

Removable Prosthodontics: Patient-Reported Treatment Outcomes in the University of Sydney Student Clinics

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Abstract

This pilot study aimed to assess the patient profile of the Removable Dental Prostheses clinics at the University of Sydney Faculty of Dentistry over four consecutive years. Additionally, patient satisfaction and prosthesis-use one year after construction and identify predictors of patient satisfaction were examined. Data across three domains (patient demographics, oral health status, and prosthesis information) was collected throughout prosthesis construction. A total of 92 patients were included (44 male and 48 female). The mean age was 69 years. 89% of patients had previous dentures. 25% of patients were current smokers and 23% smoked previously. At initial presentation, a mean Sulcus Bleeding Index of 27% and Approximal Plaque Index of 72% were found and the average number of remaining teeth was 9. 70 complete dental prostheses (CDPs) and 93 removable dental prostheses (RDPs) were constructed (58 cobalt-chrome RDPs and 35 acrylic RDPs) of which the majority (49) were Kennedy Class I. One-year follow-up data revealed that 87% of patients were satisfied with and wearing their dentures. A small sample size and incomplete data hindered calculation of statistical correlations. Additional cohorts will enable meaningful analysis of the data and help to identify factors that may help improve clinical outcomes.

Keywords: Removable partial prostheses; Follow-up study; Complete prostheses; Prosthesis satisfaction; Patient profile

Introduction

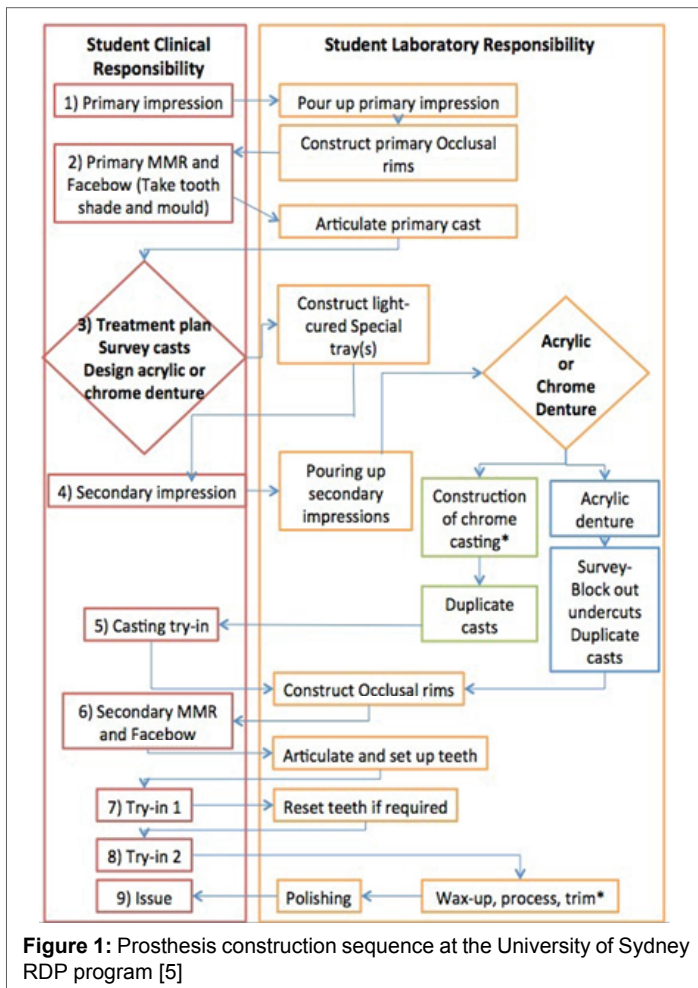
A recent dental health survey conducted in Australia found that 12.3% of the population have fewer than 21 teeth, deemed an inadequate dentition [1]. The proportion of Australians wearing partial dental prostheses ranged from 0.9% for those aged 15-24 to 47.4% for those aged 65 and over [1]. Furthermore, the proportion of edentulous Australians aged 45-64 was 5.5% compared to 21.1% for those aged 65 and over [2]. These striking figures highlight the need for optimal management of partial and complete edentulism in ageing patients who may have compromised oral or general health status.

