The purpose of this clinical study was to compare first impression success rates for 2 types of impression material and tray systems.

Dual-viscosity impressions were made with a vinyl polysiloxane (VPS) (Aquasil Ultra Monophase/Aquasil Ultra XLV) and a polyether (PE) (Impregum Penta Soft HB/Impregum Garant Soft LB) impression material. The first impression made was evaluated for success or failure using developed criteria. Fifty senior dental students participated. The type of impression material alternated for each new patient. A full-arch perforated plastic (President Tray) or a plastic dual-arch impression tray (Tri-Bite) was used based on clinical guidelines. Impression success rates were compared using logistic regression, fitted using the method of generalized estimating equations ($\alpha=.05$).

One hundred ninety-one impressions were evaluated, and the overall success rate was 61% for VPS and 54% for PE ($P=.39$). Additional regression analyses, adjusted for potential confounders, did not indicate a difference between the 2 systems ($P=.35$). There was little difference in success rates between the 2 materials when a full-arch tray was used (50% versus 49% success, $P=.89$), whereas a larger difference was apparent with the use of dual-arch trays (70% success with VPS versus 58% success with PE, $P=.21$). The most common critical defect was located on the preparation finish line (94%), and the most common operator error was inadequate gingival displacement (15%).

There was little difference in success rates between VPS and PE when full-arch impression trays were used, but there was greater success when using VPS with dual-arch trays. For single teeth, the trend favored VPS, but when more than one prepared tooth per impression was involved, the success rate was higher for PE. (J Prosthet Dent 2010;103:13-22)

Clinical Implications

When using a dual-viscosity impression technique and a full-arch disposable impression tray, VPS and PE will yield similar first impression success rates based on study results. However, when using dual-arch trays, this study showed greater success with VPS. When there were multiple tooth preparations to be captured in a single impression, the success rate was higher with PE.

Supported in part by Dentsply Caulk.
In the order of appearance in the dental market, polysulfide, condensation silicone, polyether, and vinyl polysiloxane are the 4 types of elastomeric impression materials commonly available to dentists. Currently, polyether (PE) and vinyl polysiloxane (VPS) are considered the materials of choice for making fixed and removable prosthetic impressions. The accuracy of both materials is well established in the literature, but few clinical trials have documented the clinical success rates of each in making impressions. In a study in which third-year dental students were randomly divided into 2 groups, whereby each group was assigned to use 1 of 2 VPS 1-step, putty-wash impression systems, the resulting first impression was evaluated for success or failure. Results indicated that the odds ratio to achieve a successful impression with a newer VPS system with surfactants was shown to be 8 times higher than that of the material that had been on the market longer. However, as indicated by the authors, use of viscosities other than putty could impact the outcome, and evaluators were not blinded to the type of material. In another clinical study, impressions made by experienced clinicians in an Austrian dental school were rated as perfect, acceptable, or unacceptable. No materials were compared; rather, the percent of impressions deemed perfect or acceptable were reported, and factors associated with unsuccessful impressions, such as type and depth of the finishing line, were described. The success rate reported was 97%, and, although this was not specified, only the first impression made for a particular patient was evaluated (U. Beier, Dr med Dent, personal written communication, July 3, 2009). Another clinical trial also documented that finish line location significantly affected impression success, as did a survey, and this was a common finding for impressions reaching dental laboratories. In addition, it was shown that experienced clinicians generated significantly fewer bubbles when injecting a medium-bodied VPS impression material than did third- and fourth-year dental students. A search of the literature did not reveal a clinical trial aimed at comparing success rates for VPS and PE systems.

For impressions involving 1 to 2 prepared teeth in the same quadrant, the dual-arch impression tray is commonly used by US dentists. A large-scale survey was conducted to record preferences for static and dynamic mixing of VPS impression materials, but also documented impression tray preferences; 85% of the solicited 1505 general dentists and specialists responded. Results indicated that for this group, dynamic mixing was favored, and that 73% of the impressions evaluated were for single crowns, and 77% involved subgingival finline lines. Eighty-seven percent of the impression trays used were plastic, and dual-arch trays were used for 59% of impressions, full-arch stock trays for 18.9% of the impressions, and the balance (22.1%) were made with custom trays. In a clinical trial in which each subject received a full-arch and dual-arch impression of the same crown preparation, results indicated time and material savings for dual-arch trays, without loss of crown quality. In another clinical trial aimed at comparing custom complete arch, dual-arch metal, and dual-arch plastic trays, there were few clinically significant differences in the dimensions of working dies. Support for acceptable quality of single crowns made with dual-arch impressions was also offered by Small and in a review of impression materials and techniques.

