Polishing of Denture Base Acrylic Resin with Chairside Polishing Kits: An SEM and Surface Roughness Study

Konstantinos Chatzivasileiou, DDS, MS[a]/Ioannis Emmanouil, DDS, Dr Dent[b]/
Eleni Kotsiomiti, DDS, Dr Dent[c]/Argirios Pissiotis, DDS, MS, Dr Dent[d]

Heat-cured acrylic resin specimens were polished using either conventional laboratory polishing, sandpaper, or three commercial chairside kits. The surface roughness of the polished specimens was measured with a contact profilometer. Scanning electron microscopy was used to obtain microphotographs of the polished surfaces. Laboratory polishing produced the smoothest surfaces in all cases, while sandpaper application produced the roughest. Use of the chairside polishing kits resulted in significantly rougher surfaces compared to those produced by laboratory polishing. Nonetheless, polishing of trimmed denture bases using chairside polishing kits is an effective alternative procedure for cases in which the laboratory procedure is not applicable. *Int J Prosthodont 2013;26:79–81. doi: 10.11607/ijp.3157*

Acrylic resin dentures are prone to the formation of denture plaque and the attachment and colonization of microorganisms. Denture plaque has been associated with various pathologic reactions (eg, denture stomatitis) because the plaque serves as a reservoir for infection.[1]

Compared to smooth intraoral surfaces, rough surfaces are significantly more vulnerable to bacterial accumulation and plaque formation. A roughness value of 0.2 μm is considered the threshold below which no further reduction in plaque accumulation is expected. Postinsertion adjustments of the denture base are frequently needed in clinical practice, and this process ultimately produces a rougher surface.

This study aimed to evaluate the effectiveness of three chairside polishing kits in producing smooth surfaces when applied to acrylic resin specimens.

[a]*PhD Student, Department of Removable Prosthodontics, Dental School, Aristotle University Thessaloniki, Thessaloniki, Greece.*
[b]*Assistant Professor, Department of Removable Prosthodontics, Dental School, Aristotle University Thessaloniki, Thessaloniki, Greece.*
[c]*Associate Professor, Department of Removable Prosthodontics, Dental School, Aristotle University Thessaloniki, Thessaloniki, Greece.*
[d]*Professor and Head, Department of Removable Prosthodontics, Dental School, Aristotle University Thessaloniki, Thessaloniki, Greece.*

Correspondence to: *Konstantinos Chatzivasiliou, Saggariou 2, Drama, 66100, Greece. Email: khatziv@gmail.com*

Materials and Methods

One heat-cured acrylic resin denture base material (Lucitone 199, Dentsply) was used to fabricate 48 specimens in a stainless steel mold. The specimens were stored at room temperature for 1 week in tap water, which was renewed daily. The specimens were then randomly divided into five groups according to the polishing system used:

1. A series of sandpapers with three grades of roughness (P260, P600, P800, Sungold Abrasives) applied in descending order of roughness.
2. The same series of sandpapers but followed by application of a polishing cream (Universal Polishing Paste, Ivoclar Vivadent) on a bristle brush at 3,000 rpm for 1 minute (control).
3. EVE chairside polishing kit (EVE).
4. NTI chairside polishing kit (NTI).
5. DMI chairside polishing kit (Orthodontics-DMI).

Each polishing step of the chairside kits was applied at four specimens for 1 minute at the speed recommended by the manufacturer. One operator polished all specimens by hand.

After polishing, a 10 × 10-mm piece of acrylic resin was cut out from two randomly selected specimens from each group for examination using scanning electron microscopy (JSM-840A, JOEL). Surface roughness of the acrylic resin specimens was measured using a contact profilometer (SJ-201, Mitityo). The surface roughness values calculated for the five applied treatments were statistically analyzed (one-way ANOVA and Tamhane test for post hoc comparisons, SPSS, v. 17, IBM).