The large number of patients treated in the Removable Dental Prostheses (RDP) program at the University of Sydney signifies its value, with approximately 47% of the NSW population eligible for public oral health services [3]. It is therefore imperative that dental schools teach aspects of dentistry that are relevant to the current population needs and ensure graduate competencies in removable dental prostheses construction. Partial and complete edentulism is a condition that affects individuals worldwide. Comparatively, Canadian and Australian adults have similar rates of complete tooth loss: 6.4% and 4.4% being edentulous, respectively [4]. Additionally, 12.3% of Canadian dentate adults have fewer than 21 teeth remaining, comparable to 14% in Australia [1]. This, combined with an increasing number of Canadian dental students studying in Australia, emphasises the importance of this subject in dental school curriculum.

Given the relatively stable proportions of partially dentate and edentulous people in Australia [1], removable dental prostheses offer cost-effective methods for replacing missing teeth and restoring function as compared to higher cost treatment, for example, fixed prosthodontics and implants. The RDP program at the University of Sydney aims to

teach students the entire sequence of prosthesis construction. In the first two years of the Doctor of Dental Medicine program, removable prosthodontics is taught pre-clinically, with the aim of preparing students for supervised dental prosthesis clinics in year three.

On an average of 40 patients are treated each year in the RDP clinic. Third year dental students work in pairs, and are assigned a clinical case at the beginning of the year. These students have no clinical experience in removable prosthodontics before. Cases may require upper or lower, partial or complete, acrylic or cobalt chrome prostheses. Patients are then seen over the following five months, as the students design and implement all aspects of creating the prosthesis (Figure 1) [5]. It is important to note that patients are required to pay a fee for cobalt chrome prostheses whereas acrylic prostheses are constructed at no charge. Students complete all clinical and laboratory work themselves, with the exception of processing (Figure 2). Throughout the duration of the program, students are under dental clinician and laboratory technician supervision. The program is extremely staff intensive due to a high student-to-staff ratio in the clinic and laboratory, time required in selecting suitable patients, and completion of all restorative work necessary prior to prosthesis construction. Consequently, the program is very expensive to run from a resource perspective. These resources include clinical educators, didactic lecturers, program coordinators, Sydney Dental Hospital support staff and prosthodontic equipment and materials. Furthermore, implementing the program places increased demands on dental student's workload. Currently, there is no protocol for patient follow-up to assess the success and patient satisfaction of the prostheses constructed in this program. Given the demands of the RDP clinic, a follow-up program is vital in ensuring the best possible outcomes are achieved and that the resources allocated to the program are producing acceptable clinical outcomes.



Prosthesis success and satisfaction relies on numerous variables, which can be viewed from both the patient and clinician perspective. These variables include aesthetics, functional ability, stability, retention, age, number of remaining teeth, previous prosthesis usage, patient anatomy, and overall prosthesis satisfaction. Clinical assessment, subjective responses, Visual Analogue Scales, and questionnaires are commonly used methods for measuring these variables. Prior research has shown that few variables are predictive of prosthesis satisfaction, but

that patient attitude has an influence [6]. Furthermore, Awad suggested that dentist's assessments of satisfaction and that of patients do not coincide [7].

In a study by Wu, patients were asked about their level of satisfaction with their removable partial dental prostheses, which were then assessed by a dentist [8]. It was found that most patients were satisfied with their prostheses and tended to have higher satisfaction levels than the dentist's estimation. When examining previous studies, most literature concludes that there are no significant predictors of prosthesis satisfaction. Frank carried out a study concentrating on dental prostheses made by private dentists in the United States [9]. The prostheses were examined according to clinical standards and none of these standards corresponded to patient satisfaction. Furthermore, Celebic compared the most satisfied patients who wore removable and complete dental prostheses, and aimed to determine the features of the prostheses that made the patient happiest [10]. They concluded that there was no significant difference between partial prostheses and complete prosthesis wearers for general satisfaction with their prostheses, aesthetics and comfort. Nevertheless, from a quality assurance perspective, it is important to identify whether the prostheses

constructed in the student clinics are resulting in acceptable clinical outcomes for patients. Particularly, given the resource intensive nature of the program and the need to teach key clinical competencies in prosthesis construction.

A similar study examined the clinical outcomes of removable partial prostheses created by the undergraduate program at Tokyo Medical and Dental University [11]. They reported no significant difference in mean age, gender distribution, mean number of remaining teeth, distribution of prosthesis arch, or Kennedy classification between prosthesis use and non-use, but that the abutment teeth and prosthesis base material were critical factors in determining prosthesis usage.

