Colgate Sensitive Pro-Relief™ with Pro-Argin™ technology provides instant and long-lasting relief.

With regular use, it protects and prevents sensitivity from coming back. It also helps to strengthen gums and prevent gum recession, addressing a key cause of sensitivity.

For instant relief, apply the toothpaste directly to the sensitive tooth with a finger tip and massage gently for 1 minute up to twice a day.
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FROM THE EDITOR’S DESK

WELCOME BACK!! A warm welcome to this first quarter edition of our Journal. The festive season and its well-deserved break is a distant memory; we somehow managed to survive ‘Janu-worry’; February has come and gone, and here we are, standing tall in March! Bring on the rest of the year – and what a year it promises to be.

This year, 2018, OHASA celebrates its 40th anniversary! That’s 40 years of service, 40 years of commitment, 40 years of improving people’s lives through oral health. At the outset, I wish to pay tribute and laud all those involved in the success and longevity of our organisation. From our esteemed founders, to the executives, to the members, I salute your efforts and sacrifices that have enabled OHASA to grow from its fledgling years to what it is now – a voice and rallying call in the promotion of oral health.

In this edition and in subsequent ones, we shall embark on a ‘Remembrance of a Journey’. It is my contention that if we are to know where we are going, then we must know where we come from. We intend highlighting the development and growth of OHASA in our Journal, thereby empowering all of us with some of the history of OHASA. Such knowledge will aid in developing a consciousness of OHASA, it will develop the OHASA brand, re-establish the OHASA ‘culture’ and serve to make OHASA even more relevant to all in our profession. It is easy to sometimes feel alone and to question if what you do is actually important or relevant. By engaging in our organisation’s history, we have an inkling of the strife and struggle it must have been to establish OHASA and to maintain and sustain the organisation. Such an engagement will, I hope, engender a sense of belonging in all of us.

So where did it start? The story of OHASA is intrinsically linked with Mrs Irene Varley Pretorius (née Fourie) who was born on December 16, 1927 and who passed on the baton of hope, of service, into our hands. (Read more about this pioneer in this edition.)

The question we must each ask ourselves is, “How will history judge us?” Will future generations of OHASA pay tribute to our efforts or will they say we were the ones who dropped the baton? Only our actions will answer that question, and the action is to BE INVOLVED. Our profession and its standing in the realm of medicine has changed dramatically over the past few years. At tertiary level, the diploma has been replaced by the Degree in Oral Hygiene, expanding courses are readily available and our scope of functions has changed. OHASA has been instrumental in effecting these changes, as well as lobbying for expanded functions such incorporating local anaesthesia, splinting making, tooth whitening, sealant restorations and so forth. All these added expanded functions have served to broaden the oral hygienist’s horizon.

The Fourth Industrial Revolution is upon us and our profession is not immune to the undoubted changes it will bring. It may be daunting, it definitely is challenging but it also represents exciting and unique opportunities. Whatever the future holds, I am convinced of one thing: there is strength in the collective, in standing together to make a difference and having your voice heard. Ultimately, for all of us, the choice is a simple one. You can either stand on the side lines or be a spectator in your own life, immersed in a wallowing state of apathy or you can try to make a difference. You do not have to change the whole world, just make a difference to one life. Become an active citizen, an active health professional, an active Oral Hygienist, an active member of OHASA.

I ask you to join OHASA in proudly carrying the baton forged by the sacrifices of Mrs Irene Pretorius. I ask you to hold this baton aloft as Oral Hygienists and to positively respond to the rallying call of President Ramaphosa and say, “South Africa, SEND ME!”

Until next time, be safe and keep smiling. ●
FROM THE
PRESIDENT’S DESK

HAPPY 40TH ANNIVERSARY OHASA!
Welcome to our first quarter birthday edition of the journal.
I am truly honoured and proud to be serving you as president of the association. It feels just like yesterday, (24 years ago to be exact) that I qualified as an Oral Hygienist and sat at my first OHASA meeting, in awe of the then committee and president. OHASA is an association that has been through many challenges, changes and triumphs in the last forty years, which has only made us stronger, given our profession more credibility and ourselves as individuals more self-confidence. It is on this sound foundation, set by all our previous leaders, that we can move forward together and achieve even greater heights.

Stella, there are no words to express our thanks for what you’ve done for OHASA. With your guidance, and peaceful and loving demure, I hope to follow close in your footsteps. Thank you for being a wonderful example of leadership and person of good character.

MY GOALS FOR OHASA
1. I would like to see our profession become more visible to the public of South Africa. The public should know what an Oral Hygienist is and what the profession offers in terms of oral / dental prevention and health.
2. I want to strive to encourage all Oral Hygienists, who are not yet members, to join the association. The more voices we have the more powerful we can be. The message should be clear, OHASA represents all South African Oral Hygienists and the association is serious about the continuous growth and progress of our profession in an ethical and professional manner. The latest news and important industry information will be given to our members first, it’s important for non-members to join so they do not get behind or feel left out.
3. Acknowledge and recognise South African Oral Hygienists who make an impact in South Africa and around the world through research and representation. I hope this will encourage other colleagues to follow in their footsteps.
4. Encourage good working relationships between OHASA members and the students and staff of all the universities, SADA, dentists, specialists in the private and public sector, and even our colleagues in other disciplines including doctors and other health professionals.

MY GOALS FOR OHASA MEMBERS
1. Be proud to be an OHASA member through networking, learning and having fun at each seminar.
2. Be knowledgeable and stay updated on all the developments in the profession. Be ethically and legally correct.
3. Let’s guide and encourage other members to use all the technology available to them for better communication and development.
4. Participate (with the help of the branch committees) in as many activities as possible. The more you get involved, the more you’ll build confidence in yourself and in the profession.

CONGRATULATIONS
This first quarter edition will feature all our past presidents and a little OHASA history trivia. A big congratulations to all the new and re-elected committee branch members from Gauteng, Western Cape, Eastern Cape and KwaZulu-Natal. (They will be featured in our second quarter’s edition) As a member please get involved with your branch. The committee put in a lot of time and effort organising each meeting and seminar so please support them. Any suggestions are welcome.

DATES TO DIARISE
Apart from the already scheduled branch meetings there are a few CPD events available to you:

Gauteng
1. The 2018 SADA congress will be held in Pretoria at Menlyn Maine from 12-14 October 2018. The speakers have almost been finalised. As soon as I have the costs and programme I will mail it to our members. You have already received a teaser mail from the SADA CEO in this regard.
2. On Saturday 2 June 2018, the University of Pretoria will be having a full-day refresher course in “Dental Practice Management for Oral Health Professionals.” I will mail more details soonest.

WEBSITE
There is a lot of information posted regularly on our website and on Facebook. A BIG please, go on-line, at least once a week, (put it as a permanent fixture in your diaries) and browse through all the latest information and updates. Read the journal and complete the CPD questionnaire (you do not have to do it at once, you can log out and come back later without losing any information). If you can’t log on or have any other difficulty please feel free to contact one of your branch committee members, Stella Lamprecht or myself.

THANK YOU
I wish to thank all our Dental Traders for their continuous support and generous sponsorship. Their commitment and dedication to our association is always greatly appreciated.

MEMBERSHIP
The application forms are posted on our website. Your branch chair will also be able to mail it to you. The cut-off date, without penalties incurred, is 28 February 2018. The association would appreciate it if you would encourage your friends and colleagues in this profession to join us. We will benefit financially and in voice.

My challenge to everyone for 2018 is to find true happiness, fulfillment and peace by giving all of yourself to your loved ones, at work and to OHASA, without expecting anything back.

“The highest reward for your work is not what you get for it, but what you become by it”
– John Maxwell

Yours in unity
Angelique
**WALL OF FAME:**

**OHASA PAST PRESIDENTS**

<table>
<thead>
<tr>
<th>Year</th>
<th>President NAME</th>
<th>Date of Birth</th>
<th>Qualification</th>
<th>Address</th>
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<tr>
<td>1987-1989</td>
<td>Ms IK Kuhn</td>
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<td>Dip OH Stellenbosch</td>
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<tr>
<td>1991-1993</td>
<td>Ms Elize Oosthuizen</td>
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<td></td>
<td>Unknown</td>
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<td>1995-1997</td>
<td>Ms Meloshni Govender</td>
<td>30/11/1990</td>
<td>BOH University</td>
<td>Durban-Westville</td>
<td>Australia</td>
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<td>2000-2005</td>
<td>Ms Marie Ferreira</td>
<td>13/06/1973</td>
<td>Dip MH Stellenbosch</td>
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<tr>
<td>2006-2011</td>
<td>Ms Elizabeth Schutte (vd Ham)</td>
<td>01/01/1977</td>
<td>Dip MH Stellenbosch</td>
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</tr>
<tr>
<td>2012-2017</td>
<td>Ms Stella Lamprecht</td>
<td>08/11/1979</td>
<td>Dip OH UP</td>
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</table>
A TRIBUTE TO IRENE PRETORIUS
FIRST PRESIDENT OF OHASA (1978-1987)

Irene Pretorius was born Irene Varley Fourie on December 16, 1927. She completed her matric at the age of 16 and later qualified as a chemist.

In 1972 she enrolled in Oral Hygiene at the University of Pretoria as part of the first group of 12 students to qualify. She earned her diploma cum laude in 1973.

In the following year she took up the position of lecturer at the Dental and Oral Hospital of the University of Pretoria. She was appointed Chief Oral Hygienist in the National Department of Health in 1978, a position she held until retirement.

Early in her career, she realised that much work would be needed to safeguard and enhance the interests of oral hygienists, and to place them on a firm footing as promoters of preventative dental care, a largely unknown field at the time. Her involvement was significant in the long and arduous struggle to eventually establish an officially recognised body.

