the adhesion of food fragments or bacterial plaque and it should be easy to clean; also the material must have a low density, a low thermal conductivity, and it must not undergo volumetric variations during temperature variations. [4].

The materials frequently used for partial and full dentures are acrylic resins, offering to those prosthetic constructions sufficient strength and a proper aesthetic appearance.

The question that arises is whether conventional technologies remain the method of choice for making full dentures and whether digital technologies can be implemented in order to realize these prosthetic constructions.

Making a complete denture involves a large number of clinical and technological steps, and digital methods have the advantage of greatly reducing the workflow. On the other hand, the costs of such a technological line are still very high and many technicians do not consider it an profitable investment purchase of equipment to realize removable prostheses, by additive or subtractive methods [5].

In recent years, CAD / CAM technologies for the complete dentures realization became better known and more available, methods and materials being efficiently, creating prosthetic constructions that satisfy the highest functional requirements. These procedures offer significant benefits to the dentist, dental technician and also to patients.

Complete dentures are one main choice for edentulous patients. The demand for complete dentures will increase completely over the next few decades. Moreover, as noticed in many scientific articles, edentulism is a serious public health problem in the industrialized countries due to population aging and also in developed countries due to poor oral health care of the people. It was nearly after 80 years, the methods and protocols were changed to fabricate complete dentures and gingival retraction should be taken into account [6,7].

Full dentures are not technologically difficult to get, but involve a large number of clinical and technological steps, so there is an increased risk of errors. With the development of digital technologies, subtractive and additive methods, the

working flow was considerably reduced and the precision of the prosthetic devices was significantly increased. The introduction of computer-aided design/computer-aided manufacturing (CAD/CAM) technology into complete denture (CD) fabrication ushered in to a new era in removable prosthodontics. Commercially available CAD/CAM denture systems are expected to improve upon the disadvantages associated with conventional fabrication [8].

The present study analyzes the opinion of dental technicians regarding these modern methods of making mobile prostheses and follows the proportion in which laboratories use digital technologies. Conventional technologies are using two types of resins, heat-curing and self-curing materials with specific advantages and disadvantages. Therefore, it is very important for the dental technician to know the particularities, advantages and disadvantages of the materials and technologies present on the market, in order to choose the optimal therapeutic solution for each clinical situation.

MATERIALS AND METHODS

In order to analyze the methods used in to the dental laboratory for realizing full dentures, an original questionnaire was used, with 10 questions, which was distributed to 92 technicians, aged between 24 and 49, working in private dental laboratories.

Table I The questionnaire for the dental technicians

	Question		
1.	**For the realization of full dentures, you use in the laboratory exclusively conventional technologies?**		
	Yes	**No**	**I don't know**
2.	**For making full dentures, you use mainly digital technologies**		
	Yes	**No**	**I don't know**
3.	**If you use conventional methods do you prefer HCR?**		
	Yes	**No**	**I don't know**
4.	**If you use conventional methods do you prefer SCR?**		
	Yes	**No**	**I don't know**
5.	**Do you think that the technology that uses SCR is superior to the one that uses HCR?**		
	Yes	**No**	**I don't know**

6.	**Do you appreciate that complete dentures made of SCR have better longevity over time?** **Yes** **No** **I don't know**
7	**Do you think that SCR should only be used for temporary prostheses?** **Yes** **No** **I don't know**
8.	**Do you think that prostheses made by conventional methods have a better adaptation compared to total prostheses made by digital methods?** **Yes** **No** **I don't know**
9.	**Do you consider that, for complete dentures, additive digital technologies are superior to subtractive technologies?** **Yes** **No** **I don't know**
10.	**Do you think that laboratories should purchase software for making full dentures using digital methods?** **Yes** **No** **I don't know**

74 respondents (80.43%) completed the questionnaire and expressed their opinions on the materials used in to the laboratory for doing complete dentures, as well as their opinions on the effectiveness of conventional and modern methods of making these mobile prostheses.

RESULT AND DISCUSSIONS

Following the answers to the first and second questions, it is a clear the preference of dental technicians for the use of conventional methods (90.54%) of performing full dentures (fig.1).

Even though digital technologies reduce a lot the workflow, the relatively high costs of equipment and the need for additional training of technicians, make these modern methods not preferred in current practice.