The main objectives of this pilot study are to: 1) assess the patient profile and the profile of the prostheses constructed in the RDP program at the University of Sydney, 2) evaluate patient satisfaction and usage with dental prostheses one year after final issue 3) identify variables (for example, type of prosthesis, previous prosthesis use, number of missing teeth) associated with patient satisfaction, and 4) allow for evaluation and improvement of the program to increase future patient satisfaction. The results from this study will enable the University of Sydney Faculty of Dentistry to evaluate and improve the RDP program, as well as review the patient selection criteria in order to enhance clinical outcomes.

Methods

Subjects

All patients treated in the RDP program are eligible for NSW public oral health services and are assessed and selected by staff to ensure suitability for student clinics. Any major dental work such as extractions, restorative work and periodontal treatment, are completed by hospital staff prior to commencing the prosthesis program. There is no requirement for the patients to have previously worn prostheses. The study was approved by the Sydney Local Health District Ethics Review Committee (ethics reference number X12-0098).

Data Collection

Each eligible patient was allocated to a pair of students. At the initial appointment, the treating students obtained consent and collected the following information: patient profile data (age, gender, significant medical history, medications, and smoking history), oral health status (Sulcus Bleeding Index (SBI), Approximal Plaque Index (API), and decayed, missing, and filled teeth (DMFT)), and prosthesis information (previous prosthesis history, new prosthesis base material, and Kennedy Classification). Charts used routinely in the student clinics for clinical data recording were used in the study for data collection. Prostheses were then constructed in the subsequent months. Examples of acrylic and cobalt chrome partial prostheses constructed can be seen in Figs. 2a and 2b respectively. Upon prosthesis issue at the final appointment, the treating students obtained updated oral health status information and any modifications to the prosthesis treatment plan. The researchers then collected the necessary information from the patient files, and at one-year post prosthesis construction performed follow-up phone interviews.

Prosthesis usage and patient satisfaction was evaluated based on subjective patient self-reports (as reported over the phone at the one year follow-up). Corresponding reasons for prosthesis use or non-use were also recorded at this time. Self-reports were then coded into discrete categories: currently wearing prostheses and very satisfied, wearing prostheses and satisfied with minor problems, wearing prostheses but not satisfied with major problems, not wearing the newly constructed prostheses, not wearing the new prostheses and have returned to old ones. Data from all cohorts were collated for statistical analysis. Patients with any prosthesis problems were offered to contact Sydney Dental Hospital to book an appointment.

Results

Objective 1 - assess the patient profile of the RDP program

The patient profile (2012-2015 cohorts) was comprised of 92 patients, in which 44 were male and 48 were female (Table 1). The average age was 69 years old with a range of 34 to 86 years. Medical history indicated a mean of three medical conditions with an average of four medications per patient. Smoking history showed 48 patients (52%) as non-smokers, 23 patients (25%) as current smokers, and 21 patients (23%) as previous smokers.

At the initial appointment, oral health status data revealed an SBI average of 27% and an API average of 72%. The average total number of teeth remaining was nine, with a mean of two teeth in the maxilla and six in the mandible. Furthermore, 82 patients (89%) had previous prostheses, with a mean of 12 years of usage.

During the study period, a total of 163 units were constructed; 93 partial dental prostheses and 70 complete prostheses (Figure 3). In the maxilla, 60 complete prostheses and 25 partial prostheses (12 cobalt chrome, 13 acrylic) were constructed, and in the mandible 10 complete prostheses and 68 partial prostheses (46 cobalt chrome, 22 acrylic) were constructed (Figure 4). All complete prostheses were made using an acrylic base. The distribution of prosthesis cases comprised of 46 complete on partials, 15 partial on partials, 10 complete prosthesis on complete prostheses, and 21 single prosthesis units (Figure 5). The majority of maxillary prostheses constructed were complete prostheses, whereas the majority of mandibular prostheses were Kennedy Class I. Figure 6 outlines the distribution of the prostheses constructed according to Kennedy Classification.

Objective 2 - Evaluate patient satisfaction one year after issue

Fourteen patients from the 2012 to 2015 cohort were not able to be contacted one-year post construction and not included in the study. As a result, a total of 78 patients with one-year follow-ups were included.

