A 30-Year Follow-Up of Partial Removable Dental Prostheses in a University Dental School Setting

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Abstract
Purpose: To describe the pattern of partial removable dental prosthesis (PRDP) designs over a 30-year period in a cohort of patients from the Université de Montréal, Faculty of Dentistry and to examine the effect of this design in PRDP complaints and the required treatment in a subsample of the patients’ cohort.

Materials and Methods: In this retrospective descriptive study, 1380 PRDP laboratory prescriptions (1980-2009) and 131 PRDP clinical complaint forms (2006-2008) from the archives of the undergraduate prosthodontics clinic of Université de Montréal were selected. Data on type of PRDPs, design, PRDP-related complaints, and the need for treatment were collected. Descriptive statistics and bivariate statistical analyses were conducted.

Results: U-shaped (54%) and lingual plate (94%) were the most common major connectors used in the maxillary and mandibular arch, respectively. In 95% of laboratory prescriptions, circumferential clasp was the design for the retainers. Fracture of PRDP components was the most common (41%) complaint. Most of the complaints (68%) were made by PRDP wearers having natural teeth in the opposing arch. There was a significant relationship between fracture of PRDP components and having opposing natural teeth (p = 0.002). Seventy-three percent of PRDP-related complaints were manageable only by minor treatments such as repair, readjustments, and oral hygiene instructions.

Conclusion: Changes in the design of PRDPs were noticeable at the Université de Montréal since 1980, but there has been little change in the last 20 years. Biomechanical concepts and optimum hygiene were the basic elements in the design of RDPs in this university-based dental school setting. The majority of the complaints were treated by minor treatments.

With advances in technology, the treatment options for restoration of partial tooth loss have evolved. Out of various treatment strategies for partial edentulism such as implant- and tooth-supported fixed prostheses, a well-designed partial removable dental prosthesis (PRDP) is still one of the most prescribed treatment modalities, filling the needs of millions of partial edentulous individuals worldwide. This affordable treatment option has a high survival rate with a 10-year survival rate up to 90%. However, study results have shown that two-thirds of PRDP wearers complain from some PRDP aspect, such as lack of integrity, fractures, excessive tooth wear, and poor stability and/or retention. The clinician’s education, experience, and knowledge for the design of PRDPs can influence the success and survival rate of this treatment option, though success is judged differently by patients and clinicians. Clinicians believe that patient demographics, psychology, oral and systemic health, materials used, methods of realization, and technical norms dictate the success of PRDP treatment. On the other hand, PRDP satisfaction for patients is related to esthetics, comfort, retention, stability, ease of speech, chewing, previous experience of wearing dentures, and personal motivation. This different perception of patient needs and expectations makes PRDP treatment and complaint management more challenging. Furthermore, dental schools have different visions regarding PRDP educational strategies, and some dental schools are reducing curricula hours dedicated to theoretical and clinical coaching of PRDPs because of implant-oriented education. Others including the Université de Montréal (UdeM), the
largest dental school in Quebec, have reoriented their PRDP educational strategy to address the needs of their population. Among the provinces of Canada, Quebec had the highest rate of tooth loss, which is closely associated with socioeconomic factors. Therefore, PRDPs are considered a first-line treatment for many vulnerable communities such as new immigrants, those with low socioeconomic status, and rural and remote communities with poor access to dental care. In line with this vision, and to improve the outcome of the delivered patient care, efforts have been made to document observations, diagnostic decisions, and health care treatments, and to exchange information with oral health care professionals and educational policy makers.

This article represents a reflexive documentation with the aim to examine the pattern as well as associated complaints and retreatment in the design of PRDPs in the undergraduate clinic of the UdeM over a 30-year period (1980-2009).