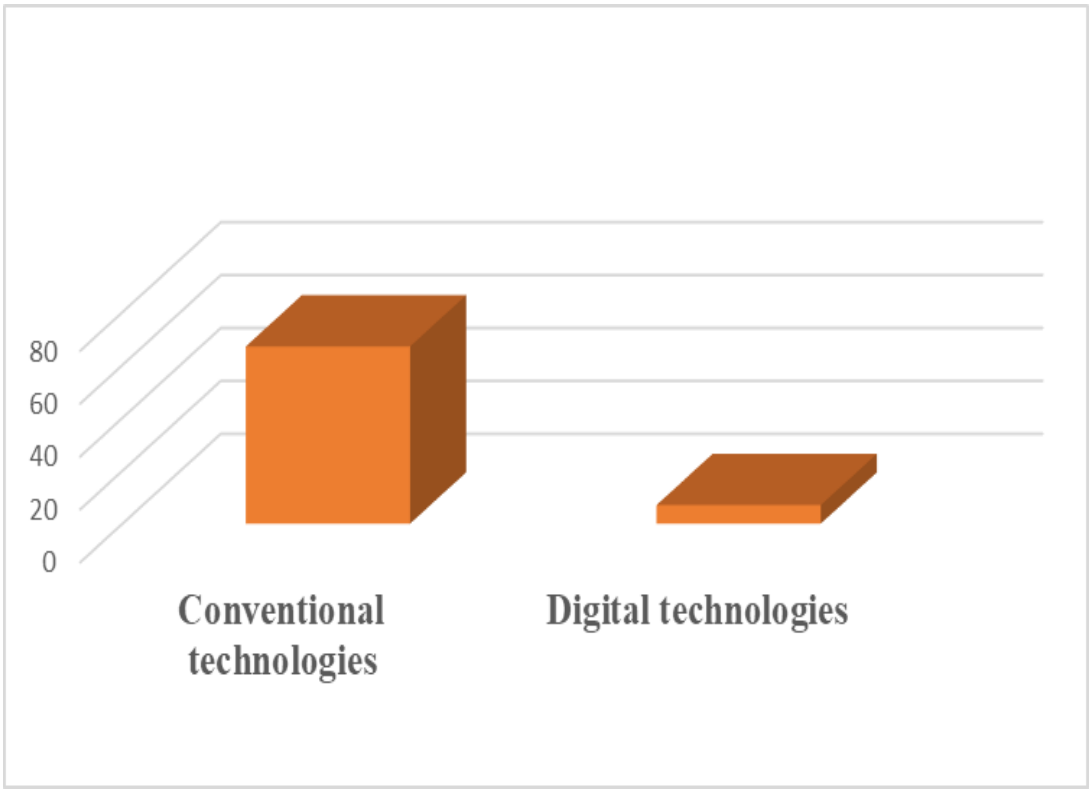

Fig.1 Technological methods for full dentures realization

Within conventional technologies, 52 respondents (70.28%) prefer heat-curing resins for removable dentures and only 22 technicians (29.73%) use self-curing acrylic resins (fig.2).