One-year post construction, 68 patients (87%) included in the study were still wearing their prostheses (Figure 7). Of those 68 patients, 38 were satisfied, with comments from patients including "I love my prostheses; they look great and fit and function well," and "please tell the students that they did a wonderful job with my prostheses; they are the best prostheses I've had." Twenty patients were satisfied but are having minor problems, and 10 patients were wearing their prostheses but were having major problems. Minor problems indicated by patients included natural teeth which had become mobile or felt like they were being compressed, and

Number of patients		92
Gender	Male	44
	Female	48
Age	Mean (years)	69
	Lowest (years)	34
	Highest (years)	86
Medical conditions	Mean	3
Medications	Mean	4
	No	48
	Yes	23
Smoking status	Previous	21
	Mean %	27
SBI Initial Visit	Mean %	72
Teeth remaining	Mean	9
Current prosthesis wear	Yes	82
	No	10
	Mean years worn	12

Table 1: Patient profile for 2012 to 2015 cohorts



Figure 2: a) complete upper acrylic prosthesis b) partial cobalt chrome prosthesis

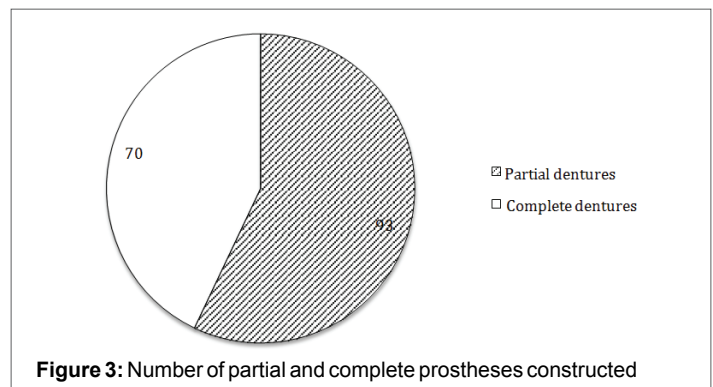


Figure 3: Number of partial and complete prostheses constructed

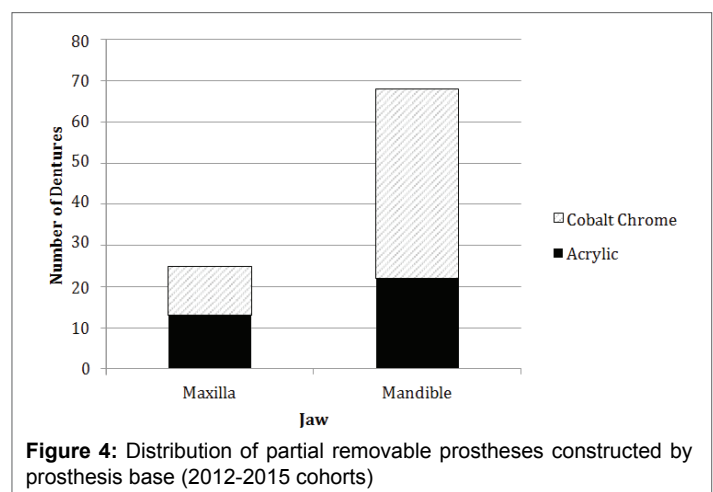


Figure 4: Distribution of partial removable prostheses constructed by prosthesis base (2012-2015 cohorts)