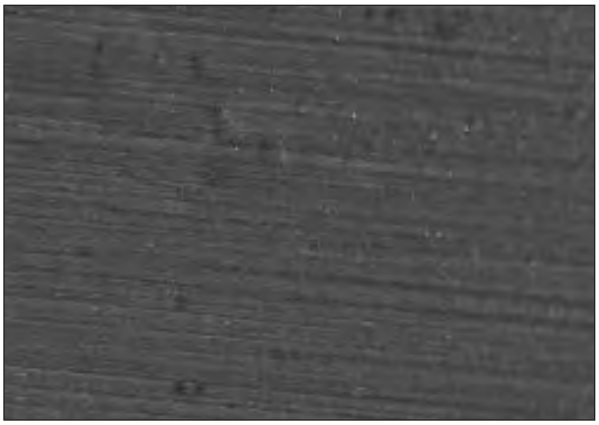

Fig 1 SEM image showing the surface of an acrylic resin specimen after polishing with the NTI chairside kit (original magnification ×500).

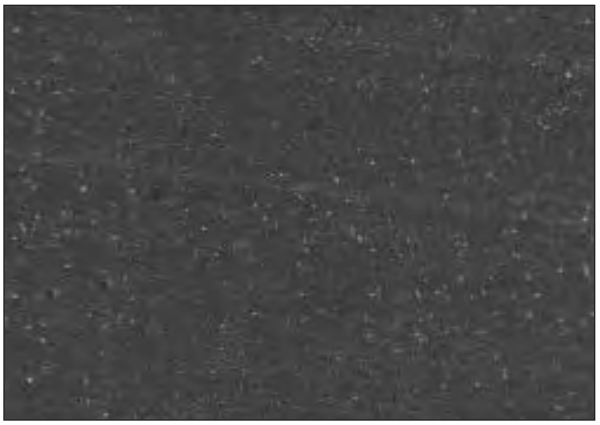

Fig 2 SEM image showing the surface of an acrylic resin specimen after laboratory polishing (original magnification ×500).

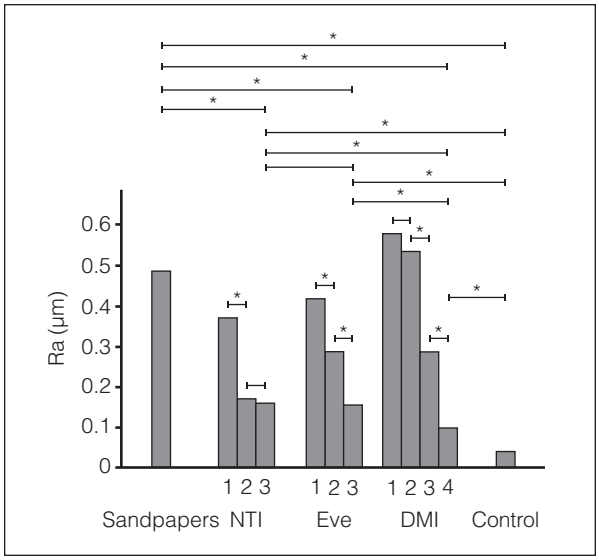

Fig 3 Mean surface roughness (Ra) of the five polishing methods. For the chairside kits, the surface roughness after each polishing step is shown. Lines with asterisks denote statistically significant differences.

Results

As observed under SEM, the laboratory polished surfaces were the most uniform, while the surfaces produced using the chairside polishing kits and sandpaper presented a gradually increasing number of scratches (Figs 1 and 2).

Based on the roughness values they produced, the polishing systems can be ranked from roughest to smoothest as follows: sandpaper, NTI, EVE, DMI, and laboratory polishing. All values differed significantly from each other except when comparing the values of the EVE and NTI kits. Laboratory polishing and all chairside kits produced roughness values significantly lower than the 0.2-μm threshold, whereas sandpaper polishing resulted in significantly higher values (Fig 3).