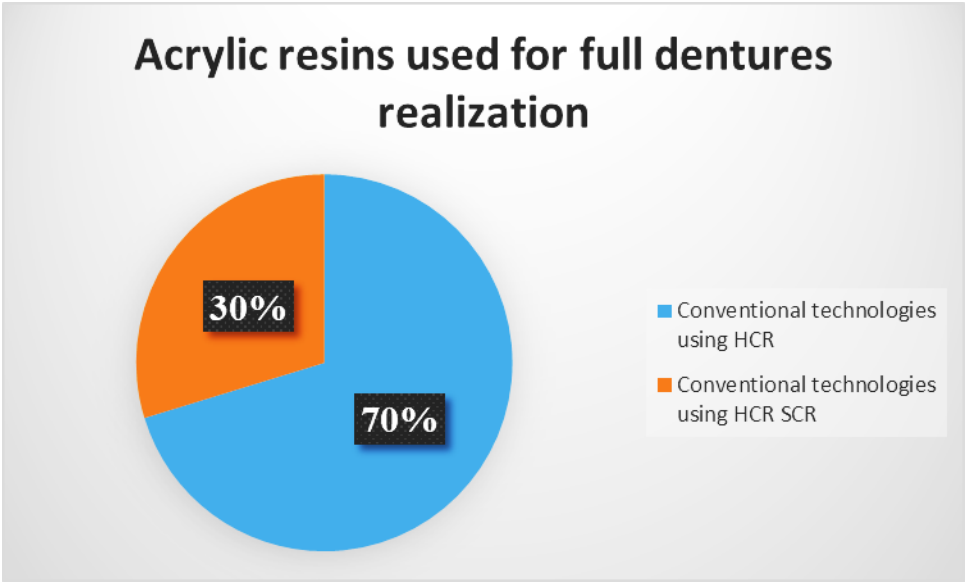

Fig.2 Acrylic resins used in conventional methods

In recent years, several types of self-curing acrylic resins have appeared, presenting optimized mechanical parameters and being used in the technology of removable prostheses. Dental technicians who answered to our questionnaire considered, in proportion of 81.08% (60 respondents) that heat-curing resins are the better choice for these type of prosthetic devices and only 18.92% (14 respondents) believed that self-curing resins are indicated for full dentures (fig.3).

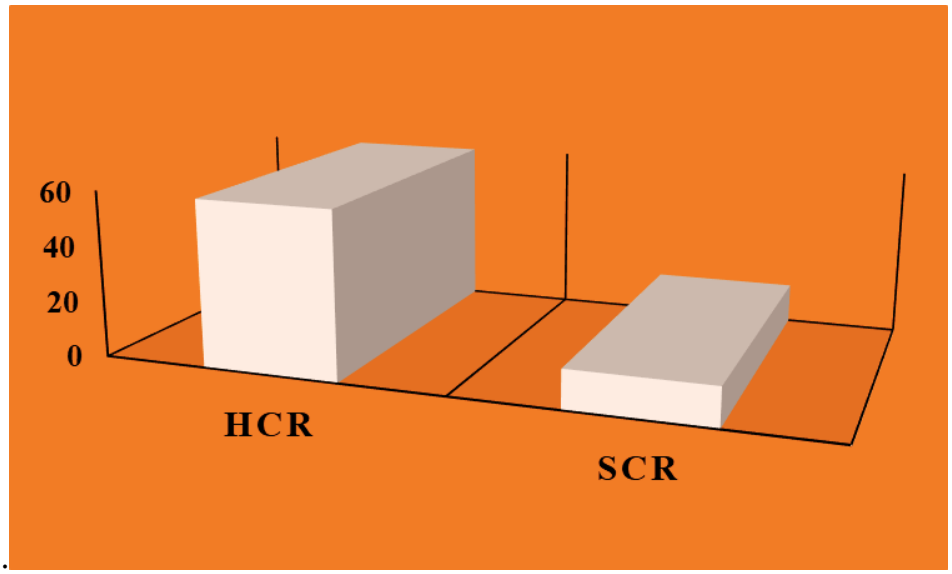

Fig.3 Opinions on use SCR utilization for full dentures realization

Only 7% of respondents (69) believe that self-curing resins have a good longevity over time compared to heat-curing resins (fig.4)