In 1975, she became chairperson of the first Oral Hygienists' club in South Africa. 1978 saw the founding of the Oral Hygienists Association of South Africa and she was duly elected its first president. The first constitution of OHASA was a product of co-operation between herself and her husband, an advocate. Eventually, in 1980, official recognition became a reality when ministerial support was given to the formation of an own professional board on which she also served for several years.

Among the honours and accolades she received in recognition of her work and services, she especially treasured the honorary OHASA membership awarded to her in 1998.

Mrs Pretorius passed away at the age of 78 in June 2005. Her legacy of loyalty and dedicated work for the interests of her profession and her fellow practitioners lives on.

WELCOME TO THE NEW PRESIDENT AND EXECUTIVE COMMITTEE MEMBERS

Dear OHASA Members and Colleagues,

Welcome to 2018, I trust that you will have a prosperous and healthy year.

I would like to thank you for your continued support and trust during the past 40 years. It is my pleasure to introduce you to the newly-elected OHASA National Executive Committee members for the next term of office running 2018–2020.

They are as follows:

President – Angelique Kearney, Gauteng Branch
Vice President – Gail Smith, Western Cape Branch
Secretariat – Anri Bernardo, Western Cape Branch
Treasurer – Suné Herman, Gauteng Branch

The additional members are:

Marie Ferreira, Eastern Cape Branch
Elaine Johnson, KwaZulu-Natal Branch

OHASAJ Editor – Rugshana Cader, Western Cape Branch
Immediate Past President – Stella Lamprecht, Gauteng Branch

New Branch Committees have been elected with the Branch Chairladies as follows:

Gauteng Branch – Kaokie Sepuru
KwaZulu-Natal – Kathy Dolloway
Eastern Cape Branch – Shaya Pillay
Western Cape Branch – Anri Bernardo

Congratulations, and thank you for accepting your respective positions with such enthusiasm – this is the kind of attitude that is required to overcome the challenges that lie ahead.

God Bless

Stella ●
DO EARLY DENTAL VISITS REDUCE TREATMENT AND TREATMENT COSTS FOR CHILDREN?

Dr Arthur J. Nowak, DMD, MA (Professor Emeritus, Department of Pediatric Dentistry, University of Iowa, Iowa City, Iowa, USA)
Dr Paul S. Casamassimo, DDS, MS (Professor, Division of Pediatric Dentistry, The Ohio State University, Columbus, Ohio, USA)
Dr JoAnna Scott, PhD (Acting assistant professor, Department of Pediatric Dentistry, University of Washington, Seattle, Wash., USA)
Mr Richard Moulton (Data manager, Church Street Health Management, Nashville, Tenn., USA)

Correspond with Dr Casamassimo at Paul.Casamassimo@Nationwidechildrens.org

Source: Pediatric Dentistry November/December 2017, Vol 36, No. 7

ABSTRACT
Purpose: The purpose of this paper was to determine if number and cost of dental treatments in high caries-risk children differs in children with early dental intervention compared to children with later intervention.

Methods: Billing data from children age zero to seven years old, whose first dental visit was between January 1, 2004 and December 31, 2004, were collected from 20 corporate treatment centers serving children from lower socioeconomic status backgrounds. Data included age at first visit, dental treatment codes, and associated costs for eight years after the first dental visit. Treatment included restorations, crowns, pulpotomies, and extractions. First visit age was categorized into early starters (younger than four years old) and late starters (four years of age or older). Linear regression with cluster adjustment for clinic determined a difference in costs and dental treatments by early and late starters.

Results: Of 42,532 subjects, 17,040 (40 percent) were early starters and 25,492 (60 percent) were late starters. There were 3.58 more dental procedures performed on late starters, over eight years of follow-up, than on early starters (P<.001). Late starters spent $360 more over eight years of follow-up than early starters (P<.001).

Conclusion: In this study, number of procedures performed were fewer and cost of treatment less for children seen earlier versus later. (Pediatr Dent 2014;36:489-93) Received March 19, 2014 | Last Revision September 15, 2014 | Accepted September 19, 2014

Keywords: dental caries, dentistry, dental care, dental care for children

According to a recent National Health and Nutrition Examination Survey [NHANES] report, dental caries in the primary teeth of very young children had increased since the previous 1999 report, with the biggest increases in poor and minority children. In 2007, the Centers for Disease Control and Prevention reported that 28 percent of two- to five-year-olds had cavities, with 73 percent of these children requiring treatment. The increase in caries in this age group poses significant problems regarding access to skilled and willing care providers; additionally, it can add to the problem of inappropriate emergency department use for palliative care and increase the occurrence of caries-related pain with its potential toxic stress implications. Since the late 1980s, the first appointment schedule, the dental home, anticipatory guidance, and perinatal supervision have been promoted by dental and medical organizations, federal agencies, and advocacy groups in an attempt to persuade health professionals to:

1. abandon the traditional approach to treat a child only when oral disease exists or the child is deemed manageable; and

2. embrace a philosophy of health promotion, with an early visit by one year old, with establishment of a dental home.

Yet, in 2000, Kanellis and Damiano found in their study of Iowa Medicaid children undergoing general anesthesia to treat early childhood dental caries that only three percent of one-year-olds had visited a dentist. Even today, only a fraction of children visit the dentist by one year old. Medical intervention for oral health during well-baby visits has been suggested to help begin prevention earlier, but results have been mixed. In 2010, Lewis and Stout reported that, in a nationally representative sample, approximately 7.5 million U.S. children (one through 17 years old) had a toothache in the past six months; among this group, 88 percent had a preventive medical visit in the past year.

Over the last decade, in spite of intense efforts at promotion and education of the pediatric community, the incorporation of oral health into pediatric medical practice has been limited. Evidence suggests that spending on dental care increases as children age, and dental caries and its severity increase. In 2006, the Medical Expenditure Panel survey reported that 19 percent of children younger than five years old had dental expenditures of $729 million. Primary prevention strategies, such as the age one dental visit, intend to avoid or slow the development of dental caries by eliminating or reducing factors related to this disease. Unfortunately, few studies have shown that early intervention concepts are effective clinically and also cost effective. Doykos reported that, for every year the first examination was delayed, subsequent fees increased incrementally by approximately $35 (or $247.92 in 2014 U.S. dollars). In 2004, Savage reported that early preventive dental visits reduced restorative needs in subsequent visits. Beil found that children who had a first visit by 18 months old had fewer treatment procedures and incurred less cost than those who first had a preventive visit at 25 to 36 months old.

Additional evidence that early intervention in a high caries-risk child population can reduce dental disease and subsequent restorative care would add support to the concept of early dental intervention. We hypothesized that early dental intervention reduces the treatment burden and costs in high caries-risk children. Children who are seen by a dentist within the first few years of life should
require less restorative care than those who wait until later in childhood to establish a dental home. The potential to reduce the occurrence of these more expensive aspects of care should result in cost savings. Additionally, the adjunctive costs of general anesthesia and the difficult-to-quantify costs of associated comorbidities could possibly be mitigated. Furthermore, existing workforce models have the potential to embrace the preventive and health promotional aspects of early intervention.

The purpose of this study was to compare treatment and its cost in children with early first dental intervention (prior to four years old) that continued every year to a group of children at similar caries risk, with later dental intervention (after four years old) that continued every year.

**METHODS**

This study was conducted beginning in January 2012, using deidentified data made available by Church Street Health Management (CSHM), Nashville, Tenn., USA, which operates clinics across the United States and serves primarily children from low-income backgrounds and covered by state Medicaid programs. The CSHM system is uniform in its procedures, staff training, and quality assurance, making it a better source of data than aggregate independent Medicaid dental providers. The Institutional Review Board of Nationwide Children’s Hospital, Columbus, Ohio, USA, deemed this study exempt, as only deidentified data would be involved. The study design was a retrospective cohort study of children age zero to eight years old whose first dental visit was between January 1, 2004 and December 31, 2004, at centers affiliated with CSHM.

**Sample selection.** Twenty treatment centers from eight states were selected from over 100 affiliated with CSHM at the time of the study and met inclusion criteria of: (1) having been in operation long enough to provide complete data for the required study period; and (2) having data available for the services used as measures in the comparison. To be included in the subject count, a child had to have been seen at least once a year in that center over the eight-year study period.

**Working assumptions.** It was not possible to identify whether children had sought care elsewhere, either prior to or concurrently, but their return for periodic care at least annually for a minimum of eight years, from time of first enrollment met at the respective center, was verified for each child in the study. The assumption was made that a child’s initial visit to a center was the first dental experience and subsequent visits were only to that CSHM center, thus constituting a regular and recurrent source of care which, for this study, was deemed the equivalent of a dental home. All children were assumed to be at high caries risk, since 95 to 97 percent of the CSHM patient population nationwide are covered for services by the Medicaid system and, thus, considered at higher risk for dental caries, based on income. **No attempt was made to characterize children by other clinical, ethnic, or social factors, due to the limitations of the data set.**

**Methodology and study rationale.** Data collected included age at the first dental visit, specific dental treatments, and associated costs of those treatments over an eight-year period following the first dental visit. Treatment was combined into the following categories: fillings (amalgam and composite restoration); crowns; pulpotomies; and extractions (simple or surgical). Each treatment category was defined using the following CDT billing codes: 2140, 2150, 2160, and 2161 for amalgam restorations; 2330, 2331, 2332, and 2335 for anterior composite restorations and 2391, 2392, 2393, and 2394 for posterior composite restorations; 2930, 2931, 2932, and 2934 for stainless steel crowns; 3220 for pulpotomy; and 711, 7140, and 7210 for simple or surgical extractions. Other treatment procedures, such as preventive and diagnostic services, space maintainers, or other appliances, were not included in this analysis. Since most of the care in CSHM is rendered by generalists, we used the most common and most likely procedures and respective codes attributable to general dentists.