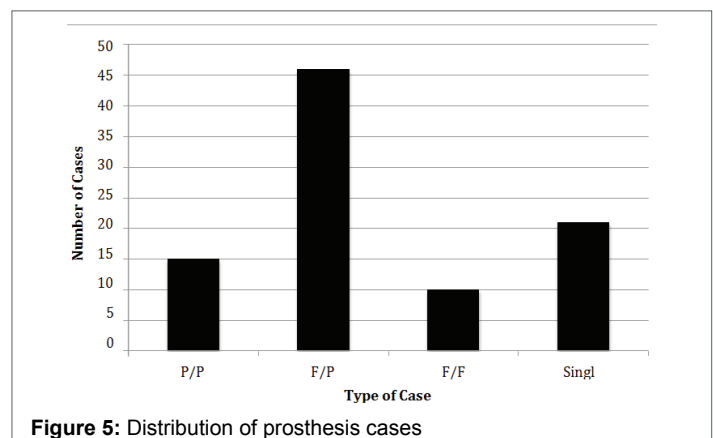


Figure 5: Distribution of prosthesis cases

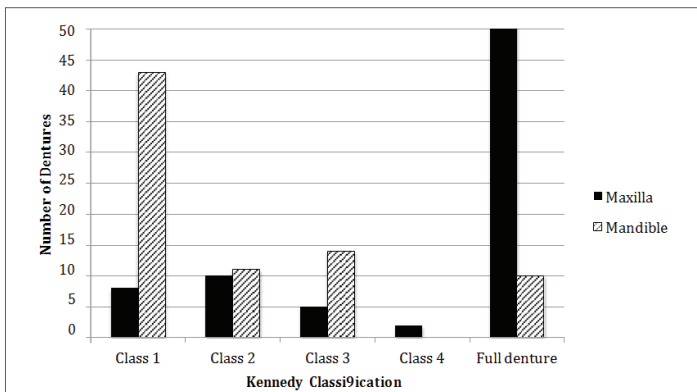


Figure 6: Distribution of removable prostheses by Kennedy Classification

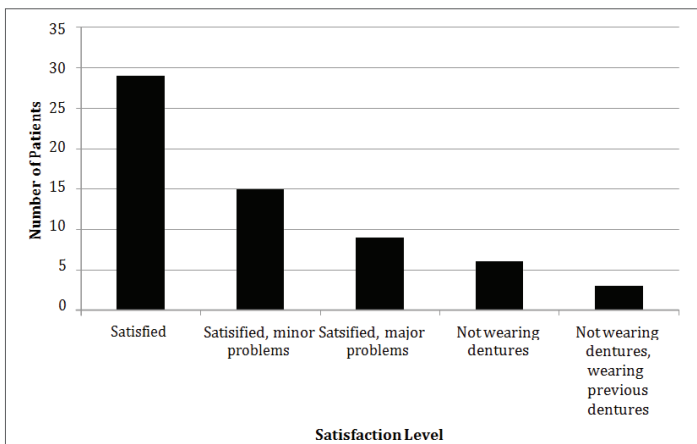


Figure 7: One year post prosthesis construction patient satisfaction level

clasps which had broken but had been repaired. Major problems indicated by patients included poor aesthetics, unstable prostheses during function and non-function, bulkiness, poor retention, and uncomfortable clasps.

Ten patients (13%) were no longer wearing their prostheses, and four of these patients had returned to their previous prostheses. Reasons for discontinued use included prostheses that were very painful or not comfortable while eating and fracture of an anterior tooth while eating. One patient stated that “the prosthesis is just too bulky and shows too much teeth when I smile; I’m now wearing my old prostheses,” and another said, “my lower prosthesis is too painful to wear.” Objective 3 - Identify variables associated with patient satisfaction

Due to small and greatly unequal sample sizes (number of wearers $n=68$ versus number of non-wearers $n = 10$) as well as incomplete data, performing meaningful statistical analyses of the data provided great difficulty. Furthermore, the sample may not be representative of the population (see discussion) skewing any results that would have been obtained.

Objective 4 – Evaluation and program improvements to be addressed in discussion/conclusion

Discussion

This study investigated the profile of patients and the prostheses constructed in the RDP program, patient satisfaction one year after prosthesis issue, variables associated with patient satisfaction, and areas for evaluation and improvement of the program to increase future and patient satisfaction. The findings from this study indicated that the majority of patients (87%) were still wearing their prostheses, and 13% of patients were no longer wearing them. It was also found that based

on the patient profile the students in the RPD program are exposed to a diverse range of clinical scenarios and cases. These include opportunities to construct upper and lower, cobalt chrome and acrylic, partial and complete prostheses.

A variety of removable prostheses programs are implemented in dental schools around the world. Clark compared the programs of 15 British dental schools, and found that the majority of prostheses were constructed using an acrylic base, and that cobalt chrome prosthesis cases were constructed less frequently [12]. This is in contrast to University of Sydney dental students, where an even proportion of cobalt chrome and acrylic prostheses are constructed. Clark also reported that the majority of schools concentrated on teaching removable prosthesis fundamentals early in the program, similar to the University of Sydney program. In addition, it was highlighted that there was a lack of experience in treating cases requiring a combination of complete and partial prostheses, unlike this program in which 50% of cases were complete or partial prostheses. Yoshida conducted a similar study looking at the prosthesis outcomes of the Tokyo Medical and Dental University prosthesis program [11], which indicated a rate of 36% prosthesis non-use as compared to 13% in the current study. However, the Tokyo program follow-up was 2-4 years post-construction, rather than one year as in this study.