Given the predominant use of the dual-arch tray in comparison to the full-arch tray, it is of interest to examine the impression success rates of PE and VPS by tray type. It is thought that material of putty (ISO type 0) or heavy (ISO type 1) consistency yields the best results when using a flexible dual-arch tray; however, one pilot clinical trial showed that the fit of fixed partial denture (FPD) frameworks was better when putty was used in a dual-arch tray compared to heavy-bodied material. Normally, the dual-arch tray is not indicated for FPD applications. Another clinical trial showed dual-arch trays produced the same casting fit as full-arch trays, but demonstrated better occlusion at crown placement.

The purpose of this study was to document the success rates of first impressions for PE and VPS impression systems, and to further analyze success rates for full-arch and dual-arch plastic impression trays. The research hypothesis was that there would be no difference in success rates for the 2 types of material and, secondarily, no differences between the 2 materials for each type of impression tray.

MATERIAL AND METHODS

The impression material systems evaluated were a polyether (PE) system, Impregum Penta Soft Heavy Body and Impregum Garant Soft Light Body (3M ESPE, St. Paul, Minn), and a vinyl polysiloxane (VPS) system, Aquasil Ultra Monophase and Aquasil Ultra XLV (Dentsply Caulk, Milford, Del). The tray materials were designated as ISO type 1 for PE and type 2 for VPS, and both low viscosity materials (Impregum Garant Soft Light Body and Aquasil Ultra XLV) were designated as ISO type 3 materials. The VPS and PE impression systems were available for student use in the predoctoral Restorative Dentistry Clinic at the University of Washington for several years before commencement of this study.

Before gathering data, approval for this study was obtained from the Division of Human Subjects at the University of Washington. Impressions were only made by fourth-year dental students at the University of Washington School of Dentistry. The impression technique and materials did not differ from those normally used in the predoctoral clinic. Treatment planning guidelines for crowns and FPDs did not differ from previ-
ously established protocols, and clinical procedures did not vary. However, each senior student alternated impression systems for each new patient enrolled. In other words, one impression system was used for a particular subject, and the other system was used when the student made the next impression for the following subject. Only the first impression attempt for each new patient was evaluated for this study. The material used for the first study impression was assigned to students alphabetically, whereby half of the students commenced with VPS and the other half began with PE. Succeeding impressions alternated between PE and VPS.

Gingival displacement and impression techniques were consistent with those described by Perakis et al. Gingival displacement involved the use of 2 braided cords (Ultrapak Cord; Ultradent Products, Inc, South Jordan, Utah); the first cord remained in the sulcus at the time the impression was made. A 1-step, dual-viscosity impression technique was always used, whereby an ISO type 2 medium-bodied (VPS) or type 1 heavy-bodied material (PE) was placed in the impression tray and a low viscosity material (ISO type 3) was injected onto the prepared tooth or teeth. The Impregum Penta Soft Heavy Body material was dispensed with the Pentamix 2 dynamic mixer (3M ESPE), and all other materials were mixed using static impression mixers from cartridges. Either a full-arch, perforated, rigid plastic impression tray (President Tray; Coltène Whaledent, Inc, Cuyahoga Falls, Ohio) or a plastic dual-arch tray (Tri-Bite; Tri-Bite Dental, Inc, Milwaukee, Wis) was used, depending upon the clinical indication and dental school protocols (Fig. 1). The dual-arch impression technique was reviewed by other investigators. Tray adhesive was used only with the full-arch trays.