The second part of the study attempted to translate differences in treatment into actual dollar amounts. The purpose of this second part of the study was to evaluate possible cost savings should earlier intervention be done routinely in high caries-risk populations. CSHM has centers throughout the United States, and Medicaid systems have varying fee schedules. For these reasons, we used actual fees from the states in which the study centers were located and attributable to those procedures for those patients.

**Statistical analysis.** Age at first visit was dichotomized into younger than four years old (early starters) versus four years of age or older (late starters). We used a liberal interpretation of three years old, since some parents may consider a dental visit by three years old to include that entire chronological period until a child is officially four years old. Descriptive statistics (means, standard deviations, and ranges) were calculated for age at the first dental visit, cost of dental treatment, and number of dental treatments by early and late starter groups. Linear regression with cluster adjustment for clinic was used to determine if there was a difference in the cost and number of dental treatments overall and within the four treatment categories by early and late starter groups.

**RESULTS**

Of the 42,532 subjects, 40 percent were in the early starter category and 60 percent were in the late starter category (Table 1). The average cost of all dental treatment over eight years of follow-up was $694.32 (±$815.13 SD) in the early starter group and $1,054.44 (±$1,229.13 SD) in the late starter group. Within both early and late starter groups, crowns was the treatment category that had the highest average dental cost over eight years of follow-up ($299.74±$442.26 and $466.97±$690.49, respectively, Table 2). The average number of dental treatments over eight years of follow-up was 7.69 (±8.61) in the early starter group and 11.27 (±12.56) in the late starter group. The treatment category with the highest average number of dental treatments over eight years of follow-up in the early starter group and in the late starter group was fillings (3.11±3.77 and 3.96±5.09, respectively, Table 3).

Within each treatment type (fillings, crowns, pulpotomies, and extractions), a late starter had, on average, significantly higher dental treatment costs over eight years of follow-up than an early starter (P<0.001 for all). On average, children whose age at the first dental visit was four years or older had a total dental cost over eight years of $360.13 more than children whose age at the first dental visit was younger than four years old (P<0.001, Table 4).

Similarly, within each treatment type (fillings, crowns, pulpotomies, and extractions), a late starter had, on average, significantly more dental treatments

---

**Table 1: Summary of age at the first dental visit early and late starter groups.**

<table>
<thead>
<tr>
<th>Age range (years)</th>
<th>Early starter</th>
<th>Late starter</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;4 yrs old</td>
<td>17,040 (40)</td>
<td>25,492 (60)</td>
</tr>
<tr>
<td>≥4 yrs old</td>
<td>2,883±0.77</td>
<td>8,821±1.16</td>
</tr>
</tbody>
</table>

**Table 2: Dental cost over eight years of follow-up by early and late starter groups.**

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Cost (SD)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fillings</td>
<td>$220.11±$272.53</td>
</tr>
<tr>
<td>Crowns</td>
<td>$299.74±$442.26</td>
</tr>
<tr>
<td>Pulpotomies</td>
<td>$129.71±$220.99</td>
</tr>
<tr>
<td>Extractions</td>
<td>$44.75±$91.49</td>
</tr>
<tr>
<td>Total</td>
<td>$694.32±$815.13</td>
</tr>
</tbody>
</table>

**Table 3: Mean age±SD at first dental visit.**

<table>
<thead>
<tr>
<th>Age range (years)</th>
<th>Early starter</th>
<th>Late starter</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;4 yrs old</td>
<td>2.88±0.77</td>
<td>5.83±1.16</td>
</tr>
<tr>
<td>≥4 yrs old</td>
<td>0.06±3.99</td>
<td>4.79±3.99</td>
</tr>
</tbody>
</table>
over eight years of follow-up than an early starter (P<.001 for all). On average, children whose age at the first dental visit was four years or older had 3.58 more total number of dental treatments over eight years than children whose age at the first dental visit was younger than four years old (P<.001; Table 5).

Table 3: Number of dental treatments over eight years of follow-up by early and late starter groups

<table>
<thead>
<tr>
<th>No. of dental treatments</th>
<th>Early starter (age at first visit &lt;4 ys old) Mean±SD*</th>
<th>Late starter (age at first visit ≥4 ys old) Mean±SD*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fillings</td>
<td>3.1±1.77</td>
<td>3.96±1.09</td>
</tr>
<tr>
<td>Crowns</td>
<td>2.28±1.35</td>
<td>3.47±1.13</td>
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<tr>
<td>Pulpotomies</td>
<td>1.57±2.66</td>
<td>2.42±1.27</td>
</tr>
<tr>
<td>Extractions</td>
<td>0.72±1.44</td>
<td>1.4±1.71</td>
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<tr>
<td>Total</td>
<td>7.69±8.61</td>
<td>11.27±12.56</td>
</tr>
</tbody>
</table>

* SD=standard deviation.

Table 4: Associations between dental cost over eight years of follow-up and early and late starter groups using linear regression (with adjustment for within clinic correlation)

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Early starter (age at first visit &lt;4 ys old) slope (95% confidence interval)</th>
<th>Late starter (age at first visit ≥4 ys old) slope (95% confidence interval)</th>
<th>P-value</th>
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<td>Fillings</td>
<td>Reference $74.44 ($51.08, $97.81) &lt;.001</td>
<td>$167.23 ($124.11, $210.34) &lt;.001</td>
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<tr>
<td>Crowns</td>
<td>Reference $167.23 ($124.11, $210.34) &lt;.001</td>
<td>$360.13 ($286.56, $433.69) &lt;.001</td>
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<tr>
<td>Pulpotomies</td>
<td>Reference $71.82 ($47.90, $95.75) &lt;.001</td>
<td>$46.63 ($37.43, $55.83) &lt;.001</td>
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<tr>
<td>Extractions</td>
<td>Reference $46.63 ($37.43, $55.83) &lt;.001</td>
<td>$167.23 ($124.11, $210.34) &lt;.001</td>
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</tr>
<tr>
<td>Total</td>
<td>Reference $360.13 ($286.56, $433.69) &lt;.001</td>
<td>$46.63 ($37.43, $55.83) &lt;.001</td>
<td></td>
</tr>
</tbody>
</table>

Table 5: Associations between number of dental treatments over eight years of follow-up and early and late starter groups using linear regression (with adjustment for within clinic correlation)

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Early starter (age at first visit &lt;4 ys old) slope (95% confidence interval)</th>
<th>Late starter (age at first visit ≥4 ys old) slope (95% confidence interval)</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fillings</td>
<td>Reference 0.85 (0.56, 1.13) &lt;.001</td>
<td>0.69 (0.57, 0.80) &lt;.001</td>
<td></td>
</tr>
<tr>
<td>Crowns</td>
<td>Reference 1.19 (0.89, 1.49) &lt;.001</td>
<td>0.69 (0.57, 0.80) &lt;.001</td>
<td></td>
</tr>
<tr>
<td>Pulpotomies</td>
<td>Reference 0.85 (0.57, 1.13) &lt;.001</td>
<td>0.69 (0.57, 0.80) &lt;.001</td>
<td></td>
</tr>
<tr>
<td>Extractions</td>
<td>Reference 3.58 (2.80, 4.36) &lt;.001</td>
<td>3.58 (2.80, 4.36) &lt;.001</td>
<td></td>
</tr>
</tbody>
</table>

DISCUSSION

The purposes of this study were to: (1) see if children who engaged a dental home at an earlier age had less treatment performed than those who waited until later in childhood to begin care; and (2) assess a representative cost savings, if any, afforded by beginning care earlier in life. Although the argument for early intervention has been made for decades to maximize the potential benefits of preventive services, adoption of infant oral health by both medical and dental providers has been slow.

Similarly, evidence to support early intervention by demonstration of improved oral health (less dental caries) and cost savings is limited. The few studies available suggest that seeing children earlier results in less overall treatment; however, these studies have limitations, such as small sample size or, conversely, use of pooled data, with variability in treatment planning and other aspects of care. We engaged in this study because of the opportunities provided by a corporate dental system that included a very large pediatric patient pool with elevated caries risk, consistent treatment and quality control protocols across the system, and excellent data management and retrieval.

This study’s results support advantages of early intervention, with the early starters having fewer treatment needs compared to those children starting while into their mixed dentition. In all categories of treatment, the mean number of services provided to children presenting for their first visit in the early starter age range was less than for those children starting later. If the mean number of treatment procedures for all age groups younger than four years old in aggregate are considered (Table 3) and compared to each age subcohort in the late starter group, this finding of less treatment persists, suggesting that the advantages of early intervention continue into the preschool ages. In other words, even if children were not linked to dental homes at one year old, they still found benefit if they entered the care system within the early preschool years. This study also showed the trend, similar to one reported by Bell, of a diminishing difference as children move into school age, perhaps as a result of loss of primary teeth or previous restoration of existing caries.

The benefits of early intervention are suggested by the results of this study, but clearly an additional economic cost-benefit analysis is needed. At face value, the cost savings are impressive in terms of treatment cost differences between the two cohorts. Delaying entry until school age almost doubles the treatment cost (Table 2) for the late starter group. Missing, however, are costs of periodic diagnostic and preventive services accumulated over the preschool years that would be incurred by children engaged in a dental home; we selected children who stayed in the system, so we would assume that these services would be consistent across groups. Also missing, however, are the significant additive costs of general anesthesia for some children delayed in seeking care but still young enough to require this expensive service. Some very young children would invariably need pharmacologic management, but the minor treatment needs revealed in this study would suggest that many very young children could be treated in an ambulatory setting. Additionally, the cost of emergency department visits for dental caries-related complications is not included but would add to the cost. A more detailed analysis of both treatment and diagnostic and preventive services would provide a more complete cost-benefit picture.