Discussion

Laboratory polishing produced the smoothest acrylic resin surfaces; therefore, it should be considered the method of choice. Nonetheless, the chairside polishing kits represent an effective alternative approach. They produced sufficiently smooth surfaces with roughness values well under 0.2 μm. Of the three chairside kits tested, the DMI kit produced the smoothest surfaces; however, this is likely of no clinical importance since all chairside kits led to roughness values below the threshold.

The clinical use of chairside polishing systems may be a convenient alternative to laboratory polishing after denture adjustments. It should be noted that higher roughness values may occur in clinical practice because the conditions in a dental office cannot be

controlled to the extent that they were in this study. It is also important to note that plaque retention is not entirely dependent on surface roughness. Many additional factors affect microbial adhesion, including the size of microorganisms,[2] phenotypic heterogeneity of microbial species,[3] environmental attributes of the oral cavity,[4] and presence of saliva.[5]

Conclusions

The following conclusions can be drawn from this study:

1. Laboratory polishing was the most effective method for reducing the surface roughness of acrylic resin.
2. The chairside polishing kits produced smooth acrylic resin surfaces, with roughness values under the threshold value of 0.2 μm.

Acknowledgments

The authors reported no conflicts of interest related to this study.

References

1. von Fraunhofer JA, Loewy ZG. Factors involved in microbial colonization of oral prostheses. Gen Dent 2009;57:136–143.
2. Taylor RL, Maryan C, Verran J. Retention of oral microorganisms on cobalt-chromium alloy and dental acrylic resin with different surface finishes. J Prosthet Dent 1998;80:592–597.
3. Luo G, Samaranayake LP. Candida glabrata, an emerging fungal pathogen, exhibits superior relative cell surface hydrophobicity and adhesion to denture acrylic surfaces compared with Candida albicans. APMIS 2002;110:601–610.
4. Samaranayake LP, Mccourtie J, Macfarlane TW. Factors affecting the in-vitro adherence of Candida albicans to acrylic surfaces. Arch Oral Biol 1980;25:611–615.
5. Pereira-Cenci T, Del Bel Cury AA, Crielaard W, Tencate JM. Development of Candida-associated denture stomatitis: New insights. J Appl Oral Sci 2008;16:86–94.

Literature Abstract

Oral piercing injuries treated in United States emergency departments, 2002–2008

This is a retrospective study that reported the epidemiology and clinical history of oral piercing-related injuries across all ages treated in US hospital emergency departments (ED). Data were obtained from the National Electronic Injury Surveillance System (NEISS) operated by the United States Consumer Products Safety Commission. The weighted data for 617 patients treated for oral piercing-related injuries in the NEISS network formed the basis of the national estimates reported in the study. During the 7-year period, an estimated 24,459 oral piercing-related injuries were presented to US EDs. Female patients accounted for 72% of the estimated ED visits. Patients aged between 14 and 22 years old accounted for 72% of the ED visits. Most common injuries involved the lips (46%), tongue (42%), and teeth (10%), while the predominant cause of injuries were infections (42%) and soft tissue puncture wounds (29%). The patient's inability to remove mucosally overgrown oral piercings accounted for 39% of ED visits. Hospitalization as a result of these injuries was rarely required (< 1%). Although this study found that ED visits resulting from oral piercing-related injuries seem to be relatively infrequent, the NEISS data only represents data presented to US EDs. As such, these national estimates do not account for individuals who do not seek medical attention or where services are rendered at other locations, such as medical or dental offices. Thus, estimates represented in the study may underestimate the true magnitude of the problem. The authors conclude that patients aged between 14 and 22 years were the most likely to present as US EDs with oral piercing-related injuries, while infections and mucosal overgrowth were the most common reasons for seeking treatment at EDs. Hospitalization accounted for less than 1% of cases.

Gill JB, Karp JM, Kopycka-Kedzierawski DT. *Pediatr Dent* 2012;34:56–60. **References:** 41. **Reprints:** Dr J Karp, Eastman Institute of Oral Health, University of Rochester Medical Center, Rochester, New York, USA. Email: jeff_karp@urmc.rochester.edu—*Teo Juin Wei, Singapore*