

THE EVALUATION OF TWO DIFFERENT METHODS OF ACRYLIC RESIN POLYMERIZATION

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ABSTRACT

Background. During the polymerization and processing procedures of heat-polymerization, polymethyl methacrylate shrinkage of acrylic resin has been noticed. The purpose of the study was to compare two methods of polymerization of acrylic resin: compression molding and injection molding technique.

Materials and methods. 167 patients who needed removable denture treatment were examined. Among them, the patients who met the inclusion criteria were selected to be part of our study. Two types of complete dentures were constructed: The first group of dentures was constructed with the compression molding technique, while the second group of dentures was constructed with the injection molding technique. The first group of dentures was delivered to the patients. They were left for a month, a period during which we made follow up visits each week. The same procedure was followed for the second group. At the end of the first month, the patients fulfilled a questionnaire, assessing OHRQoL. The answers were also clinically evaluated.

Result. The data were collected and the statistical valuation of the data was accomplished. Based on the result it was observed that there was a statistically significant improvement in OHRQoL regarding the dentures constructed with injection molding technique.

Conclusion. Within the limitation of this study, it can be concluded that the resin injection molding technique showed greater advantages compared to the compression molding technique.

Key words: Compression molding, injection molding, OHRQoL.

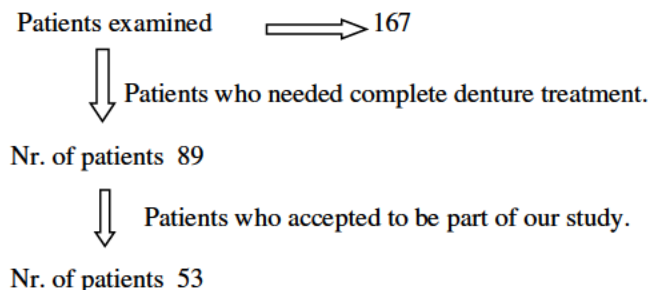
Introduction

Acrylic resin polymers are the materials of choice for denture base construction. They have many advantages such as good physical qualities, aesthetics, low toxicity¹⁻³. The process of resin compression molding is the traditional way of constructing dentures⁴⁻⁶. During this procedure, it has been observed resin shrinkage¹. Different materials have been used to reduce the dimensional change of the denture base during compression molding such as glass fibers, metal elements, etc.⁷. Different techniques have been used in the attempt of reducing resin shrinkage. One of these is the injection molding method. It was first presented in 1942, by Pryor^{8,9}. Nowadays there are several methods and materials used for the injection molding technique^{10,11}. This procedure has always attracted the researchers' attention, based on the data, a reduction of acrylic resin shrinkage has been documented¹². The purpose of our study was to compare the impact of two different processing techniques of complete dentures on the life quality of the patients.

Material and Methods

167 patients who needed removable denture treatment were examined. Among them, 89 patients were selected who needed complete denture treatment. Among them, 53 patients accepted to be part of our study (Chart Nr.1).

Chart Nr. 1



Two types of complete dentures were constructed: The first group of dentures was constructed with the compression molding technique, while the second group of dentures with the injection molding technique using vertex castavaria. The first impression was made with alginate. A

sectional border molding with Kerry wax was done. The final impression was made with Zinc Oxide Eugenol. The centric record was done based on the usual steps. Teeth set up was done based on the bilateral balanced occlusion concept. Anatomic teeth were selected for the trial stage. The try-in stage was realized. All these procedures were realized by the same clinician. The same steps, materials, and techniques were followed for both groups. In the first group, SR Triplex Hot resin was used for the compression molding technique. Polymer and monomer were mixed based on the manufactures instructions. For the construction of the second group of dentures, Vertex™ ThermoJect 22 was used to inject the resin.

The first group of dentures was delivered to the patients. They were left for a month, a period during which we made follow up visits each week. The same procedure was followed for the second group. At the end of the first month, the patients fulfilled a questionnaire about the impact of the dentures in their quality of life. The selected patients were informed about the study and written consent was taken.

Results

The data was collected and the evaluation of the data was accomplished. All patients fulfilled two questionnaires: one for the conventional technique of dentures, and the second for the injection molding technique. Based on the results, there was a significant difference between the group of the dentures processed with the injection molding and compression molding technique. In the injection molding group, over 85 % of the patients did not report any problem regarding Functional limitation, Physical disability, Physical pain, Psychological discomfort, Psychological disability, Social disability, and Handicap. In all the parameters, the values of the patients who had completed dentures with injection molding technique were statistically higher compared to the values of the patients who had complete dentures constructed with the compression molding technique. The results are shown in Table 1 and Table 2.

