Adequacy of framework fit is a fundamental requirement for cobalt-chromium (Co-Cr) partial removable dental prostheses (PRDPs). In clinical practice, visual and tactile inspection with a mouth mirror and dental explorer have often been the preferred method to check the acceptability of framework fit, based on the guidelines of a number of specialist societies. These guidelines state that fit is judged as good if all rests are completely seated in position in their corresponding rest seats, if all rigid framework components snugly contact the teeth, and if the intaglio surface of the major connector does not press against the soft tissue or exhibit a detectable gap of more than 1 mm. A number of clinical and laboratory factors have been implicated as potentially influencing the fit of PRDP Co-Cr frameworks. In particular, the effects of impression material and impression tray type have been the subject of multiple investigations, although clear-cut evidence of the decisive roles of these factors is still lacking.

As regards impression material, irreversible hydrocolloid (alginate) has been proposed by several authors as a substitute for elastomeric impression materials in Co-Cr PRDP framework construction. Regarding usage patterns, alginate has been reported as the predominantly used final impression material according to some dental laboratories.
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MATERIALS AND METHODS

The study was comprised of 103 patients (144 partially dentate arches) drawn sequentially and on a PRDP need-to-treat basis from patients undergoing comprehensive dental care in an undergraduate dental teaching clinic during the period of February 1, 2017, to April 30, 2019. The sample size required for the study had been estimated to be 93 partially dentate arches/frameworks (47 in each impression group) for a least significant difference between the two groups of 1 attempt and a standard deviation estimated as 0.34. This was based on 90% power of the study and a .05 significance level.

Inclusion Criteria

Partially dentate patients who were planned for Co-Cr PRDP treatment for one or both arches as part of their comprehensive dental care and had PRDPs provided by undergraduate dental students under supervision of a specialist prosthodontic faculty member were included.

Informed consent was obtained after explanation of the purpose and nature of the study at the initial patient screening performed by relevant clinical staff and/or by the supervising prosthodontic staff at the commencement of the PRDP treatment. Patients were clearly informed that their treatment would be performed according to the standard clinical protocols of the university dental clinic. Ethical approval was obtained from the institutional ethical committee, and permission to conduct the study during the undergraduate clinical course was obtained from the Faculty of Dentistry clinical committee.

For all patients, demographic data, arch type, Kennedy class, impression material, tray type, and the number of fabrication attempts of the frameworks needed to achieve a clinically acceptable fit for each of the dental arches were noted. The investigation was conducted using a single-blinded design—although the students were aware that the patients were participating in a clinical trial, they were blinded to the test variables. The primary dependent variables, namely choice of impression material and tray type, were at the discretion of the supervising prosthodontic staff based on their independent evaluation of the clinical features of the case and guided by the standard clinical protocols followed in the university dental clinic. Since the setting was an undergraduate teaching clinic, the supervisor engaged the student in the choice of material and tray to be used, thus reinforcing the principles that they were taught. It also follows that, since patients were enrolled on a sequential, need-to-treat basis and on the
The criteria applied for in vivo assessment of framework fit were drawn from previously published guidelines\(^1\)\(^-\)\(^4\) that form the basis for standard practice among all members of the discipline within the dental school. All rigid elements of the framework, including parts of major connectors, clasps, and guide plates, must be verified as having an intimate, nonbinding contact with the teeth. The major connector must conform passively to the supporting tissues without evidence of stress or exhibiting a space of >1 mm between the fitting surface and the tissues. Stability and accuracy of fit were judged on the basis of no detectable gaps between rest seats and rests using a dental explorer. Additionally, a silicone fit checker applied to the intaglio surface of the framework permitted examination of the proximity of framework seating by demonstrating no conspicuous internal fit discrepancies in the region of the rests. The fit checker record was both visually assessed and objectively analyzed using an Iwansson (dial) caliper. Since there are no clear-cut quantitative guidelines regarding what constitutes acceptable internal gaps in the region of the rests, clinical judgement was relied upon to determine the level of discrepancy, if any, and to decide on the acceptability of the framework.

In the region of the major connectors, besides the visual and tactile examination using a dental explorer, the fit was also confirmed using silicone fit checker material. The frameworks were also checked for visible spaces between clasps and abutment teeth and further confirmed using a dental explorer tip and/or orthodontic wire of 0.5-mm diameter. Frameworks that did not meet the qualitative assessment criteria were deemed unacceptable and were rejected. New frameworks were then fabricated, again following the standard protocol of new definitive impressions, and the same procedure of checks was followed at the subsequent try-in attempt(s).

For all intents and purposes, this documented standard of care served as a means of indirect calibration for the clinical assessment of framework fit, while the role of the second examiner strengthened the accuracy and consistency of the assessment procedure. Frameworks were accepted if all the noted assessment criteria were satisfied with no discernible defects noted; if a framework did not meet all of the acceptability criteria, then a remake was required.