Materials and methods
In this retrospective descriptive study, 1380 PRDP laboratory prescriptions were selected using stratified random sampling from the archive of the undergraduate prosthodontic clinic at UdeM. The study was performed retrospectively on clinical files and did not require Institutional Review Board approval. Identifying patient information was not available to the researchers. All designs were made by undergraduate students supervised by qualified part- and full-time instructors. The data were stratified according to the year of the prescription and type of PRPD (maxillary vs. mandibular). The inclusion criteria included: prescription records of 1980 to 2009, chrome-cobalt frameworks, and completeness of the prescription as well as approval of the prescriptions by the instructors. Exploratory variables included: the Kennedy classification, major connectors, and direct retainers. An exploratory random time-cluster subgroup analysis of clinical complaints form of the patients who received and returned to clinic with PRDP complaints during a fixed time-period (September 2006 to September 2008) was carried out. This method allowed restricting the source of systematic errors such as variations in clinicians, technicians, and impression materials as well as material used for fabrication of PRDPs. Prosthodontic clinical complaint forms were filled by undergraduate students during clinical examination sessions at the complaints clinic. PRDP clinical instructors (academic prosthodontists or expert clinician) rechecked all forms. The forms were excluded in case of incompleteness or nonrelevant data (any type of complaints received by non-PRDP wearers). Available information in regard to PRDP types, causes of complaints, and consecutive treatment plan were collected. PRDP types were divided according to opposing arch status into: Type 1: opposing arch having either PRDP (P/P) or removable complete dental prosthesis (C/P), Type 2: opposing arch having natural teeth (P/N) or (N/P). The type of treatment was dichotomized into two groups: (1) major treatment that necessitated remaking the PRDP and (2) minor treatment including various repairs, peripheral readjustments, clasp rearrangement, or oral hygiene and care instructions.

Data were analyzed using descriptive statistics and chi-square tests by SPSS v.21 (SPSS Inc., Chicago, IL). Statistical significance was set at $p < 0.05$.

Results
Kennedy Class II and Class I were the most common partial edentulous state in the maxilla (50%; Fig 1) and the mandible (70%; Fig 2) of patients from UdeM who received PRDP treatment over the 30-year period. The U-shape or horseshoe shape (54%) and the lingual plate (90%) were the dominant major connectors (Figs 3 and 4). The circumferential clasps (back action, cast RPA, and wrought wire RPA) were the most prescribed direct retainer in this institution, whereas infrabulge vertical clasps were used in less than 5% of cases (Fig 5). Moreover, the prescription of circumferential wrought wire clasps has significantly increased since 1986, and circumferential clasps were the most prescribed direct retainers (90%; Fig 6).

Within the selected time period (September 2006 to September 2008), a total of 292 complaint forms were obtained: 161 forms were excluded because of non-PRDP-related complaints (140 removable complete dental prosthesis complaints), and 21 due to the lack of one or more of the following: patient personal information, file number, type of worn complete RDP, patient complaint, diagnosis, or clinicians’ signature. Therefore, in total 131 PRDP complaint forms were examined.

Within the selected time period, 66% of the complaints were from women and 34% were from men. It was observed that 68%, 18%, and 14% of the complaints originated from PRDP wearers opposing natural teeth, a maxillary removable complete dental prosthesis, or a partial dental prosthesis in the opposing arch, respectively. There were no complaints recorded for partial dental prostheses on the maxilla or removable complete dental prostheses on the mandible (Fig 7).

The highest frequency of complaints (41%) was recorded for broken PRDP; 12% of patients complained of problems related to pain and ulcerative lesions, 15% presented loose PRDP, 10% experienced discomfort while chewing, 8% had multiple complaints, 9% expressed having difficulties holding the PRDP in its place, and only 5% complained of poor esthetics (Fig 7). Seventy-three percent PRDP wearer complaints were manageable by means of minor treatment; 37% required various repairs, 16% required clasp rearrangement, 15% needed peripheral readjustments, and 5% were given oral hygiene and PRDP care instructions (Fig 8).

There was no statistically significant association between gender and frequency of complaints ($p > 0.05$) or between gender and type of treatment needed to manage these complaints ($p > 0.05$). Although there was no significant relationship between major or minor treatment and type of PRDP ($p = 0.54$), an opposing arch having natural teeth was associated with lower odds of getting major treatment (Table 1). The odds ratio of fracture of PRDP in presence of opposing natural teeth versus opposing removable complete dental prosthesis or PRDP was statistically significant ($p = 0.002$; Table 2).
Figure 1  Different classes of maxilla (Kennedy classification of RDP) during a 30 year period.

Figure 2  Different classes of mandible (Kennedy classification of RDP) during 30 years period.

Figure 3  Maxillary major connectors distribution.

Figure 4  Mandibular major connectors distribution.

Figure 5  Cast and wrought wire RPA clasps.

Figure 6  Circumferential clasps.
Discussion

PRDPs are still one of the major elements of dental school curricula because of their affordability, the availability of technical expertise, and the requirement by millions of people worldwide. Therefore, retrospective analyses of PRPDs in different health care settings and follow-up of PRDP cases can assist clinicians to elucidate factors related to patient satisfaction, expectation, and needs for PRDP treatment.