Unfortunately, meaningful statistical analysis could not be performed on the data collected from this investigation due to the amount of missing data and differing sample sizes in each category. This did not allow for the variables affecting or correlating to prosthesis satisfaction to be investigated. The findings for the patient satisfaction demonstrate that 87% of the patients in our study are continuing to wear their prostheses one year after issue. However, this outcome may be an inflated or deflated representation of the true success rate of prostheses from each cohort. Not all patients were included in the study; certain patients did not want to consent to participate in the study. Furthermore, a small proportion of patients from each cohort could not be contacted for the one-year follow up. As a result, approximately only 50% of patients treated between 2012 and 2015 were included in the study, resulting in a decreased and questionable validity of the current results, as well as introducing bias into any conclusions made. This resulting small sample size was a key limitation of this study. It is important to note that as this is a pilot study, the aim was to evaluate overall patient satisfaction with dental prostheses constructed in the student clinics.

An additional limitation of this study was that the student records in the patient files were incomplete in some cases and consequently, complete patient data could not be collected. For example, oral hygiene parameters could not be determined at final issue, as most students did not conduct this examination during the final appointment. This resulted in fewer complete sets of parameters that could be investigated. Due to follow-up data being collected via phone survey, measurement of prosthesis satisfaction was challenging and could have been more objectively sought out using Visual Analogue Scales at prosthesis issue and at one-year follow-up during a clinical visit. However, this would have required the patient to return to the hospital for the follow-up visit which may have proved challenging for the elderly patient cohort.

There are potential confounding factors that may have influenced the prosthesis satisfaction of patients at one-year follow-up, namely the patient- clinician relationship during prosthesis construction process and the students’ ability and technical skills in clinical and laboratory steps. Both of these components are critical in prosthesis success. Furthermore, due to the multiple visits that the prosthesis construction process involves in the student clinics, patients may lose motivation, and therefore poorly rate the prosthesis success. Post final prosthesis issue, any prosthesis adjustments required were often performed by dentists at Sydney Dental Hospital, introducing additional confounding factors when investing

student made prostheses. Fees associated with the construction of cobalt chrome prostheses may not be affordable for all patients and therefore the most appropriate prosthesis base may not always be chosen. In addition, the laboratory only stocks certain acrylic tooth shades; if the tooth shade of the patient could not be matched sufficiently, the aesthetics of the prosthesis may have been compromised.

Following this pilot study we recommend continuation of this project with additional cohorts, introducing methods to improve the response rate and the completeness of the dental records. These measures will enable more meaningful statistical analysis. One way to achieve this may be to introduce a case presentation into the program and ask students to provide patient records including a one-year follow-up as part of their routine management of the case. Additionally, we recommend quantitative data on patient's satisfaction be collected via the use of a rating scale (Visual Analogue Scale). This may also be built into the case presentation and patients may be advised of this as a requirement when they are selected for the program. Currently, patients are seen every two weeks; by reducing the duration between these appointments, fewer patients will fail to attend appointments, as patient motivation will remain increased. Additional confounding factors affecting prosthesis success such as medications causing dry mouth and prosthesis adjustments should be investigated further. Finally, it would be beneficial to evaluate the student learning outcomes of the RDP program of the Doctor of Dental Medicine course by providing surveys to dental students before and after completing their work in the RDP program. This will allow for RDP program improvements to be made, and to ensure that University of Sydney dental graduates are provided with adequate competency in diagnosing, treatment planning, and constructing removable prostheses for partially and fully edentulous patients.

Conclusion

This pilot study assessed the patient profile in the RDP clinics at the University of Sydney Faculty of Dentistry, assessed patient satisfaction with the prostheses provided one year after final issue, and allowed for evaluation and improvement of the program to increase future patient satisfaction. Although meaningful statistical analyses could not be performed to determine parameters affecting prosthesis satisfaction, it was found that majority patients in the RDP clinics are still wearing their prostheses one year after construction. Given the proportion of the population with partial and complete edentulism, removable dental prostheses remain very relevant in the scope of dentistry, and is imperative that dental schools' curriculum reflect the needs of society.

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