Impressions selected for evaluation were those for any anterior or posterior tooth for which a complete veneer gold (FGC) or metal ceramic crown (PFM) or FPD was planned. Impressions were also included for all-ceramic crowns (CER). To use the same basis for determining success rates for the 2 impression systems, only the first impression made for a particular patient (such as crown preparation or multiple preparations) was evaluated. Impression trays used for “first impressions” were marked to avoid confusing them with additional impressions made for the same patient when indicated. The evaluation of each first impression was conducted by 1 of 4 prosthodontists who comprised the Restorative Dentistry Quality Control group. This system of quality assessment was already in operation at the University of Washington for several years before the commencement of the study, with the purpose of monitoring and controlling quality of all outgoing and incoming dental laboratory work. It is known that dental laboratories receive impressions from clinicians which are unacceptable, and this internal quality control system has the advantage of intercepting such laboratory work before it is sent to the dental laboratory, and is used for counseling clinical students.

Each impression was evaluated based on criteria developed to assess clinical success. (Table I). The evaluation is consistent with evaluations normally conducted by supervising clinical faculty and then by Quality Control, but was prepared in written form for this study. The assessment focused only on features that determine success or failure of an impression. Examiner training and calibration were conducted to develop impression rejection criteria and to establish consistency among the 4 evaluators. The observed percent agreement and the kappa statistic (k) were used to summarize the agreement among evaluators.

The design was a controlled, prospective clinical trial. Based on estimates of statistical power using data from a clinical pilot study and through communication with the sponsor, agreement was reached on a sample size of at least 75 impressions (VPS ≥75, PE ≥75), for a total of at least 150 impressions. This was estimated to yield 71% to 89% power to detect a 15- to 20-point difference in success rates (50% versus 70%), based on a 2-sided chi-square test at a significance level of .05, to test the primary null hypothesis: that the first impression success rate for VPS is equal to that of PE. The sample size was recalculated after 160 study impressions were evaluated, and a much smaller difference in the success rates was observed (10-point difference) than that observed in the pilot study. It was determined that a total of 1000 impres-
**Table I.** First impression evaluation data sheet. Primary outcome analyzed was presence or absence of “critical defects” as indicated with no or yes for prepared tooth

<table>
<thead>
<tr>
<th>Subject Number:</th>
<th>Operator Number:</th>
<th>Date:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>mo ____ / day ____ / year ____</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Material</th>
<th>Vinyl polysiloxane</th>
<th>Polyether</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tray</td>
<td>Full arch</td>
<td>Dual arch</td>
</tr>
<tr>
<td>Evaluator</td>
<td>1</td>
<td>2</td>
</tr>
</tbody>
</table>

**“First Impression” Evaluation**

<table>
<thead>
<tr>
<th>Tooth #</th>
<th>Fine die trim</th>
<th>No</th>
<th>Yes</th>
<th>No</th>
<th>Yes</th>
<th>No</th>
<th>Yes</th>
<th>No</th>
<th>Yes</th>
<th>No</th>
<th>Yes</th>
<th>No</th>
<th>Yes</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Crown type</td>
<td>FGC</td>
<td>PFM</td>
<td>CER</td>
<td>FGC</td>
<td>PFM</td>
<td>CER</td>
<td>FGC</td>
<td>PFM</td>
<td>CER</td>
<td>FGC</td>
<td>PFM</td>
<td>CER</td>
</tr>
<tr>
<td>Critical defects</td>
<td>No</td>
<td>Yes</td>
<td>If Yes, type/ error</td>
<td>No</td>
<td>Yes</td>
<td>If Yes, type/ error</td>
<td>No</td>
<td>Yes</td>
<td>If Yes, type/ error</td>
<td>No</td>
<td>Yes</td>
<td>If Yes, type/ error</td>
<td></td>
</tr>
<tr>
<td>1. Finish line</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. Axial surface</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. Occlusal surface</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. Other surfaces</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Comments:**

**Type of critical defects:**
1. Local bubbles(s) - small void(s)
2. Large void/defect
3. Blend of material
4. Tear
5. Distortion (pull, flow)
6. Lack of polymerization
7. Lack of adaptation of material
8. Other

**Operator error:**
a. Inadequate amount of material
b. Improper seating of tray
c. Incorrect tray selection
d. Retraction cord/cotton roll covering margin
e. Inadequate gingival displacement
f. Poor moisture displacement
g. Other

...
If imbalances were present, the relevant factors were controlled in the above logistic regression analysis by including these factors as additional independent variables in the logistic regression model. The alpha level was .05 for all comparisons.