The treatment needs, as depicted in this study, follow a trajectory similar to the incidence of early childhood caries (ECC). It could be argued that early intervention might not alter the trajectory of ECC; hence, establishing a dental home might not equate with prevention or control of the condition. In fact, some evidence suggests that establishment of ECC predisposes a child to future caries and that subsequent preventive care may not alter that path. The results of this study do not address that question, but they suggest that waiting creates an additional treatment burden. This snapshot of treatment requirements by increasing age confirms that the sooner a child is seen by a dentist the less treatment he or her treatment needs will be. This finding has significant implications for policy and funding. Early intervention and a source of regular dental care may be the most desirable goals. A recent study from Colorado found that those with a regular source of care were twice as likely to have regular visits. Although we did not follow the children in this study for preventive services, we did require that they stay in the center for at least one visit for...
some service each year for four years after initial visits, suggesting that the availability and provision of care in a dental home can be beneficial. It could be argued that differences noted were the result of diligent parents who not only sought dental care earlier but also exhibited preventive behaviors that contributed to these differences. The presence of measurable treatment needs suggests, however, that parents may have been responding to identified problems and the difference reflects the effect of early preventive services. It was not until 2009 that CSHM instituted a system-wide infant oral health promotion.

Investments in school-based health and workforce change aimed at increasing restorative capacity may be less effective than wider adoption of early prevention utilizing the existing workforce. This raises the question of efficient use of the dental workforce and the wisdom of its diversion from other necessary necessary treatment to early restorative treatment of young children. The following question needs to be asked: Should society’s resources should be devoted to train a new workforce to handle the failed attention to early prevention instead of changing the culture and practice of the existing dental health care system?

The limitations of this study include its retrospective nature, lack of information about prior or subsequent dental care, and the consistency of and motivation for treatment decisions, which may have influenced the distribution of services. Other studies have tried to relate treatment to age using pooled data from Medicaid, with care provision by hundreds if not thousands of independent clinicians including students and residents. By contrast, this study used data from an established system with relatively well-controlled guidance on care delivery and limited providers. No attempt was made to determine whether a child had previous treatment that might have limited the need for additional treatment and, thus, the procedure count. We believe that, at least for the early starters, the likelihood of previous treatment was low; the fact that most of these children were covered by Medicaid also supports the likelihood that their caregivers sought care in the CSHM system, which is known in communities to welcome Medicaid patients. Because of the preponderance of Medicaid-covered children in the CSHM system, the results may not be generalizable to the general population.

A strength of this study is the careful management of billing and strong oversight of service provisions by the CSHM system to meet federal standards. The likelihood of erroneous billing and procedure counts is low. In summary, this study confirms that children seen early in life had fewer treatment needs than those who were first seen later in life. The results support the policy of many dental organizations to begin oral health intervention at one year old and may encourage pediatricians to overcome obstacles and make dental referrals. The opportunity to reduce both monetary expense and human suffering while optimizing the use of the existing dental workforce devoted to children are supported by this study’s results.

CONCLUSIONS

Based on this study’s results, the following conclusions can be made:

1. Early starters (children who began dental care at younger than four years old) had less treatment for restorations, crowns, pulpotomies, and extractions than late starters (children who began dental care at four years of age or older).
2. Early starters had lower expenditures for treatment procedures than late starters.

REFERENCES


Conflict of interest: Drs. Camassimasso and Nowak were unpaid members of the Pediatric Advisory Board of CSHM LLC. Mr. Moulton was employed by CSHM LLC.
Erythritol Functional Roles in Oral-Systemic Health

P. de Cock
Advances in Dental Research 2018, Vol. 29(1) 104–109; NDI_Jan 2018

Oral Health Functionality of Erythritol

Mäkinen et al. 2005 demonstrated that in comparison to other sugar alcohols like sorbitol and xylitol, erythritol can decrease dental plaque mass and acids associated. Erythritol has the potential to reduce streptococci mutans in saliva hence minimizing the risk of dental caries.

Falony et al. 2016 concluded that the erythritol group had significantly fewer tooth surfaces with enamel or dentin caries in comparison with sorbitol.

In addition, the time of enamel or dentin caries lesions to progress and dentin caries to extend further was significantly longer in the erythritol group compared with the other polyol groups.

Runnel et al. 2013 confirmed that the amount of fresh dental plaque and counts of S. mutans in saliva and plaque were lower in the erythritol group in comparison to the sorbitol and xylitol groups. Dental plaque in the erythritol group also showed lower levels of acetic, propionic, and lactic acid compared to control.

Honkala et al. 2014 in a study demonstrated that at the end of a 3 year intervention, the erythritol group had the lowest caries.

Yao et al. 2009 in another study suggested that compared to xylitol, erythritol in low concentrations had a weaker inhibition effect on the bacterial growth and acid production of S. mutans while having stronger effect at high concentrations.

Hashino et al. 2013 reported that 10% erythritol had an inhibitory effect on the microstructure and metabolomic profiles of biofilm composed of Porphyromonas gingivalis and Streptococcus gordonii.

Erythritol was the most effective reagent to reduce P. gingivalis accumulation onto S. gordonii substrata compared to xylitol and sorbitol.

Systemic Health Effects

Erythritol is noncaloric, noninsulinemic, and nonglycemic besides being well-tolerated. It has a very high bioavailability, showing potential to provide cardiovascular benefits due to its capability to act as an antioxidant systemically.

Effects of Erythritol on the Gastrointestinal Tract

Munro et al. 1998 reported the fact that erythritol due to its small molecular size is rapidly absorbed through passive diffusion. Approximately 90% of the ingested dose is absorbed from the small intestine and excreted in the urine unchanged. European Food Safety Authority also confirmed that young children tolerate erythritol equally well as adults on a body weight basis.

Effects of Erythritol on Cardiovascular Health

Boesten et al. 2013 in a research confirmed that in endothelial cells, erythritol could shift a variety of damage and dysfunction parameters to a safer side, thereby reversing the damaging effects of hyperglycemic conditions.

Conclusion

• Erythritol as an antioxidant improves the endothelial function and their vascular health status in people with type 2 diabetes.
• Erythritol provides healthier tooth protection than sorbitol and xylitol, in children and teenagers.
• Erythritol is of great importance not only in oral care or dietary-based preventive strategy but also to help maintain oral and cardiovascular health besides supporting weight management benefits when replacing sugar.

Erythritol is not just an AIR FLOW powder, but a complete, efficient and safe one stop solution for dental prophylaxis.
INTRODUCTION

Negligence refers to the breach of a duty of care which results in damage. It occurs when a person’s conduct falls below the standards of behaviour established by law for the protection of others against unreasonable risk of harm. A person has acted negligently if he or she has departed from the conduct expected of a reasonably prudent person acting under similar circumstances. In a legal situation, in order to establish negligence it must be proven that the defendant had a duty to the claimant, the defendant breached that duty by failing to conform to the required standard of conduct, the defendant’s negligent conduct was the cause of the harm incurred by the claimant, and the latter was, in fact, harmed or damaged.1

LITERATURE REVIEW

1. Negligence

Historically, English Common Law imposed liability for all wrongful acts. However, the concept of negligence only emerged as an independent entity in the eighteenth century, when the concept of legal liability for a “failure to act” emerged. This was originally imposed on those who undertook to perform a service, but failed to exercise care or skill in carrying out that service. This breach of promise to exercise care, whether overt or implied, formed the origins of the concept of “duty.”1 These ideas spread and today negligence is one of the most wide-ranging misdemeanors, encompassing most forms of unintentional or wrongful conduct where others are injured. While the actual laws pertaining to negligence may differ throughout the world, the basic notions and values remain the same. One of the most important arguments used in negligence law is that of the “reasonable person,” which provides the standard by which their conduct is judged.1

1.1 The “Reasonable Man Rule”

By definition, “a person has acted negligently if they have departed from the conduct expected of a reasonably prudent person acting under similar circumstances. The hypothetical reasonable person provides an objective by which the conduct of others is judged.”1 This helps distinguish negligence from intentional wrongdoing such as assault and battery where the actions were deliberate and intended to cause harm. A negligence suit, however, seeks to establish that failure of the defendant to act as a reasonable person caused the plaintiff’s injury. It considers many factors including the person’s knowledge, experience, and perceptions, the activity they are engaging in, and the circumstances surrounding their actions.1

In the medical/dental context, when a clinician engages in an activity requiring special skills, education, training, or experience, the standard by which their conduct is measured is the conduct of a reasonably skilled, competent, and experienced person who is a qualified member of the group authorized to engage in that activity. They cannot deny personal knowledge of basic aspects of the profession that are commonly known and practiced by their peers. The law does not make a special allowance for beginners with regard to special skills, and holds everyone to the standard of conduct of persons who are reasonably skilled and experienced in the activity.1 In addition, a person’s physical characteristics or impairments and experienced in the activity.1