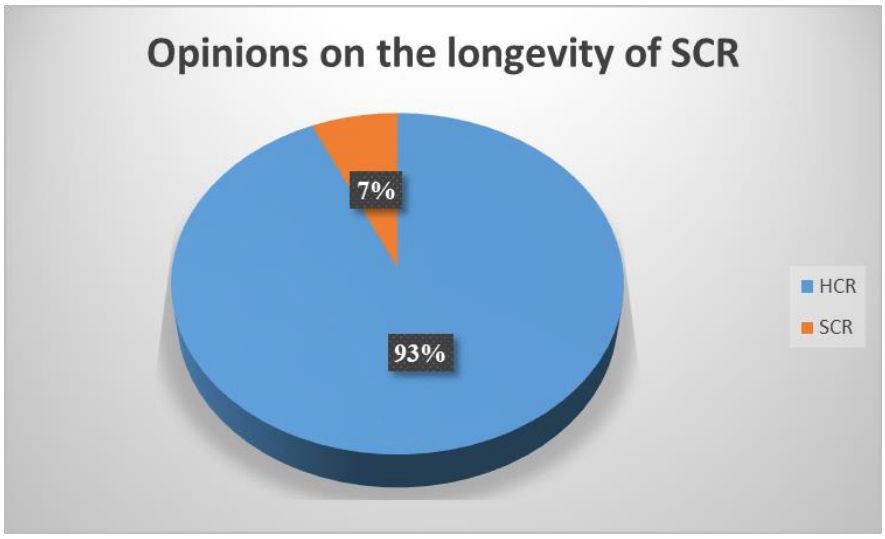

Fig.4 Longevity of self-curing and heat-curing resins

Researchers in the dental materials field show that self-curing materials have a higher porosity compared to materials polymerized by other methods, therefore, recommend self-curing resins for temporary prostheses. Technicians who answered this question agreed in percent of 79.73% (59 respondents) that self-curing resins should be used exclusively for temporary restorations (fig.5).

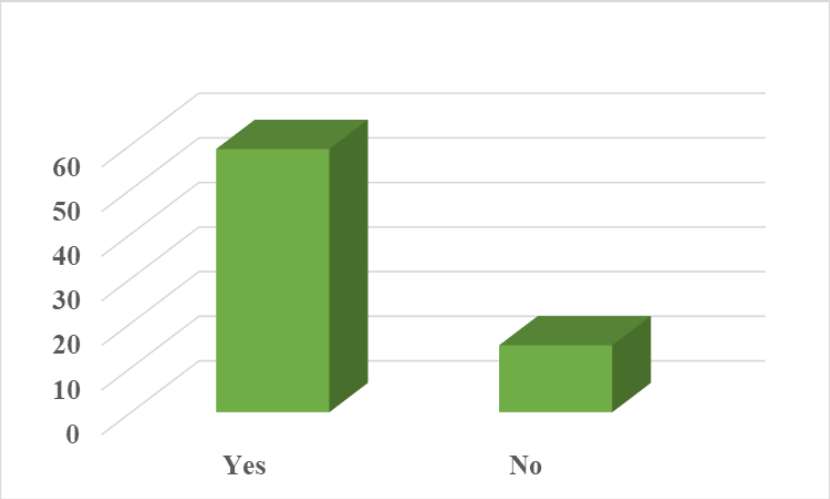

Fig.5 Opinion on the SCR utilization for temporary restoration

Nowadays there are very few studies to compare the adaptation of CAD-CAM and conventional dentures. Some experts believe that digital complete dentures have a perfect marginal fit, while others notice that the stability and fit of digital dentures is poor. 73% of the dental technicians (54 respondents) noticed that the conventional dentures are better fitted on the prosthetic area in comparison to the computerized dentures (fig.6).

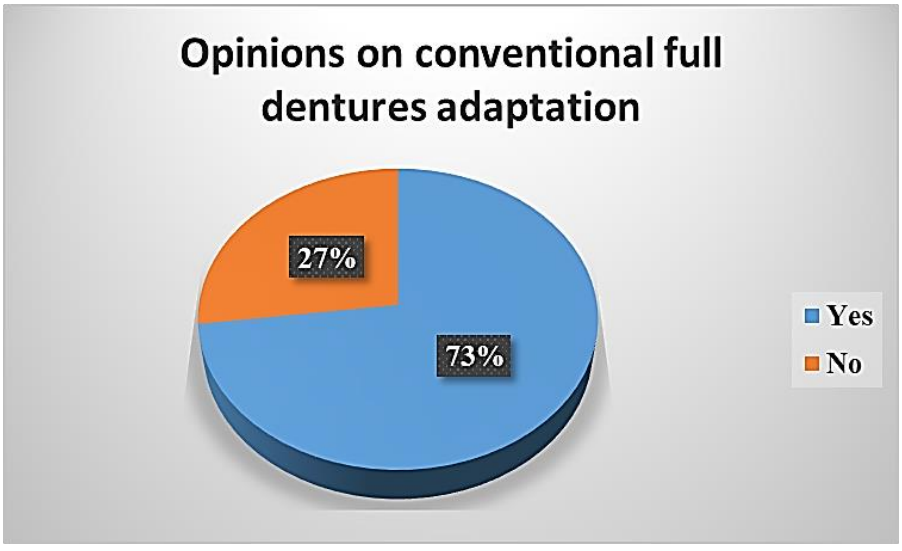

Fig.6 Opinions on the marginal adaptation of prostheses made by conventional and digital methods

Digital technologies used to obtain dental prosthesis can be represented by subtractive or additive methods. Subtractive technologies involve the use of resin discs that will be milled, based on the information received from the CAD component, getting the elements of the full denture.

