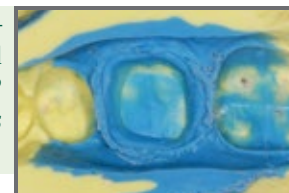




Impression Materials—Update 2019

Gordon’s Clinical Observations: Digital impressions from intraoral scanners are rapidly increasing in popularity—but alginate, VPS, and polyether impressions still dominate dentistry. VPS has been used in dentistry since 1976, and polyether for about the same time. Are the newer materials improved? Which is best for fixed or removable prosth? Are they equally accurate? Can they be disinfected without distortion? *In this report, CR scientists and clinicians provide the answers and product comparisons for you.*



A good impression should clearly capture all margin details without voids, rips, or distortions.

Current impression materials are very accurate and clinical success is possible with virtually any brand. Impression defects are usually related to technique problems rather than material shortcomings. The most commonly used materials for a wide variety of impression purposes are:

- VPS (vinyl polysiloxane)
- Alginate
- Polyether

Other types of materials—including VPES (vinyl polyether silicone), condensation silicone, polysulfide, reversible hydrocolloid, and zinc oxide eugenol—are also common, but used to a lesser extent. **The following report shows current trends with impressions, compares VPS material properties, and provides clinical tips.**

Current Trends in Impression Making

A recent CR survey of clinicians indicated the following (n=940):

- **Common problems:** 63% of clinicians reported no frequent problems with impression materials. **The most frequently cited problems were generally related to improper techniques**—voids (14%), distortions (10%), missing detail (8%), etc. See “Foolproof Techniques for Optimum Impressions,” *Clinicians Report March 2015*. Common material problems were poor taste (8%) and slow set (5%).
- **Types of materials (or equipment) used regularly:** VPS 90%; Alginate 54%; Intraoral scanner 24%; Polyether 23%; Others 6%
- **Popular brands:** Alginate (of various brands) 29%; Aquasil Ultra+ 27%; Impregum 19%; Imprint 18%; EXAFLEX/EXAMIX/EXAFLEX 10%; Panasil 5%; Permadyne 5%; Cinch 4%; Splash! Max 4%; Flexitime 4%; Genie 4%; plus 48 additional brands reported
- **Technique used most frequently:** Dual-viscosity (simultaneous heavy- and light-body) 69%; Intraoral scanner 17%; Single-viscosity/monophase 10%; 2-step hydraulic 4%
- **Overall satisfaction:** Excellent 81%; Good 19%

Digital impressions: Intraoral scanners simplify and expedite digital workflows (CAD/CAM), and resulting restorations are well proven to have adequate clinical fit. Conventional impression materials continue to be used, and most labs scan the cast or impression. Conventional materials capture greater detail than scanning and are superior for many situations, including sub-gingival margins, seeping blood, loose soft tissue, etc.

VPS Material Comparison

VPS dominates impressions made for indirect restorations. CR tested 16 brands of VPS, 1 VPES, and 1 polyether shown in the table below. Numerous additional brands are available. Light-body, fast-set materials were tested; other viscosities and setting times are available in each brand to meet clinical requirements.

Principle characteristics evaluated included:

- Cost
- Color and seeing detail
- Dispensing
- Flow
- Hydrophilicity
- Tear strength
- Recovery from deformation
- Dimensional accuracy
- Detail reproduction in stone

All materials exhibited excellent recovery from deformation ($\geq 99.0\%$), excellent dimensional accuracy ($\geq 99.6\%$), and excellent detail reproduction ($\leq 20 \mu\text{m}$ features). The table shows characteristics where major differences were noted.

Brand Company	Type	Colors	Approximate Cost of Dual-Arch Quadrant Impression (per ml)	Flow of Light-Body Material	Hydrophilicity (water contact angle)	Tear Strength (force)	Overall Rating
Aquasil Ultra+ Dentsply Sirona	VPS		\$8.40 (57¢/ml)	14.5 mm	47°	32 N	Excellent (93.8)
Reflection Patterson	VPS		\$5.90 (37¢/ml)	14.8 mm	52°	19 N	Excellent (91.0)
Flexitime Kulzer	VPS		\$8.60 (59¢/ml)	12.3 mm	34°	11 N	Excellent (90.1)
Take 1 Advanced KaVo Kerr	VPS		\$9.50 (66¢/ml)	12.8 mm	48°	13 N	Excellent (89.5)
Virtual XD Ivoclar Vivadent	VPS		\$9.20 (64¢/ml)	11.2 mm	56°	19 N	Excellent (89.4)

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VPS Material Comparison (Continued)