The law may consider that a trained professional was given. To do this they may need to evaluate the conditions and circumstances, examine the patient if possible, and deliver a professional opinion. Note: it is easy to become emotional and accusatory when called upon to comment on the wrongdoings of others. However, one needs to remember that no third party can ever really know the full circumstances and details of what transpired during a clinical appointment. As such, findings should be presented in a clearly written document that reports on the current situation as observed clinically and radiographically. It should include a detailed description of the entire oral cavity, the tooth number, type of restorations present, and acceptability or problems associated with these, and may offer advice on possible solutions,
including time and financial implications. Unless the expert witness has access to pre-operative records it will be impossible for he/she to report on the extent of damage caused by the accused colleague. As such the report should not include personal allegations, accusations or assertions of guilt. Bear in mind that this document could be presented in a court of law, and all observations, opinions and deductions should be defensible and justifiable. Also consider that one never knows the exact circumstances, or issues that may have been beyond the clinician’s control which could account for their actions.13 Circumstantial evidence is very difficult to prove and when used in medical situations, the principle of Res Ista Loquitur (the thing speaks for itself) is invoked. Res ipsa loquitur argues that the injury could not have occurred in the absence of the clinician’s negligence, was due to instrumention or management that was exclusively under their control and that the injury would not have occurred if the clinician had acted with reasonable care.1

1.3 Negligence and Duty
Negligence on the grounds of duty refers to those situations where a pre-existing relationship creates an obligation to exercise care and to protect another person from harm. “While a person generally has a duty to not endanger the safety of others, they don’t have a duty to render aid or prevent harm if it is from some other independent cause”. A doctor who witnesses an accident has no duty to offer emergency medical assistance to the accident victims. However they can voluntarily decide to help, but are then obliged to exercise reasonable care in rendering that aid. This has resulted in doctors who have given medical assistance to accident victims being sued for negligence, and led to the so called “good Samaritan” rule to relieve them from negligence liability.1

1.4 Patient Negligence
There are times when the patient could have acted negligently and thus adding to their own injury. This is called “contributory negligence” and often results in their being unable to claim for the damages caused by the clinician. To compensate for this they may seek restitution based on “comparative negligence” in which their own negligence will not completely bar them from claiming damages, however their damages will be reduced by whatever percentage their own fault contributed to the injury.1 The clinician and patient may also have contradictory accounts as to the mechanism and extent of injury based on their subjective recollection and interpretation of the events.

1.5 Assumption of Risk
This rule would allow a clinician to avoid liability for his/her negligence by proving that the patient voluntarily consented to the procedure knowing its potential dangers and/or the dentist’s limited capabilities. It is almost never used in a medical context.1

2. Malpractice

2.1 Magnitude
There is a common misconception that the magnitude scale is itself some kind of instrument or apparatus. Visitors will frequently ask to ‘see the scale.’ Charles Francis Richter.9

This quotation with reference to earthquakes could quite easily also be applied to the difficulty one has in determining the magnitude of a misdemeanor in the clinical context. A minor injury may be considered an adverse event in situations that were out of the clinician’s hands, where a well justified decision turned out badly, where there may not be a universal agreement as to the best treatment option that should have been chose, or where the dentist displayed an isolated case of poor judgement or skills. These instances may be condoned if isolated, and are very often overlooked by the patients, whose memories fade as they heal or adapt. However more destructive damage that is detrimental to their oral health, function, appearance, psycho-social wellbeing, or puts their lives at risk could constitute negligence or malpractice. Very often the deciding factor between an adverse event, negligence and malpractice is determined by the magnitude.

Note: Informed consent is no protection against malpractice.

2.2 Frequency
Oscar Wilde said that “To err once is human, twice is careless.”

In dentistry, an isolated adverse occurrence could be due to patient factors, the clinical situation, unavoidable damage or human error and negligence. However repeated injurious incidents, no matter how minor, may constitute carelessness at best and malpractice at worst. Arguably, if the latter is an isolated incident it should still only be considered negligent. However the practitioner should communicate with the patient immediately after the adverse event and offer to carry out all possible corrective measures or agree to some form of restitution.

2.3 Intent
“We judge others by their behaviour. We judge ourselves by our intentions” (Ian Percy).10
Intention can be defined as: an act or instance of determining mentally upon some action or result; the end or object intended; purpose or attitude toward the effect of one’s actions or conduct.

In legal terms (and alphabetically it seems) it refers to the aim, ambition, consilium, design, desire, destination, determination, direction, earnestness, end view, end intended, fixed direction, fixed purpose, goal, institutum, mark, object, objective, plan, proposition, purpose, resolution, resolve, set purpose, settled determination, target, ultimate purpose (Burton, 2010 #95). Any dental intervention carries with it a risk of error or failure. Complications can and do occur. It’s impossible to save every tooth, to fully restore every mouth to optimal health or to satisfy every patient’s oral needs. However, in determining negligence or malpractice, one would need to analyze the dentist’s intention in terms of whether the action was beneficent or not. Questions to ask include: was the aim to provide a therapeutic benefit, to protect the patient, to prevent harm, to remove conditions that could lead to future harm, and was the therapy aimed at promoting the patient’s best interests?11

CONCLUSION
In light of the above arguments, it is proposed that a transgression in any one of the three points be considered negligence, while liability in two or all three aspects could constitute malpractice. However all detected incidents of negligence should still be reported, documented and followed by a warning. Repeated offenses could signify a trend which would warrant Council investigation and intervention in order to protect future patients. At the same time, in order to protect clinicians against malpractice suits, there needs to be a stronger emphasis on teaching and practicing “evidence-based” rather than “experience-based” dentistry. To this end the dental profession need to collectively develop more extensive best practice guidelines.

REFERENCES


DENTAL IMPLICATIONS OF BISPHOSPHONATE THERAPY IN OSTEOGENESIS IMPERFECTA

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ACRONYMS

AR: autosomal recessive
OI: Osteogenesis imperfecta
OI III: steogenesis imperfecta type III
ONJ: Osteonecrosis of the jaw

ABSTRACT

Bisphosphonate therapy, which is effective in reducing the rate of fracturing, represents a significant advance in the medical management of Osteogenesis imperfecta (OI). When administered to affected persons, bisphosphonate therapy is relevant in their dental and craniofacial management. A particular concern is bisphosphonate induced osteonecrosis of the jaws, a rare but potentially devastating problem.

Osteogenesis imperfecta type III (OI III) is relatively common amongst the indigenous Black African population of South Africa. With the co-operation of medical colleagues 64 Black South African individuals with OI III, between the ages of three months and 18 years, were identified and were dentally assessed. Fifty-five of these individuals had received or were receiving bisphosphonate therapy. This impacted on dental treatment planning and delivery since there is a risk of the complication of bisphosphonate induced osteonecrosis of the jaws.

There is a paucity of information regarding the dental management of persons with OI who are receiving bisphosphonate therapy. In particular, orthodontists and maxillofacial surgeons have expressed concern regarding the advisability of orthodontic extractions, tooth movement when faced with the potential for developing osteonecrosis of the jaws. In view of these uncertainties, the dental implications of bisphosphonate therapy have been reviewed and discussed in this article.

INTRODUCTION

Bisphosphonates are synthetic analogs of pyrophosphates, which, being deposited on the bone surface, inhibit bone resorption. They are then ingested by osteoclasts with consequent apoptosis of these cells. Bisphosphonates also demonstrate anti-angiogenic activity by inhibiting vascular endothelial growth factor and the formation of new blood vessels.1 Bisphosphonate therapy is used for several conditions notably osteoporosis, Paget’s disease, metastatic bone malignancies and Osteogenesis imperfecta (OI). Although impressive radiological and clinical improvements following bisphosphonate therapy have been observed and are well documented in persons with different forms of OI, nevertheless bisphosphonate induced osteonecrosis of the jaw (ONJ) remains a rare but potentially devastating problem.

In South Africa, there is a need to record clinical experiences and to devise and develop a clinical management protocol and guidelines for optimizing dental therapy in persons affected with OI who have received bisphosphonate therapy.

PATIENTS AND METHODS

All investigations were undertaken in complete accordance with the Declaration of Helsinki, the Hippocratic Oath and the Singapore Statement on Research Integrity. Formal ethical approval (HREC reference number: 203/2013) was obtained from the Ethics Committee, University of Cape Town. Informed signed consent was obtained from parents, or from guardians of affected children where appropriate.

Severe autosomal recessive (AR) Osteogenesis imperfecta type III (OI III) is relatively common amongst the indigenous Black African population of South Africa. With the co-operation of medical colleagues, 64 Black African individuals with OI III in South Africa, between the ages of 3 months and 19 years, were identified and dentally assessed. Fifty-five of these individuals had received or were receiving bisphosphonate therapy and a detailed account of this aspect of management of OI III on 26 of these persons has recently been documented.2

An extensive appraisal of the literature in terms of dental management in conjunction with bisphosphonate therapy in OI has been undertaken and the findings and conclusions form the subject of this paper.

DISCUSSION

Pamidronate is a bisphosphonate frequently used in children. A study which included 26 Black African patients with OI III in South Africa who had received Pamidronate therapy, concluded that this treatment was well tolerated. The affected persons ranged in age from 1.5 years to 24 years and the majority reported a reduction in symptoms and an increased sense of well-being.2 No reported instances of Pamidronate being associated with osteonecrosis of the jaws in OI could be found in the literature. In circumstances where affected persons did not respond optimally to Pamidronate, Zoledronic acid has been used. It may be relevant that Zoledronic acid has frequently been used in South African patients. Although concern exists that this form of therapy has been associated with aseptic necrosis of the jaw in adult persons, none of the South African patients presented with any symptoms of ONJ.2
Bisphosphonate Therapy and Dentistry

The jaws are susceptible to osteonecrosis due to several anatomical and physiological factors. Bisphosphonates tend to accumulate in the bones of the jaws due to the high vascularity and turnover rate. The forces of mastication and consequent tension on the periodontal ligament ensure a high turnover rate of alveolar bone and the thin oral mucosa can easily be traumatized during dental procedures, allowing oral microbes to track into the mucoperiosteal region of the jaws. The pathophysiology of ONJ is multifactorial, involving factors such as marked suppression of angiogenesis, altered functioning of oral mucosal cells, modification of the oral microbial flora, an anti-inflammatory effect and a genetic predisposition. It is relevant that bisphosphonate uptake results in decreased remodeling of the alveolar bone and a sclerotic lamina dura.