Additive technologies involve a superposition of the material, layer by layer, to the goal of the complete edification of the prosthesis morphology These methods conduct to prosthetic construction with complex spatial geometry and very compact internal structure. The technicians who use the digital methods in to the laboratory answered in this questionnaire, in proportion of 81.08% (60 respondents) that the additive methods are superior to the subtractive ones and allow to obtain more precise prostheses (fig.7).

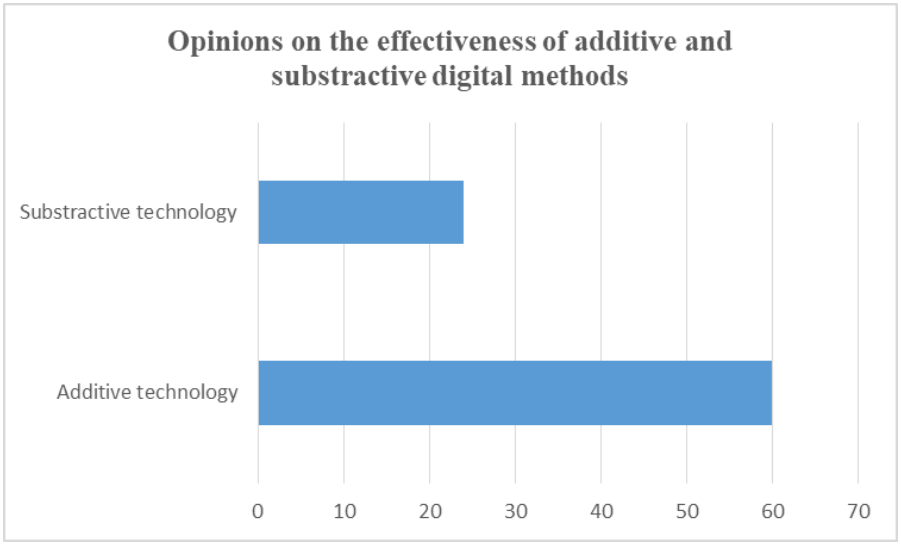

Fig.7 Opinions on the effectiveness of additive and subtractive digital methods

57% of technicians (44 respondents) stated that, despite the advantages, it is not justified to introduce digital systems for removable full dentures realization in the dental laboratory (fig.8).

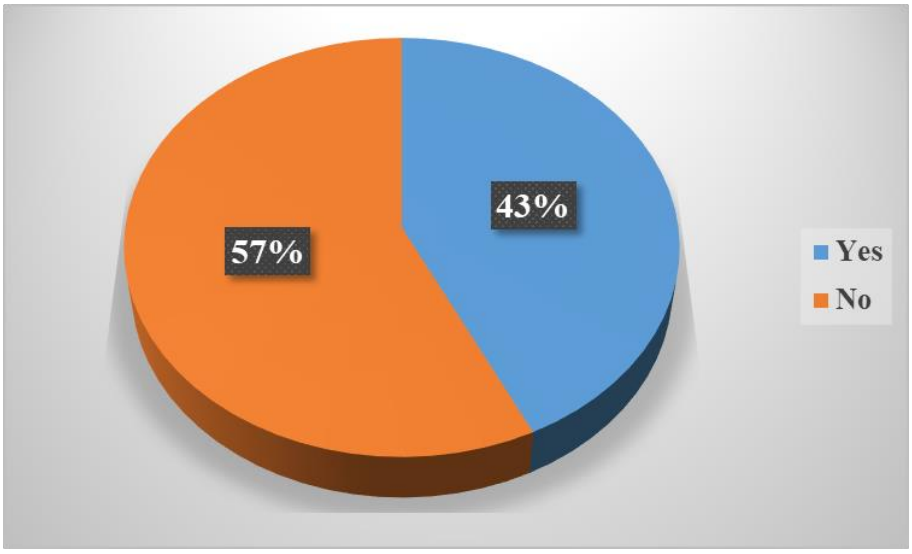

Fig.8 Opinions regarding the usefulness of acquiring CAD-CAM systems for complete denture realization

The conventional technology of full dentures realization involves a multitude of laboratory stages, during which errors can occur; a mistake during a technological step is transmitted and amplified in the next step that can eventually lead to an incorrect adaptation of the denture on the prosthetic area, incorrect occlusal contacts or reduced mechanical strength. Researches had also shown that conventional acrylic resins, based on methyl polymethacrylate, in addition to the many advantages, are characterized by a sum of disadvantages.