Brand Company	Type	Colors	Approximate Cost of Dual-Arch Quadrant Impression (per ml)	Flow of Light-Body Material	Hydrophilicity (water contact angle)	Tear Strength (force)	Overall Rating
Splash! Max Denmat	VPS		\$6.50 (42¢/ml)	9.4 mm	63°	22 N	Excellent (87.7)
EXAFast NDS GC America	VPS		\$6.40 (41¢/ml)	11.0 mm	48°	13 N	Excellent (87.3)
Imprint 4 3M	VPS		\$9.30 (65¢/ml)	11.1 mm	65°	22 N	Excellent (87.1)
Thermo Clone Ultradent	VPS		\$6.50 (42¢/ml)	9.6 mm	57°	16 N	Excellent (86.0)
AFFINIS Coltene	VPS		\$10.10 (71¢/ml)	11.4 mm	67°	15 N	Excellent–Good (85.2)
Vaccu-sil Ho Dental	VPS		\$5.40 (25¢/ml)	8.7 mm	69°	18 N	Excellent–Good (84.8)
Correct Plus Pentron	VPS		\$5.80 (36¢/ml)	9.3 mm	70°	17 N	Excellent–Good (84.7)
Genie Sultan Healthcare	VPS		\$6.20 (39¢/ml)	9.6 mm	76°	19 N	Excellent–Good (84.5)
First Quarter Zest Dental Solutions	VPS		\$7.80 (52¢/ml)	4.6 mm	76°	22 N	Excellent–Good (81.5)
Cinch Parkell	VPS		\$4.90 (29¢/ml)	5.5 mm	90°	16 N	Excellent–Good (80.4)
VP Mix HP Henry Schein	VPS		\$4.70 (19¢/ml)	6.3 mm	82°	12 N	Excellent–Good (80.1)
EXA'lence GC America	VPES		\$9.80 (69¢/ml)	9.8 mm	55°	31 N	Excellent (88.4)
Impregum Soft 3M	Polyether		\$10.60 (75¢/ml)	14.5 mm	23°	8 N	Excellent (90.3)

Summary of Testing:

- **Cost:** Approximate retail price varied from \$0.19 to \$0.75 per milliliter. Cost did not always correlate with other characteristics, and **economically priced materials often had similar features as premium materials.**
- **Flow:** Distance of flow related to the viscosity and consistency of the material. Materials with high flow potentially penetrate restricted spaces further to capture more detail. **Flow steadily decreased over time from the start of mix**, well before the development of elastic properties that signal the end of working time. **Trays should always be seated as quickly as possible for optimum flow.**
- **Hydrophilicity:** A smaller water-contact angle (*greater hydrophilicity*) potentially allows better adaptation to moist oral tissues for greater detail capture.
- **Tear Strength:** Higher tear strength improves integrity of thin structures when impression is removed from the mouth. Tear strength did not necessarily correlate with elasticity or firmness of the materials.
- **Overall Rating:** Eight clinically significant characteristics were scored and weighted with an emphasis on accuracy and reliability. All brands tested performed well and were clinically adequate. If clinician's current impression materials provide accurate results, then there is no compelling reason to change. Data shown in the table can guide clinicians seeking to improve specific characteristics. In this study, the three materials with the highest overall ratings were Aquasil Ultra+ (*Dentsply Sirona*), Reflection (*Patterson*), and Flexitime (*Kulzer*). Aquasil Ultra+ was notable for its combination of high flow, hydrophilicity, and high tear strength in its XLV light-body material.



Flow test samples



Hydrophilicity test samples

Clinical Tips

- **Impression disinfection:** **Impressions should be disinfected before being sent to lab.** CR research has shown that VPS, polyether, and VPES materials tolerate 10-minute contact with glutaraldehyde, Lysol spray, Cavicide spray, or bleach spray with less than 0.3% dimensional distortion. Steam autoclaving is also possible, but only if the impression tray tolerates heat without distorting. Disinfection of alginate impressions resulted in loss of detail.
- **Stability over time:** CR research showed that VPS and VPES materials can maintain dimensional accuracy for years, and polyether for weeks to months. Alginate, if stored sealed with moisture, can remain accurate for a few days.
- **Immediate pour up:** In some situations it may be necessary to immediately pour up a VPS impression. Outgassing from the material can cause porosity in the stone cast. Materials that produced no porosity when poured up 10 minutes following mix were Impregum Soft (*polyether*), AFFINIS, Cinch, EXAFast NDS, and Thermo Clone. **Most materials specify waiting at least 30 minutes before pouring up.**
- **Best materials for removable prosthodontics:** High flow and hydrophilicity are desirable for capturing soft-tissue detail. Example brands include Impregum Soft (*polyether*), Aquasil Ultra+, Reflection, Flexitime, and Take 1 Advanced.



Porosity in stone due to immediate pour up

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Clinical Tips *(Continued)*

- **Combining different brands:** **Mixing brands is generally discouraged.** CR research showed that combining different brands of VPS and VPES materials was successful for both 1-step and 2-step impression techniques. Combining polyether and VPS materials always resulted in incomplete polymerization and lack of adhesion between the different materials.
- **Scanning impressions:** Impressions can be challenging to scan because of glossy reflective surfaces, color, and hidden details. CR research showed that Flexitime (*Kulzer*) was the easiest impression material to scan.

CR CONCLUSIONS: All impression materials evaluated were accurate and reliable when used with proper clinical technique. VPS is the most widely used type of material, followed by alginate and intraoral scanning. Materials tested had excellent detail capture and accuracy, but differed in flow, hydrophilicity, tear strength, and cost. Materials with best combination of features were Aquasil Ultra+ (*Dentsply Sirona*), Reflection (*Patterson*), Flexitime (*Kulzer*), and Impregum Soft polyether (*3M*). Digital impressions continue to improve, but conventional materials remain the primary resource for most impression needs.



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Clinical Success is the Final Test

Clinicians Report® a Publication of CR Foundation®

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