A search of the literature suggests that various clinical settings in dentistry may potentially be involved if an individual has a history of or is currently receiving bisphosphonate therapy. Several case reports and cohort studies have linked bisphosphonate therapy and osteonecrosis of the jaw (ONJ) in adults in different disorders. Reports of three hundred and sixtyeight cases of ONJ have been published in a systematic review, the majority occurring in elderly persons with malignancies. However, to date, there have been no published data of the frequency of ONJ in children. The only dental report which was found pertaining to children, referred to a 167-year delay in tooth eruption in 33 persons with OI who received bisphosphonate therapy.

A retrospective Swedish survey, identified a large series of persons with various forms of OI, between the ages of 2 months and 20 years, who had received or were on bisphosphonate therapy, many of whom had had dental surgical procedures. No evidence of ONJ were identified in any of these patients at their eight-year follow-up.

There were no reports or history of ONJ subsequent to dental therapy amongst the 55 persons in the current South African series who were affected with OI III and who had received or were receiving bisphosphonate therapy.

1. Dental Implants

Persons with OI have an increased risk of early loss of teeth and, hence, rehabilitation using dental implants may be a management option. Although bone graft surgery and dental implants are considered potential risk factors for the development of ONJ in individuals receiving bisphosphonate therapy, studies of this possibility have reported no incidences of ONJ in persons with OI.

2. Periodontics

The potential beneficial effects of bisphosphonates on periodontal disease have been explored, for the density of alveolar bone is increased, a favourable outcome, but, paradoxically, there is an increased risk of ONJ. A reported incidence of the development of osteonecromosis in a patient who received non-surgical periodontal treatment highlights the importance of practitioners being cognizant of this possible debilitating consequence, even when nonsurgical therapy is performed. Since ONJ is difficult to predict and prevent the avoidance of surgery has been advised.

In OI affected individuals, the lamina dura is absent, suggesting decreased mineralization of the alveolar bone (Figure 1). This factor places these persons at risk for the development of periodontal disease and consequent alveolar bone loss. The presence of periodontal disease may necessitate invasive periodontal procedures or dental extraction, which will increase the risk of ONJ.

Figure 1: Panorex radiograph of a 19 year old boy with OI. The lamina dura is absent and several radiographic features of Dentinogenesis Imperfecta are evident in all his teeth. There is cervical constriction of the molars (1). The pulp chambers are partially or completely obliterated in almost all of his teeth (2). The roots are thin and short (3).

For this reason, impeccable oral hygiene practices are encouraged in persons with OI who are receiving bisphosphonate therapy. Despite a vigorous literature search, no published reports were found which documented persons with OI and ONJ consequent to periodontal therapy.

3. Orthodontics

Bisphosphonates are effective in the medical management of children with OI. No instances of ONJ have been reported and the extraction of teeth is not contraindicated in these children. The current authors suggest that a young age may be a protective factor.

Increasingly, adults with OI with bisphosphonate exposure are now seeking orthodontic care. Nevertheless, a literature search has not revealed any case reports of ONJ developing during orthodontic management. Bisphosphonates may compromise orthodontic treatment in that tooth movement involves bone resorption and deposition. It has been shown that bisphosphonates can reduce the rate of orthodontic tooth movement due to their inhibition of bone resorption by osteoclast apoptosis and reduced bone vasculature. Inhibition of orthodontic tooth movement has been documented in four cases with a history of bisphosphonate exposure. No studies have specifically implicated orthodontic management as a factor in increased ONJ risk, but there is evidence that prolonged orthodontic treatment in patients suffering OI may intensify the potential for ONJ.

4. Endodontics

In persons with OI and a history of bisphosphonate therapy, endodontic treatment is preferred over extraction in order to minimize the risk of ONJ.

5. Oral Surgery

A report documents several middle aged to elderly medically compromised patients on bisphosphonate therapy who presented with unusual non-healing extraction wounds. In this clinical setting, namely, bisphosphonate therapy in medically compromised individuals, it is imperative that a detailed medical history is obtained, in particular information on bisphosphonate usage and that proper procedure is followed in order to avoid the onset of ONJ. Dental extractions and surgical procedures need to be as atraumatic as possible and good oral hygiene is crucial in order to ensure optimal healing. These constraints are especially relevant in a bisphosphonate induced environment of reduced blood supply, sclerotic bone and reduced bone turnover.

6. Cranial Base Abnormalities

Pathology of the cranio-cervical and base of skull region in OI can be divided into platybasia, basilar invagination and basilar impression and it is suggested that these complications can occur separately or concurrently. Cranial base anomalies impact on dental therapy and caution is warranted when a patient’s head is manipulated in order to avoid atlanto-axial subluxation and spinal cord compression. In cephalometric analyses of dentofacial morphology, details on the cranial base constitute important reference points. This situation necessitates awareness by the dental clinician in order to enable the distinction between pathology and normal developmental patterns.

A research report documented the natural progression of cranial base anomalies in 150 persons with OI, aged between 0-39 years and recorded that 37% had abnormalities. The authors subsequently
recommended a radiological surveillance strategy with regular follow-up. In this cohort of patients, the number of individuals on bisphosphonate therapy was low; hence, a further study was undertaken in order to resolve the issue of the effect of bisphosphonates on the development of cranial base abnormalities. The conclusion was that although the early initiation of bisphosphonate treatment may defer the development of cranial base pathology, abnormalities may still arise despite this therapy.

7. Antibiotic Prophylaxis
A survey of dental specialists and dentists in the UK revealed that their approaches to the management of paediatric patients on bisphosphonates ranged from no precautions against ONJ, to antibiotic prophylaxis. It also highlighted the fact that OI centres in the UK frequently received calls from dental practitioners requesting management advice for this group of individuals and it is evident that guidance in this regard is necessary.

The question of antibiotic prophylaxis during dental intervention arose in the context of South African patients with OI who had orthopedic roots. There is a paucity of published information pertaining to this situation. A few reports have suggested that antibiotic prophylaxis for ONJ is not required when dental treatment is undertaken. The instance of a boy aged 10 years with OI who had dental surgery with no administration of antibiotics and without the suspension of bisphosphonate therapy has been reported. Eighteen months later at his follow-up appointment, he showed no signs of ONJ.

8. Reported Dental Management Protocol
Currently, no established protocols or guidelines have been formulated for the dental management of persons with OI who are on bisphosphonate therapy. The perception that dental extractions and other oral surgical procedures in children should be carried out only when necessary is based upon experience with adult individuals receiving bisphosphonate therapy. Delaying or avoiding the extraction of severely carious teeth may result in infection and chronic pain which can have serious consequences. Similarly, a delay or failure to manage an evolving malocclusion may deny paediatric patients a functional occlusion.

A suggested management approach is to discontinue bisphosphonate therapy 8-15 days prior to simple procedures such as a dental extraction and four months prior to invasive surgery such as an osteotomy. In both circumstances, antibacterial prophylaxis is recommended. It has also been documented that although bisphosphonate therapy withdrawal may not interfere with the bisphosphonate previously assimilated into the bone, withdrawal of therapy may expedite the healing process of the injured tissues by averting the antiangiogenic effect of bisphosphonates.

Referring to patients in whom bisphosphonate therapy has already been initiated, the American Association of Oral and Maxillofacial Surgeons23 and the Japanese ‘Allied Task Force Committee of Bisphosphonate-Related Osteonecrosis of the Jaw’ suggest that dental procedures be performed prior to the bisphosphonate dose reaching a high level. It is recommended that, prior to the commencement and during the administration of bisphosphonate therapy in this group of patients, they be referred to a dental clinician for examination, for the identification of any risk factors for ONJ, and for the development of an appropriate treatment plan and frequent follow-up.

In the South African situation, the authors advocate that, in order to obtain baseline information of the relation between dental and craniofacial manifestations and bisphosphonate therapy, cephalometric radiographs of affected persons who have not received bisphosphonate infusions should be compared with those of OI affected persons who have received bisphosphonate therapy. In this way, the effect of bisphosphonate therapy on the dental and craniofacial structures may be identified.

CONCLUDING COMMENTS
Most reported cases of ONJ related to bisphosphonate therapy have been in patients older than 60 years and often associated with malignancies. Osteonecrosis of the jaws has also been seen in children and adolescents with a history of malignancies who were treated with bisphosphonates.

Several reports have suggested that there is little risk of ONJ in paediatric OI dental patients receiving bisphosphonate therapy. The reasons for this reduced risk are unclear.

When dental treatment is vital in this group of children on bisphosphonate therapy, communication with the child’s medical team is essential. Patients and their parents or caregivers should be informed of the importance of maintaining good oral hygiene and having regular dental evaluations in order to prevent dental disease.

It should also be considered that as bisphosphonates are retained in bone for many years, any dental intervention in this period may, in theory, result in ONJ.

The Canadian Association of Oral and Maxillofacial Surgeons established a multidisciplinary task force that reviewed all relevant research and current literature related to ONJ. These authors concluded that although ONJ was identified as a risk factor in oncology patients receiving high dose intravenous bisphosphonates, low-dose bisphosphonate use in patients, especially children, with OI, did not pose a risk for the development of ONJ and no causal link was established.

A review of the literature suggests that the risk of bisphosphonate-associated ONJ in persons with OI is considered to be extremely low and that persons requiring dental management should not be deprived of treatment. Prior to any dental procedures, dental practitioners should inform patients of the potential risk of ONJ and thereby receive informed consent. Follow-up appointments are obligatory so that healing is closely monitored. If the patient develops symptoms of ONJ, referral for secondary care is mandatory.