**RESULTS**

The results for examiner agreement are provided in Table II. The examiner agreement was 92% for detecting a finish line defect, 94% for an axial surface defect, and 87% for detecting a critical defect on another surface. The kappa values indicate the evaluators had good to excellent agreement for detecting a particular type of critical defect (kappa ≥0.75).

A total of 221 impressions were received for evaluation, involving 270 teeth prepared for crowns. Fifty-two percent (n=116) were made using VPS, and 48% (n=105) were made using PE. The impressions were made for a total of 191 subjects; 166 subjects had only 1 impression, 21 subjects had 2 impressions, 3 subjects had 3 impressions, and 1 subject had 4 impressions made. The impressions were made by 50 student clinicians, with a range of 1 to 10 impressions per clinician. The primary analysis compared the rate of success of first impressions between the 2 systems. The reduced data set consisted of 191 impressions, with n=103 (54%) impressions made with VPS and n=88 (46%) impressions made with PE.

The 2 impression systems were evenly distributed for each evaluator. Two evaluators examined 21% and 22% of the impressions, a third evaluated 41%, and the fourth evaluated 12% of the impressions. Of interest is that 61% of the impressions were made using a dual-arch tray, with which both arches are captured in a single impression. Only 7% of the impressions were sent to the dental laboratory with a request to return definitive casts for a fine die trim. With trimming, a determination was made as to whether the laboratory work could proceed with the existing impression. Regarding types of crowns placed, 29% were complete gold, 70% metal ceramic, and 1% ceramic. Eighty-one percent of the impressions were made for single units and 19% (37/191) were made for multiple units, and of these, 2 units were the predominant situation (35/37), such as 2 abutment crowns for a 3-unit FPD or 2 individual crowns.

VPS impressions were successful 61% of the time (95% CI, 50-71%) compared to 54% for PE (95% CI, 43-65%), for a difference of 7% with a corresponding 95% confidence interval of -8% to 22% (P=.39; GEE logistic regression). Additional logistic regression analyses (Table III), which adjusted for potential confounders such as evaluator (1, 2, 3, or 4), number of units/teeth per impression (1 or >1), tray (full arch or dual arch), die trim (yes or no), and crown type (FGC, PFM, or CER), did not indicate a difference between the 2 materials (P=.35; GEE logistic regression).

Given that not all operators used both materials, an additional logis-

<table>
<thead>
<tr>
<th>Defect Location</th>
<th>Mean Percent Agreement</th>
<th>Kappa Statistic (κ)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Finish line</td>
<td>92%</td>
<td>0.75</td>
</tr>
<tr>
<td>Axial surface</td>
<td>94%</td>
<td>0.97</td>
</tr>
<tr>
<td>Occlusal surface</td>
<td>100%</td>
<td>–</td>
</tr>
<tr>
<td>Other surface</td>
<td>87%</td>
<td>0.87</td>
</tr>
</tbody>
</table>
Table III. Odds ratios and 95% confidence intervals for successful impressions (vinyl polysiloxane versus polyether)

<table>
<thead>
<tr>
<th>Method</th>
<th>Odds Ratio</th>
<th>95% CI</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>All first impressions</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No adjustment for confounders</td>
<td>1.3</td>
<td>0.7-2.4</td>
<td>.39</td>
</tr>
<tr>
<td>Adjustment for confounders¹</td>
<td>1.3</td>
<td>0.7-2.6</td>
<td>.35</td>
</tr>
<tr>
<td>Within-operator comparison of materials²</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No adjustment for confounders</td>
<td>1.2</td>
<td>0.6-2.3</td>
<td>.55</td>
</tr>
<tr>
<td>Adjustment for confounders¹</td>
<td>1.2</td>
<td>0.6-2.5</td>
<td>.54</td>
</tr>
</tbody>
</table>

¹Adjusted for evaluator, number of teeth per impression, tray, die trim, and crown type.
²Comparison restricted to operators who used both materials.

2. Polyether impression of prepared molar, made during clinical trial, exhibiting 2 critical defects due to “local bubble(s)-small void(s)” located on distal and lingual finish lines. Larger bubble on mesiolingual, slightly gingival to finish line, was not rated as critical defect. Had this been sole area of concern, “fine die trim” would have been stipulated to examine working die for acceptability.