This study has found changes in the design of PRDP in UdeM since 1980, but there has been little change in the last 20 years. Thirty years ago, Kennedy class II in the maxilla and class I in the mandible were the most common partial dental prosthesis designs at the UdeM, which is related to the pattern of tooth loss in the maxilla and mandible and also matches with the patterns showed by different studies from other countries. In this institution, lingual bars were replaced by lingual plates and I-bar clasp design by circumferential horizontal clasps, showing that preference was given to the design based on simplicity, versatility, strength, and gingival health. Biomechanically, a more rigid design was preferable, as studies show improvement in stability and patient comfort. It was believed that PRDP increases caries and periodontal disease, and the consensus was to minimize tissue coverage to improve oral health using a minimal, more delicate PRDP design. A lingual bar was preferred to avoid unnecessary gingival coverage, conditions of lingual sulcus depth, tori, and periodontal disease.

However, current scientific evidence demonstrates that regardless of the design, PRDP wearers can maintain good oral health with adequate hygiene care and planned maintenance follow-up. An anatomical restriction like an 8 mm minimum depth of the active floor for the lingual bar, provision of indirect retainer, more rigidity when needed (class I and II PRDP), increase of stability, and versatility (i.e., incisors to be added if lost in the future) are evidence to favor a lingual plate. The advantages of a U-shaped major connector are simple design, minimal coverage of palate, and less metal-tooth-or-tissue edges than anteroposterior strap design. The disadvantages are not as rigid as other maxillary major connectors, but they can be managed by incorporating a horizontal and vertical component of the palate in the PRDP framework.

The advantages of the circumferential clasp are that it is easy to construct and simple to repair. Disadvantages include more coverage of the tooth surface area than with the I bar. The advantages of the I bar are greater retention, better esthetics, and more control over its flexibility; disadvantages are that it is technically sensitive to prepare, and it includes anatomical restrictions in prescriptions such as severe tilts of abutment teeth, shallow buccal/labial vestibule, and severe tissue undercuts.

In the literature, gender differences in satisfaction with PRDPs have been reported, showing that men are able to better adapt to PRDPs than women. This was supported by our findings, as women reported more complaints than men, although the association was not statistically significant. Similarily, in Moroi et al’s study, which was conducted between a group wearing maxillofacial prostheses and a control group wearing PRDPs, women rated their prostheses lower than men did, but the association was not statistically significant. Another study also did not find significant relations between gender and ongoing denture difficulties.

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Published studies have supported the idea that patient satisfaction with PRDPs is related to different factors, such as comfort, mastication, retention, and esthetics. Furthermore, a patient’s attitude, personality, and motivation may also influence their perceived satisfaction with PRDPs. This observational study showed that fracture of PRDP components was the most reported and was significantly correlated to the opposite arch having natural teeth. These findings are in line with other studies, showing the prevalence of fracture in PRDPs from 1.4% to 33% in 5 to 10 years of PRDP use, respectively. The reasons for fracture may be related to more wearing of PRDP occlusal rest or clasps or more bone loss underneath the PRDP, and subsequent less contact with the mucosa and base of PRDP. These factors lead to a detrimental load on PRDP clasps or components. This is also supported by a
few studies that have shown increased longevity for a PRDP if the opposing arch is rehabilitated with tissue-supported removable complete dental prostheses, but they lack either uniform definitions of RDP success or clear reporting of the status of opposing dentition in the entire period.47

At the UdeM, most of the patients’ complaints regarding PRDPs were managed by minor treatments such as repairs, peripheral rearrangements, clasp adjustments, relining, and oral hygiene and PRDP care instructions. Only 27% of PRDP wearers needed major treatment, mainly for fractures of PRDP components, inadequate fit, or instability of PRDPs during functional movements. Interestingly, there was no significant association between type of treatment received and gender. This showed that patient gender does not influence the clinical decision making of clinicians and their choice of treatment in regard to the complaints. Reports support that if a patient visits the dentist regularly, then most complaints will resolve as minor repairs, relining, and occlusal corrections, because many problems are related to accumulation of plaque leading to periodontal inflammation, tooth mobility, and caries.48-50 Furthermore, minor treatments may increase survival of PRDPs, an idea supported by literature reporting survival rates from 90% to 90.5% after 4 years and 5.3 years, respectively.51 These finding suggest further research in RDP materials to improve longevity and patient compliance.

This study has the limitation that the study sample was not representative of the general population, as it was derived from a university-based dental school setting of people who were seeking or were proposed with a PRDP treatment. Practice-based research could be a good complement for such data.

### Conclusion

Since 1980, changes in PRDP design at the UdeM were noticeable, but there has been little change in the last 20 years. Biomechanical concepts and optimum hygiene were the basic elements in the design of PRDPs in this university-based dental school setting. The majority of complaints were treated by minor treatments.

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### References