SUGGESTIONS FOR FUTURE RESEARCH IN SOUTH AFRICA
A prevalence study and the frequency of persons with OI receiving bisphosphonate treatment who have developed ONJ consequent to dental intervention in South African clinics is necessary. Postoperative follow-up of persons with OI who have received bisphosphonate therapy is important as well as documentation of the antibiotic regimen and the type of bisphosphonate used.

Osteonecrosis of the jaws is a serious clinical problem and, therefore, in order to obtain data in the South African context and to create a greater awareness of this potentially devastating concern, longitudinal studies, such as those mentioned, are necessary.

REFERENCES
THE EFFECTS OF VARIOUS AIR POLISHING POWDERS ON ENAMEL AND SELECTED ESTHETIC RESTORATIVE MATERIALS

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ABSTRACT

Objective
The purpose of this study was to investigate the effects of each of the commercially available air polishing powders on the surface characterization of human enamel, hybrid composite, and glass ionomer using a highly standardized protocol. The air polishing powders utilized in the study included aluminum trihydroxide, calcium carbonate, calcium sodium phosphosilicate, glycine, and sodium bicarbonate.

Methods
The hybrid composite and glass ionomer cement were mixed and photo light-cured for 40 seconds according to manufacturer’s directions, and formed in a specially prepared mold that was coated using a Teflon® aerosolized spray. The enamel samples were prepared by removing sections of human enamel from extracted unerupted third molars using a water-cooled, slowspeed diamond rotary saw. The enamel sections were approximately one centimeter in diameter and 3 mm thick. The enamel sections were flattened using a series of silicon carbide grit papers (600, 800, and 1200 grit). The 1200 grit abrasive paper used is equivalent to a dental polishing disc commonly used to finish dental restorations. All samples were stored in distilled water at 37ºC prior to testing. Each of the three types of samples was treated with each air polishing powder for one, two, and five seconds. A test group of five samples each of hybrid composite, glass ionomer cement, and enamel was fabricated for each of the six types of abrasive powder and three-time exposures for the air polishing treatment, resulting in a total of 270 samples. The treatment samples were exposed to the air polishing powders for the three periods of time using a custom mounting jig and shutter device that was fabricated to standardize the air polishing treatments. The air polishing handpiece was placed in a mounting jig that positioned the tip of the handpiece at an 80º angle from the sample surface. The exposure to the air polishing air, water, and polishing powder was regulated by an articulated metal plate positioned between the tip and the test sample. The holder for the test sample kept the sample in a constant circular motion to simulate clinical use of the air polishing handpiece. A custom computer program was developed to activate a stepper motor that rotated the metal plate away from the sample for the controlled exposure times of one, two, and five seconds before the plate moved back to intercept the polishing spray mixture.

Results
The effect of the air polishing application on the surfaces of the tooth enamel and restorative materials was evaluated for changes in surface roughness and surface topography. The average surface roughness value was evaluated with a contact profilometer prior to and after the air polishing treatment. Changes in the surface characterization of each sample due to air polishing treatment were recorded using scanning electron microscopy. Epoxy resin replicas of representative test samples were made for evaluating under the scanning electron microscope. Samples were sputter-coated with gold palladium and the scanning electron photomicrographs were taken at a magnification of 25X and at a 45º angle. Based on evaluation with the contact profilometer, there were statistically significant interactions between the type of powder and material, type of power and time, and type of material and time. The SEM photomicrographs were used to evaluate the clinical significance of the effects of the air polishing on each type of material. The SEM photomicrographs provided a visual quantitative analysis of the effects of air polishing powders on the restorative materials and the enamel. Any disruption of the surface characterization was considered to be clinically significant and represented volumetric loss and violation of the integrity of the restorative materials and/or enamel.

Conclusions
Based on the results of this study, the air polishing powders that are compatible with use on hybrid composite and glass ionomer cements are EMS glycine and EMS sodium bicarbonate. The air polishing powders that are compatible for use on enamel include EMS glycine, Dentsply sodium bicarbonate, and EMS sodium bicarbonate.
INTRODUCTION

Over 35 years ago, air polishing (AP) was introduced to dentistry and dental hygiene by an inventive dentist named Dr. Robert Black. This alternative method of polishing teeth that uses a spray of compressed air, water, and an abrasive agent (Figure 1) has become a mainstay in the equipment used by dental hygienists. Since it was introduced, it has been widely investigated using both in vivo and in vitro studies.

Once it was determined that air polishing could be used on enamel without harm, there were well-founded concerns regarding the effect that the AP powder particles could have on restorative materials. Since then, a profusion of studies have been conducted on various types, brands, and formulations of composites and glass ionomers, gold, amalgam, porcelain, titanium implant materials, and orthodontic bands and brackets. As a result of the research efforts, air polishing has become the method of choice for removing dental plaque and biofilm from orthodontic bands and brackets, and heavily stained enamel, and is the choice for preparing tooth surfaces prior to sealant placement.

In addition to the supragingival powder applications, there is interest in subgingival AP which has been an object of research. The use of subgingival AP began in Europe and has recently been introduced in the United States. The objectives for subgingival use include the removal of subgingival biofilm in periodontal pockets and the management of subgingival biofilm as a part of the treatment regimen for peri-implantitis. To date, the powders that have been used for subgingival AP include glycine and a powder formulation that contains erythritol. Glycine is widely available for supragingival and subgingival AP in the United States; however, erythritol powder is currently commercially available only in Europe.

Since air polishing was introduced in 1976, there have been a number of polishing units made by a variety of manufacturers, and there are multiple variations of this equipment. The variation of these units include table-top models which can be combined with piezoelectric or magnetostrictive ultrasonic scalers, and hand-held models that connect to the handpiece that supplies air and water. Some units operate off the air and water supply to the air and water syringe. No matter which type of equipment is selected, the units operate basically in the same manner. Compressed air and water must be mixed with the powder to result in a spray that is delivered with a handpiece, making it a two-body abrasive system. The result is that dental stains and dental plaque biofilm are removed as a result of the compressed air, water, and abrasive particles being propelled by kinetic energy.

The most critical item in the air polishing armamentarium is the polishing powder. Initially, the equipment utilized specially processed sodium bicarbonate as the abrasive agent, as it was the only abrasive powder available. When investigating the abrasives that had potential for use as AP, Dr. Black was challenged with some limiting requirements as the abrasive agent had to remove stain safely, remove heavy stain while leaving the enamel surface intact, could not injure soft tissues or tooth structures, must be physiologically compatible with the digestive system, and could not become embedded as a foreign body in the soft tissues of the oral cavity.

Specially processed sodium bicarbonate is well-suited as an abrasive agent; however, due to the salt content, there are some contraindications for the use of the powder. The use of the specially processed sodium bicarbonate is contraindicated for patients on a sodium-restricted diet and patients with renal disease (there are additional contraindications for the use of AP and these are also related specifically to the salt content of the sodium bicarbonate powder). Furthermore, there are patients who simply cannot tolerate the taste of the sodium bicarbonate. Industry responded with the first alternative abrasive powder for AP, which was aluminum trihydroxide, introduced in 2003. Since aluminum trihydroxide was made commercially available, there have been three additional powders that have been introduced. Currently, sodium bicarbonate, aluminum trihydroxide, glycine, calcium carbonate, and calcium sodium phosphosilicate (novamin) on hybrid composites, enamel, and glass ionomer. The purpose of this study was to investigate the effects of each of the identified powders on the surface characterization of human enamel, hybrid composite, and glass ionomer using a highly standardized protocol. The effects of the powders were evaluated with a profilometer and scanning electron microscopy.

Air Polishing Powders

Sodium Bicarbonate

Sodium bicarbonate proved to be an excellent but not perfect choice as a powder, given the limiting requirements an AP abrasive agent had to meet. The inventor of AP, Dr. Robert Black, collaborated with chemists, pharmacists, engineers, and various scientists and came up with the formula that has now become the “gold standard” for air polishing powders. The final formulation for the sodium bicarbonate powder is tribasic, free-flowing, food grade, and contains calcium carbonate and scant amounts of silica. The Mohs Relative Scale hardness value for sodium bicarbonate is 2.5 and the particles average 74 μm in size.

Aluminum Trihydroxide

There was a call from dental hygienists and dentists for a sodium bicarbonate-free air polishing powder
due to the concern that sodium bicarbonate powder is contraindicated for use on some patients, as discussed above. Aluminum trihydroxide air polishing powder was introduced in 2003. Aluminum trihydroxide is much more abrasive than sodium bicarbonate, with a Mohs hardness value of 4.0 and a particle size ranging from 80–325 μm.

**Calcium Carbonate**
Calcium carbonate is a naturally occurring substance that is found in rocks, sea shells, pearls, and egg shells. Medically, calcium carbonate is used as a calcium supplement, as an antacid, and is an ingredient in many pharmaceutical compounds. Additionally, calcium carbonate is used as an abrasive and is a common ingredient in dentifrices. Calcium carbonate has a Mohs hardness value of 3 and the particle size is 55 μm.

**Glycine.**
Glycine is the smallest nonessential amino acid found in proteins. For use in powders, glycine crystals are grown using a solvent of water and sodium-salt. Glycine particles for use in air polishing have a Mohs hardness value of 2 and the particles are 20-25 μm in size. Notably, glycine powder has the smallest particle size and the lowest Mohs hardness number of all of the air polishing powders currently available.

**Calcium Sodium Phosphosilicate (Novamin)**
The last AP powder to be made commercially available is calcium sodium phosphosilicate (Novamin). Novamin is both a trade name and a generic name. Calcium sodium phosphosilicate is a bioactive glass and has a Mohs hardness value of 6, making it the hardest air polishing particle used. The particles vary from 25-120 μm in size. For purposes of comparison, the hardness number and particle size for each type of powder are shown in Table I.