3. Vinyl polysiloxane impression made during clinical trial which shows acceptable impression of prepared molar, but critical “large void-defect” on mesial finish line of premolar.

tic regression analysis was performed that removed potential operator confounding by doing a within-operator comparison of the materials; this analysis compared the materials only between operators that used both treatments (Table III). The within-operator comparison did not indicate a difference between the 2 materials (P= .54; GEE logistic regression). An additional logistic regression analysis using all impressions (allowing multiple impressions from the same subject) provided results similar to the primary analysis. The success rate of VPS was 61% versus 55% for PE (P=.44; GEE logistic regression).

The most common critical impression defect was located on the finish line (39% of the impressions, or 75/191; 94% of failures, or 75/80). The second most common location for a critical defect was on the axial surface (6% of the impressions, or 11/191; 14% of the failures, or 11/80). The 2 most common types of finish line defects (25%, or 48/191) were “local bubble(s)-small void(s),” as shown in Figure 2, and a “large void-defect,” with an example of such in Figure 3. The most common type of operator error was “inadequate gingival displacement” (15%, or 29/191), as shown in Figure 4.

Success rates by tray selection, evaluator, and number of teeth in an
Polyether impression made during clinical trial which illustrates most common type of operator error, “inadequate gingival displacement.” Portion of distal finish line was not captured in impression.

**Table IV.** Success rate for polyether and vinyl polysiloxane by type of impression tray used, number of teeth per impression, and evaluator

<table>
<thead>
<tr>
<th>Tray type</th>
<th>Combined</th>
<th>Vinyl Polysiloxane</th>
<th>Polyether</th>
<th>P^1</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n</td>
<td>Percent Successful</td>
<td>n</td>
<td>Percent Successful</td>
</tr>
<tr>
<td>Full arch</td>
<td>75</td>
<td>49%</td>
<td>44</td>
<td>50%</td>
</tr>
<tr>
<td>Dual arch</td>
<td>116</td>
<td>64%</td>
<td>59</td>
<td>70%</td>
</tr>
<tr>
<td>Number of prepared teeth/impression</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>184</td>
<td>59%</td>
<td>80</td>
<td>65%</td>
</tr>
<tr>
<td>&gt;1</td>
<td>37</td>
<td>54%</td>
<td>23</td>
<td>48%</td>
</tr>
<tr>
<td>Evaluator</td>
<td>1</td>
<td>62%</td>
<td>22</td>
<td>68%</td>
</tr>
<tr>
<td>2</td>
<td>41</td>
<td>44%</td>
<td>22</td>
<td>50%</td>
</tr>
<tr>
<td>3</td>
<td>85</td>
<td>61%</td>
<td>45</td>
<td>64%</td>
</tr>
<tr>
<td>4</td>
<td>23</td>
<td>65%</td>
<td>14</td>
<td>57%</td>
</tr>
</tbody>
</table>

^1 P values shown are from GEE logistic regression analysis to test for differences between 2 materials.

impression are given in Table IV. There was little difference in success rates between materials when a full-arch tray was used (50% versus 48% success, P= .89), whereas a relatively large difference was apparent with use of the dual-arch tray with VPS (70% success) versus PE (58% success) (P= .21), as shown in Table IV. Although trends are evident, no differences between materials by tray type were statistically significant. For a single prepared tooth in an impression, a higher success rate was observed with VPS (65% versus 48%, P= .16), and may be due to the preference for a dual-arch tray under these circumstances. Conversely, there was a higher success rate with use of PE (64% versus 48%, P= .37) when more than a single prepared tooth was being captured in an impression. As before, trends were apparent, but differences were not statistically significant.

The overall acceptance rates for 3 evaluators were 61-65%, with 1 evaluator at 44%. The examiner calibration was good at the commencement of the study, but some variation developed among evaluators during the course of the study. Since 3 of the 4 evaluators (1, 3, 4) exhibited similar acceptance trends for the 2 materials...
(that is, no interaction), there is little concern that the overall results were affected with the lower success rate of evaluator 2. These 3 evaluators account for 88% of all the impressions evaluated, so the “interaction by material” evident with evaluator 2 is of minor concern (Table IV).