### Statistical Analyses

Descriptive statistics were carried out, and factorial analysis of variance (ANOVA) was used to compare the relationships of impression material, Kennedy class, and tray type with the number of frameworks fabricated for each patient (SPSS v. 20) at \(\alpha = .05\) for both maxillary and mandibular arches together. Post hoc Tukey tests were further performed to compare the means of the different Kennedy classes in terms of number of framework attempts.

### RESULTS

A total of 142 treated partially dentate arches (65 maxillary; 77 mandibular) were analyzed, and the descriptive characteristics of the studied sample are presented in Table 1. For all cases, alginate or PVS impression materials were used with modified metal stock or light-cured custom trays. With regards to the distribution of
The findings of this paper corroborate those of a recent clinical study\(^7\) that showed insignificant statistical differences in relation to use of alginate or PVS in terms of Co-Cr fabricated until acceptable fit (N = 142).

**Table 1** Descriptive Analysis of the 142 Frameworks of Partially Dentate Arches Prospectively Evaluated in this Study

<table>
<thead>
<tr>
<th>Variables of interest</th>
<th>No. of attempts (%)</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Arch</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Maxilla</td>
<td>56 (86)</td>
<td>65 (46)</td>
</tr>
<tr>
<td>Mandible</td>
<td>68 (88)</td>
<td>77 (54)</td>
</tr>
<tr>
<td>Kennedy class</td>
<td></td>
<td></td>
</tr>
<tr>
<td>I</td>
<td>46 (90)</td>
<td>51 (36)</td>
</tr>
<tr>
<td>II</td>
<td>34 (92)</td>
<td>37 (26)</td>
</tr>
<tr>
<td>III</td>
<td>44 (82)</td>
<td>54 (38)</td>
</tr>
<tr>
<td>Impression material</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Alginate</td>
<td>76 (85)</td>
<td>90 (63)</td>
</tr>
<tr>
<td>Polyvinyl siloxane</td>
<td>48 (92)</td>
<td>52 (37)</td>
</tr>
<tr>
<td>Tray type</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Stock metal</td>
<td>95 (86)</td>
<td>111 (78)</td>
</tr>
<tr>
<td>Custom</td>
<td>29 (94)</td>
<td>31 (22)</td>
</tr>
<tr>
<td>Total</td>
<td>124 (87)</td>
<td>142 (100)</td>
</tr>
</tbody>
</table>

**DISCUSSION**

This prospective clinical study based on assessment of partially dentate patients who had been provided with PRDPs in an undergraduate dental teaching clinic sought to analyze the association of various factors with respect to the production of clinically acceptable metal framework fit, as inferred from the number of framework construction attempts that needed to be made to achieve the result. The factors that were assessed for possible correlation with framework fit were: choice of final impression material (ie, alginate or PVS); pattern of partial edentulism (ie, Kennedy class); and choice of impression tray (ie, light-cured custom or metal stock trays).

Overall, no difference with respect to framework fit between the two materials used as a final impression material was found, regardless of the tray type, Kennedy class, and arch type. Similarly, there were no correlations between the pattern of partial edentulism (Kennedy class) and impression tray type in relation to the number of frameworks that needed to be fabricated per partially edentulous arch. Based on these findings, it follows that the null hypotheses failed to get rejected.

The findings of this paper corroborate those of a recent clinical study\(^11\) that found no differences between alginate and PVS in terms of fit of PRDPs at different stages of evaluation. However, it should be noted that only custom impression trays were used in that investigation, whereas the current study engaged a mix of stock metal and light-cured acrylic custom trays. Additionally, the number of patients/PRDPs (49/56) was far fewer in the earlier investigation compared to the current one. These results also concur with another retrospective clinical evaluation\(^10\) and an in vitro study\(^2\) that showed insignificant statistical differences in relation to use of alginate or PVS in terms of Co-Cr...
PRDP metal framework fit. On the other hand, these findings differ from those of an earlier clinical study that found significant differences between condensation silicone and alginate in terms of intraoral fit of PRDPs. There could be various factors attributable to the disagreement, notably differences in the actual impression material products that were employed in the two studies, differences in laboratory-related processes, and differences in the test parameters that were used.

Regarding the pattern of partial edentulism, the finding of no significant correlation with framework fit contrasts findings of an earlier investigation that found differences between the various mandibular Kennedy classes in terms of metal framework rest adaptation. In the present study, framework fit was not assessed by quantifying the space between the rests and the rest seats at four different locations, as was done in the cited investigation. Rather, framework fit was evaluated clinically by applying textbook-recommended assessment standards including the use of silicone-based disclosing medium to confirm fit and to detect any discrepancies at the framework try-in appointment. It can be noted that the role of variations in modification spaces in the dental arches between the two studies could have also contributed to the effect. The current study results, however, found agreement with another recent clinical evaluation that also found no effect of partially dentate arch type on framework fit. Due to an absence of more closely matching published clinical studies, further comparison with the existing results on this aspect was not possible.