Therefore, new materials emerged and technologies evolved and diversified. Systems for injecting the resin into the mold became increasingly popular in practice, the method presenting several advantages in comparison to the manual introduction of acrylate.

Currently, full dentures can also be made in new generation self-curing resins, with cold polymerization, on temperatures lower than 60°C (Palapress, PalaXpress, Palapress Vario/Kulzer) that have comparable or even superior properties in comparison to heat curing ones: chromatic stability over time, resistance to bending, shock and better elasticity. They can be molded by pressing and injection.

Digital systems are also used to make total mobile prostheses. Computer Aided Design / Computer Aided Manufacturing (CAD-CAM) methods have the advantage of eliminating a lot of laboratory steps and reducing the cost and the risk of errors, offering benefits to the patient and dental team. [9].

CAD / CAM technologies follow three important steps: data acquisition, by using intraoral scanners or by scanning a plaster model poured into a conventional impression, designing the virtual prosthetic construction and digital realization of the prosthesis, using new generation materials.

The resins used in digital technologies are industrially produced, have a high impact and distortion resistance, color and dimensional stability. The pre-polymerized acrylic resin is produced under high pressure and heat and no polymerization shrinkage occurs, the porosity is reduced and the microbial adhesion to the base of the prosthesis is low. The lack of polymerization contraction associated with these types of prostheses results in a very precise adaptation of the prosthesis and optimal maintenance and stability.

Not only the base of the prosthesis can be made by digital methods, but also artificial teeth, being able to obtain artificial arches with a superior morphology, strength and aesthetics [10,11].

Some methods realize the base, saddles and arch artificially in one step, while other technologies recommend to fabricate the base and saddles in to the same step and the artificial teeth into the next one, the elements being assembled in one subsequent step.

Additive technologies represent another possibility of making total prostheses by computerized methods, producing prosthetic construction with complex spatial geometry and high compact internal structure [12].

In the manufacturing process by using additive method the prosthesis will be made by superimposing the material layer by layer, until the complete edification of the morphology. The main stages of prosthetic construction are: deposition of resin layers in the horizontal direction and their successive polymerization, in vertical orientation, removal of rods necessary to support the device during construction, removal of non-cured material and completion of prosthetic device. When the polymerization is completed, the prosthesis is finished and polished [13].

In the subsequent stage, the artificial teeth are fixed into the saddles using a light-curing resin. The 3D Printing method has several advantages compared to conventional technology: superior precision, superior reproduction of details, increased work efficiency (more prostheses can be done simultaneously), less material use and a shorter work-flow [14, 15].

The results show that dental technicians prefer conventional technologies and heat curing acrylic resins for complete dentures, even though digital methods offer a number of advantages that make it easier for practitioners to work.

CONCLUSIONS

The differences between digital and conventional technologies are much discussed by specialists, each method having undeniable advantages, but also disadvantages.

The conventional technology, using heat curing resins for complete dentures was the oldest and earliest techniques; with the presence on the market of the new materials, with improved properties, the tendency is to replace these classic methods with new and more advanced production systems.

Digital technologies, initially used to make crowns and dental bridges, began to be used for removable partial and full prostheses.

The main motivations for accepting or rejecting these technologies include the relative advantages they offer compared to the classical methods, and these can be represented by time saving

On the other hand, prostheses made using conventional methods have stood the test of time, demonstrating good mechanical behavior and satisfactory biocompatibility.

Our conclusions from this analysis notice that at this moment, for the manufacture of complete dentures, technicians prefer conventional methods, even if the working flow involves a large number of clinical and technological steps, and increased risk of errors.

CAD-CAM systems still have a high price and their purchase would increase the costs of prosthetic devices, complete dentures being usually therapeutic solutions addressed to elderly patients or patients with limited financial possibilities.

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