DISCUSSION

The primary purpose of this study was to compare the first impression success rates of VPS and PE impression systems for senior dental students at the University of Washington. It is clear from this study that one material was not shown to be superior to the other; thus, the primary hypothesis was accepted. But it is also apparent that within the University of Washington Dental School student clinics, there was a trend for greater success with the VPS system compared to PE when the dual-arch impression trays were used. With the use of full-arch trays, the success rates for VPS and PE were similar.

In a study of 2 different 1-step VPS putty and light systems with third-year dental students as clinicians,8 the first impression success rate was 92% for a newer system containing nonionic surfactants, whereas it was 60% for the older system without wetting agents. Such a large difference arising from the presence of surfactants in the newer impression material is unusual, and a first impression success rate of 92% is nearly inexplicable for third-year dental students. A minimum of 144 subjects per group was planned, but the trial was terminated with 65 subjects enrolled in each treatment group when an interim analysis indicated that a distinct difference in success rates between the 2 groups existed. Had the planned sample size of 144 been attained, the success rates for the 2 systems may have been different.8 The authors also stated that evaluators were not blinded to the type of material, and cautioned that the use of tray consistency other than putty may yield different results.

The percentage of successful first impressions associated with the material without surfactants was 60%, which is near the overall success rate observed in the current study.

The impression success rates for student clinicians are lower than for experienced clinicians, but studies of first impression success rates in private practices are few in number. An overall first impression success rate of 97% for experienced clinicians was published in one such trial. In another clinical trial, experienced clinicians produced significantly fewer bubbles in impressions when injecting low viscosity material than did dental students. Senior dental students are somewhat experienced, but not nearly as experienced in making impressions as most clinicians. Although not documented in the present study, but generally recognized, the clinical situation for making impressions is often difficult in the dental school environment. This is because many individuals who seek dental school treatment have neglected dental care for some time and present with significant loss of tooth structure. After initial disease control, including periodontal therapy, more definitive restorative procedures are planned. This often includes placement of extensive foundation restorations followed by tooth preparation for crowns and fixed partial dentures. In many of these situations, the impression must capture a portion of the preparation finish line that is deep subgingivally and, therefore, a challenge for making a successful impression. This trend has been documented by others.5,9,10,13 However, the training of dental students for these procedures is given emphasis at the University of Washington, and student clinical experience is extensive; the mean number of crown and FPD units placed per student for this particular senior class was 28.6 at the time of graduation. One final reason for the success rates shown is that high standards are maintained and enforced in a succession of controls; the impression is first examined by the dental student, then the supervising faculty member, and, finally, by the independent quality control team. Impressions of questionable quality are uniformly rejected, and that may not always be the situation clinically.15,24

Most of the critical defects of impressions were observed on the finish line of the preparation. Forty percent of the failures demonstrated finish line defects. Almost by instinct, this is the area of a newly made impression that clinicians examine first to determine acceptability, since it is generally concluded that this is the area most critical to clinical success.24 If this area is not distinct in the impression, good fixed prosthodontic practice would dictate a remake of the impression and, in some situations, a modification of preparation detail before making a new impression. When it was possible to determine if operator error may have contributed to a critical defect, the single item most often cited in this study was inadequate gingival displacement. The percentage likely would be lower with experienced clinicians.

Students preferred the use of a dual-arch impression tray (61%) compared to a full-arch tray (39%), and this result is consistent with published data for North American dentists.11 Perhaps the most unexpected result was that the success rate differed between the 2 materials when the dual-arch tray was used, but not for the full-arch tray. This is somewhat difficult to explain, but the tray consistency of Aquasil Ultra Monophase may be better suited for the dual-arch tray with limited side support (Fig. 1), compared to Impregum Penta Soft HB. However, the sides of the plastic full-arch tray are more extensive and support the impression material to a greater extent. Although classified as an ISO type 1 viscosity, a rheology study demonstrated that Impregum Penta Soft HB was much more liquid-like (higher tan δ) than the ISO type 2 medium-bodied VPS (Aquasil Ultra Deca; Dentsply Caulk) at the time of initial mixing.22 Thus, Impregum Pen-
ta Soft HB would be less capable of holding its shape in a dual-arch tray with minimal side support, compared to the full-arch tray. Regarding low viscosities, the same study showed that Impregum Garant Soft LB was significantly more liquidlike than Aquasil XLV immediately after mixing. Thus, the viscosity combination for the VPS used in the student clinics (Aquasil Ultra Monophase and XLV) may be better suited for avoiding the creation of voids and bubbles on the finish line when using a dual-arch tray than the combination of Impregum Penta Soft HB and Garant Soft LB. Further investigation is needed to understand the reasons for this.