Discussion

In this study, we compared the conventional group of dentures with the dentures constructed with injection molding technique based on the OHRQoL. The conventional way is most used and it often serves as an etalon of comparison with other methods. The injection molding technique is characterized by injecting resin lay after lay, with heat under pressure. The space, which is created from the resin shrinkage during polymerization is compensated by the new resin, which is injected under pressure by compensating so dimensional change¹²⁻¹⁴. The Spanish validated version of the OHIP-14 questionnaire was used to assess the patients' quality of life.¹⁵ The full OHIP consists of 49 parameters that cover seven parameters: functional limitation, physical pain, psychologic discomfort, physical disability, psychologic disability, social disability, and handicap. Locker and Allen¹⁶ studied a version of 14 of the first 49 parameters, which can be practiced in any case where a simpler version is applicable. Answers were derived from the Likert sample, with 5 point answers from “never” (1) to “always” (5).¹⁷ Several studies have concluded about the advantages of injection molding technique compared to the traditional methods¹⁸⁻²². Most of them were used as a comparison parameter to the dimensional change of the denture base, where it demonstrated higher dimensional stability of the dentures constructed with the injection molding technique. In contrast with the previous studies, Garfunkel *et al.*²³ concluded that there was no significant advantage between this method and the traditional one. However, this study was published in 1952 before the introduction of newer injection molding systems. Anyway, no study was done in order to compare the injection molding technique and compression molding technique, based on the Oral Health-Related Quality of Life questionnaire.

Conclusion

Within the limitation of this study, we can conclude that the injection molding technique offers greater advantages compared to the compression molding technique. Future research is necessary regarding all parameters of these dentures, compared to CAD-CAM dentures.

Table 1: The results using OHIP-14 about the dentures constructed with the injection molding method
Results of Quality of Life Assessment Using the OHIP-14 Questionnaire (% of patients)
about the dentures constructed with the injection molding technique

| Items | Never | Rarely | Occasionally | Frequently | Always |
|-----------------------------|-------|--------|--------------|------------|--------|
| Problems with pronunciation | 88.6 | 11.4 | - | - | - |
| Bad sense of taste | 94.3 | 5.7 | - | - | - |

| | | | | | |
|--|------|------|---|---|---|
| Pain | 92.4 | 7.6 | - | - | - |
| Discomfort when eating | 84.9 | 15.1 | - | - | - |
| Concern for the mouth | 86.7 | 13.3 | - | - | - |
| Self-consciousness due to oral problems | 88.6 | 11.4 | - | - | - |
| Dissatisfaction with food intake | 92.4 | 7.6 | - | - | - |
| Interruption of meals | 88.6 | 11.4 | - | - | - |
| Difficulty relaxing due to denture problems | 84.9 | 15.1 | - | - | - |
| Embarrassment arising from oral problems | 94.3 | 5.7 | - | - | - |
| Irritability | 86.7 | 13.3 | - | - | - |
| Problems at work due to denture problems | 94.3 | 5.7 | - | - | - |
| Found life less satisfying due to denture problems | 84.9 | 15.1 | - | - | - |
| Complete inability to function | 92.4 | 7.6 | - | - | - |

Table 2:The results using OHIP-14 about the dentures constructed with compression molding method

| <i>Results of Quality of Life Assessment Using the OHIP-14 Questionnaire (% of patients) about dentures constructed with the compression molding technique.</i> | | | | | |
|---|-------|--------|--------------|------------|--------|
| Items | Never | Rarely | Occasionally | Frequently | Always |
| Problems with pronunciation | 52.8 | 24.5 | 22.6 | | |
| Bad sense of taste | 71.6 | 22.6 | 5.6 | - | - |
| Pain | 56.6 | 32.0 | 11.3 | - | - |
| Discomfort when eating | 37.7 | 37.7 | 24.6 | - | - |
| Concern for the mouth | 62.2 | 15.0 | 22.6 | - | - |
| Self-consciousness due to oral problems | 88.6 | 11.4 | - | - | - |
| Dissatisfaction with food intake | 54.7 | 22.6 | 22.6 | - | - |
| Interruption of meals | 52.8 | 24.5 | 22.6 | - | - |
| Difficulty relaxing due to denture problems | 66.0 | 43.3 | - | - | - |
| Embarrassment arising from oral problems | 56.6 | 11.3 | 32 | - | - |
| Irritability | 71.6 | 5.6 | 22.6 | - | - |
| Problems at work due to denture problems | 62.2 | 22.6 | 15 | - | - |
| Found life less satisfying due to denture problems | 56.6 | 32.0 | 11.3 | - | - |
| Complete inability to function | 54.7 | 22.6 | 22.6 | - | - |

Conflict of interest:

The authors declare that there is **no conflict of interest**.

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