The last factor investigated was tray type, which was again not correlated with the fit of the PRDP metal frameworks. The reasons for preferring stock trays over custom trays, as noted in many clinical and in vitro studies, include their ready availability, cost effectiveness, and varieties of design. It is worth noting that only metal stock trays were utilized in this study, and the results could have been different if plastic stock trays were used instead, given their known shortcomings in terms of rigidity and design factors.

It is known that variations in laboratory processes can potentially affect the fit of PRDP metal frameworks, including the type of dental stone used, impression pouring technique, investment material type, spruing technique, type of alloy used, and the fitting and polishing techniques on the master cast, among others. By virtue of all the frameworks in the present study being fabricated in the in-house production laboratory, uniformity in all phases of the production cycle can be said to have been maintained. Moreover, stringent quality control measures were applied on every framework before approval for transfer to the clinic for patient try-in. Thus, it may be fair to infer that a homogenous approach to laboratory fabrication of frameworks coupled with the adherence to set clinical protocols by a closely monitored clinical dental student would have favorably impacted the study outcomes, as suggested by the 87% success with framework fit at the first attempt. It can be speculated that the outcome may have been different if treatment had been provided in a less standardized setting.

The central question addressed in this investigation was whether the fit of the PRDP framework was, upon initial clinical insertion, associated with specified clinical variables. The definitive evaluation of acceptable fit of frameworks was made by two experienced specialist prosthodontic staff teaching in the same undergraduate institutional setting for several years. Their decisions with respect to framework fit were independently agreed upon in each case, and it is suggested that this served to strengthen the reliability of the results.

There are some probable limitations of the study that can be stated. For one, there were considerably fewer cases that employed custom acrylic trays compared to the metal stock trays, and such disparate numbers may potentially unfavorably influence the validity of the results. Likewise, the very few cases of Kennedy class IV partial edentulism in the current sample prompted elimination of this class from statistical analysis, compromising the reliable examination of the role of arch configuration. The number of cases was also unevenly distributed among the impression material categories. However, it needs to be noted that in this prospective study, the independent variables (impression material, tray type) were not randomly allocated to the patients to ensure equal sample sizes for comparison purposes. It was instead the judgement of the supervising prosthodontist based on his/her individual assessment of the patient, guided by the clinical standards of care agreed upon by all staff working in the discipline. Also, all prosthodontists guiding students in the university clinic acted independently of the two prosthodontists who checked the fit of the frameworks.

Another possible critique might be in the way the framework fit was examined. While it was not an objectively quantitative method, the evaluation was done by members of a clinical academic department, all of whom were guided by the clinical standards of care agreed upon by all staff working in the discipline. The only quantitative analysis of the frameworks was the evaluation of the thickness of silicone fit check records in the region of the rests and major connector using an Lwansson (dial) caliper. A few previous studies have analyzed the silicone fit records using stereo-microscopes or other measurement techniques in the laboratory to compare the discrepancy of fit. However, such an evaluation is not a realistic option in clinical practice. In fact, to date, no clear quantitative guidelines exist to determine the acceptability of fit of the frameworks in the “rest” areas; rather, clinical judgement relies on the
References:


References:

21. Reprints: Yen-Yu Chen, yychen@mail2000.com.tw

—Brian Fitzpatrick, Australia

Dental Treatment Procedures for Periodontal Disease and the Subsequent Risk of Ischaemic Stroke: A Retrospective Population-Based Cohort Study

The purpose of this study was to investigate the associations between specific dental therapies for periodontal disease and the risk of ischemic stroke. The authors conducted a population-based cohort study that used data from the Taiwan National Health Insurance Research Database 2005 for the period 2000 to 2013. The observations focused on patients with diagnoses of gingivitis or periodontitis with and without specific treatment and subsequent incidence of ischemic stroke. Dental care services included dental scaling, intensive treatment (ie, subgingival curettage and root planing), and tooth extraction. Multivariate Cox regression analysis was used to estimate the hazard ratios and corresponding 95% confidence intervals. Compared to those in the gingivitis cohort, patients with periodontitis had a higher risk of ischemic stroke and a lower survival rate of stroke over the 10-year follow-up period. After integrative dental care (both dental scaling and intensive treatment), the risk was reduced, especially in patients with periodontitis, while patients with periodontal disease may have an increased risk of stroke after tooth extraction therapy. This study showed that periodontitis is a risk factor for ischemic stroke. Both dental scaling and intensive treatment for periodontal disease are associated with a lower risk of further ischemic stroke events.


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CONCLUSIONS

Based on the limitations of this study, it can be concluded:

- Irreversible hydrocolloid (alginate) can be used as an alternative final impression material in the fabrication of Co-Cr frameworks in PRDP treatment.
- Metal stock trays can be routinely employed for performing final impressions in the construction of Co-Cr PRDPs.
- Arch configuration (Kennedy class) did not affect the fit of the Co-Cr PRDP frameworks.

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The authors report no conflicts of interest.

REFERENCES


Literature Abstract

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