A limitation for some might be that the same ISO type 2 medium viscosity21 VPS material was used in the tray whether a dual-arch or full-arch impression was made. This protocol was in effect in the student clinic for several years with success, and was continued for the study so as to not change standard procedures. Manufacturers and authors have recommended use of a heavy or putty consistency for the tray when making dual-arch impressions, especially when a flexible plastic tray is used.16 Results from a pilot study and a clinical trial supported the use of putty over a heavy consistency material19,20 but another clinical trial showed accuracy comparable to a custom tray when an ISO type 1 heavy consistency was used.3 Unlike these past clinical trials, accuracy was not assessed in this present clinical study since that was not an objective, nor relevant, since only “first impression” attempts were evaluated to standardize the study design. A limitation previously discussed was the use of senior dental students as clinicians. However, these students had extensive experience with both VPS and PE, whereas experienced clinicians tend to use only one type of material. Another limitation was that the sample size attained, over 100 impressions per material, was able to show trends but could not detect statistically significant differences. An advantage of clinician-based research is achieving a high sample size in a shorter period of time and in a more representative setting. However, much greater emphasis would be needed to standardize procedures among clinicians in private practice than was necessary for seniors in the dental school setting. Another limitation was that the material selection (PE versus VPS) was not based on a randomization scheme; rather, the clinician alternated the material with each new patient enrolled. Similarly, it was not possible to randomize the use of the dual-arch and full-arch plastic trays, since the former could only be used in certain clinical situations. It was also not possible to control for the type of restoration, type of preparation, and number and location of prepared teeth.

CONCLUSIONS

A controlled, prospective clinical trial was conducted involving 50 senior dental student clinicians at the University of Washington School of Dentistry, with the aim of comparing success rates of VPS and PE crown and FPD impression systems using full-arch and dual-arch plastic trays. Using a standardized evaluation of only the first impression made for a given situation, the success rate was 61% when a VPS dual-visibility system was used and 54% when the PE dual-visibility system was used. Statistically, a difference could not be shown between these 2 rates of success (P=.39); however, a trend was evident with greater impression success in the dental school environment when the VPS system was used. This trend was most apparent with use of dual-arch impression trays (70% versus 58%) and not evident when using full-arch trays (50% versus 48%). For single teeth, the trend favored VPS (65% versus 53%), but in situations involving more than a single prepared tooth per impression, the success rate was higher for PE (64% versus 48%).

REFERENCES

Quality of impressions after use of the Magic FoamCord gingival retraction system-- A clinical study of 269 abutment teeth


Purpose: The aim of this study was to evaluate a new gingival retraction system relative to clinical success for fixed dental restorations under various clinical conditions.

Materials and Methods: Two hundred sixty-nine abutment teeth were evaluated. The ability to displace gingiva was indirectly measured by the quality of the final impression. Preparation finish line with respect to the crest of the marginal gingiva (Level I through III) and type of preparation finish line (ie, shoulder or beveled) were recorded. The reproduction of the preparation finish line and an absence of bubbles or voids (Criteria I through III) were assessed. The results were compared with an established retraction system using one retraction cord.

Results: Of the 269 impressions evaluated, 93.7% were clinically acceptable and showed complete reproduction of the preparation finish line; 17.5% showed small defects but the impressions were still rated clinically acceptable and categorized as Criteria II. Only 6.3% of the impressions were unacceptable and categorized as Criteria III. A significant influence on the quality of the impressions was found when the preparation finish line was more than 2 mm subgingivally for shoulder (P < .004) as well as beveled preparations (P < .004). Nearly twice as many impressions were rated Criteria III when using the Magic FoamCord (MFC) system compared to impressions done with the single cord retraction technique.

Conclusions: In cases of epigingival and subgingival (< 2 mm) preparation margins, MFC was a less traumatic alternative method of gingival retraction. However, when there were deep subgingival margins and a beveled preparation, the material was less effective than the single cord retraction technique.

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