**Esthetic Restorative Materials**
With the advances in esthetic restorative materials, many esthetic restorations are all but impossible to detect, even with enhanced magnified vision. It becomes of critical importance, then, for the dental healthcare provider to have a scientific basis for determining the appropriate air polishing powder to use on or in the vicinity of these artfully created restorations. Because of slight inherent overspray from AP handpieces, the highly abrasive powders should not be used even in the vicinity of these esthetic restorations.1,3,7,9

The esthetic restorative materials selected for this investigation include a hybrid composite and a resin-filled glass ionomer.

**Hybrid Composites**
Hybrid composites contain a wider distribution of filler particle sizes than some other types of composites. The dispersed phase consists of a blend of microfill (0.04 μm) and small (0.06–1.0 μm) filler particles.4 Filler particle content by volume percent varies from 57-70%. This combination of particles improves the polish-ability and surface smoothness of the restoration, as well as increases its mechanical properties. Hybrid composites can be used in the restoration of both anterior and posterior teeth (i.e., class I, II, III, IV, and V restorations). Improvements in the esthetic properties and strength of the hybrid composite have made it the most widely manufactured direct placement restorative material.

**Resin Modified Glass Ionomer Cements**
Resin modified glass ionomer cements (RMGIC) incorporate a photo-polymerizing resin (2-hydroxyethyl-methacrylate, HEMA). The addition of the light-cured resin improves the handling characteristics and mechanical properties of the glass ionomer.42 RMGIC can be used as cavity liners, bases, tooth core buildups, luting agents, and low stress area restorations. The photo-polymerized component provides a “quick set” and minimizes disruption of the restoration during the slower acid-base reaction. Types and brands of restorative materials and air polishing powders utilized in this study are shown in Table II.

**Materials Preparation**
Composite resin and glass ionomer cement samples were identically prepared and were formed in a custom-made mold lubricated with a Teflon® aerosol spray. The resin composite and triturated glass ionomer cement materials were packed into the mold form to produce a sample 10 mm in diameter and 2 mm in depth. A glass microscope slide was compressed onto the restorative material to create a smooth, flat surface. The composite resin and glass ionomer cement samples were polymerized for 40 seconds using a photo-curing light (COE Lunarta, GC America, Alsip, IL, USA). The restorative materials were wet-polished to produce a uniform smooth surface and to remove the resin-rich surface layer using a series of 600, 800, and 1200 grit silicon carbide abrasive paper attached to a rotary polishing machine (Leco, St. Joseph, MI, USA; Figure 2). An example of a glass ionomer sample can be seen in Figure 3. The 1200 grit abrasive paper is equivalent to a 3M ESPE Super Fine Dental polishing disc (3M ESPE, St. Paul, MN, USA), which is commonly used to finish dental restorations.

Enamel samples were prepared by removing sections of tooth enamel from extracted, unerupted, human third molars using a water-cooled, slow-speed diamond rotary saw. The enamel sections were approximately one centimeter in diameter and 3 mm thick (Figures 4 and 5). The enamel surfaces of the samples were flattened using a series of silicon carbide grit papers (600, 800, and 1200 grit) mounted on a rotating polishing wheel. A flat polished enamel surface, at least 5 mm in size, was produced and embedded in the hybrid composite, which was prepared in the same manner as the hybrid composite samples used for testing purposes, resulting in a sample approximately 10 mm

<table>
<thead>
<tr>
<th>Type of Powder</th>
<th>Mohs Hardness Index</th>
<th>Particle Size</th>
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</thead>
<tbody>
<tr>
<td>Glycine</td>
<td>2</td>
<td>20-25 μm</td>
</tr>
<tr>
<td>Sodium bicarbonate</td>
<td>2.5</td>
<td>74 μm</td>
</tr>
<tr>
<td>Calcium Carbonate</td>
<td>3</td>
<td>55 μm</td>
</tr>
<tr>
<td>Aluminum Trihydroxide</td>
<td>4</td>
<td>80-325 μm</td>
</tr>
<tr>
<td>Calcium sodium phosphosilicate</td>
<td>6</td>
<td>25-120 μm</td>
</tr>
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</table>

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<tr>
<th>Manufacturer</th>
<th>Restorative Materials</th>
<th>Composition</th>
</tr>
</thead>
<tbody>
<tr>
<td>GC America</td>
<td>Fuji II LC</td>
<td>Resin modified glass ionomer cement</td>
</tr>
<tr>
<td>Kerr</td>
<td>Point 4</td>
<td>Light-cured hybrid composite</td>
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</tbody>
</table>

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<th>Manufacturer</th>
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<th>Composition</th>
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<tbody>
<tr>
<td>Dentsply</td>
<td>Prophy Jet</td>
<td>Sodium bicarbonate</td>
</tr>
<tr>
<td>Dentsply</td>
<td>Jet Fresh</td>
<td>Aluminum trihydroxide</td>
</tr>
<tr>
<td>EMS</td>
<td>Classic</td>
<td>Sodium bicarbonate</td>
</tr>
<tr>
<td>EMS</td>
<td>Soft</td>
<td>Glycine</td>
</tr>
<tr>
<td>KaVo</td>
<td>Prophy Pearls</td>
<td>Calcium carbonate</td>
</tr>
<tr>
<td>Dıspray</td>
<td>SY:LC</td>
<td>Calcium sodium phosphosilicate</td>
</tr>
</tbody>
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<tr>
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<td>Aluminum trihydroxide</td>
</tr>
<tr>
<td>EMS</td>
<td>Classic</td>
<td>Sodium bicarbonate</td>
</tr>
<tr>
<td>EMS</td>
<td>Soft</td>
<td>Glycine</td>
</tr>
<tr>
<td>KaVo</td>
<td>Prophy Pearls</td>
<td>Calcium carbonate</td>
</tr>
<tr>
<td>Dıspray</td>
<td>SY:LC</td>
<td>Calcium sodium phosphosilicate</td>
</tr>
</tbody>
</table>
in diameter and 2 mm thick. Test samples were stored in distilled water at 37°C prior to testing. The dental restorative materials and the tooth enamel samples were exposed to six simulated dental AP treatments. All procedures were performed with the EMS S-1 (Electro Medical Systems, Nyon, Switzerland) as received from the manufacturer, with the air polishing unit operating at a medium setting.

Each AP procedure was used for three different exposure times (one second, two seconds, and five seconds) on five samples of each material (enamel, hybrid composite, glass ionomer cement). These test times are based on the time-exposure theory of Atkinson-Cobb and confirmed by Barnes: one tooth receives 0.5 seconds of exposure to air polishing powder during one maintenance air polishing procedure. Therefore, these times represent one-year, two-year, and excessive five-year air polishing exposures.

A custom mounting jig and a shutter device were fabricated to standardize the AP treatment procedures (Figure 6). The AP handpiece was placed in a mounting jig that positioned the tip at an angle of 90° and 4 mm from the surface of the test sample.

The duration of the compressed air, water, and polishing abrasive was regulated by an articulated metal plate positioned between the handpiece tip and the test samples. The plate deflected the air abrasive until a constant pressure stream was achieved. A custom computer program (LabVIEW, National Instruments Co., Austin, TX, USA) was used to activate a stepper motor that rotated the metal plate away from the sample. The computer program allowed for the controlled exposure times of one, two, or five seconds before the plate movement returned to intercept the polishing spray mixture.

A test group size of five (n=5) tooth enamel, hybrid composite, and glass ionomer cement samples were fabricated for each of the six types of abrasive powder and three time exposures for the AP treatment. A total of 270 experimental samples were fabricated.

**Evaluation**

The effect of the polishing powder application on the surfaces of tooth enamel and restorative materials was evaluated for changes in the surface roughness and surface topography (SEM). The surface roughness (Ra – average surface roughness value) of each sample was measured prior to and after air polishing treatment. The Ra was measured for each sample with a contact profilometer (Mitutoyo SJ-400, Mitutoyo Corp., Kanagawa, Japan) using ANSI/ASME B46.1 standards. Three measurements were made across the center of the samples using a 2 μm diameter diamond stylus tip with a .75 mN load. Five sampling lengths, each with a cutoff value of 0.25 mm, were used for a total trace length of 1.25 mm. The sample’s surface roughness was defined by the arithmetic mean of the magnitude of the deviation of the profile from the mean line measured within the sampling length (Ra). Three measurements were recorded from each sample and the average of the Ra values was recorded as the sample’s surface roughness.

**Scanning Electron Microscopy**

Changes in the surface characterization of a sample due to air polishing treatment were recorded using scanning electron microscopy (Hitachi 3000N variable pressure SEM, Hitachi North America, New York, NY, USA). The scanning electron micrographs (SEM) were used to evaluate the clinical significance of the effects of air polishing on each type of material treated in the study. Any disruption of the surface characterization was to be interpreted as clinically significant. Epoxy resin replicas of representative test samples were made for evaluation under a scanning electron microscope. Impressions for the replicas were made using a light body vinyl polysiloxane impression material (Reprosil® Light Body, Caulk, Milford, DE, USA) and poured with an epoxy resin (WEST® System Epoxy Resin, Jamestown Distributors, Bristol, RI, USA). Samples were sputter-coated with gold palladium and scanning electron photomicrographs were taken at a magnification of 25X and at a 45° angle.
ANALYSIS

Descriptive statistics that were used to analyze the results included the mean, standard deviation, median, minimum, and maximum. For each outcome, a three-way ANOVA model was used to determine if there were differences in the outcome based on type of powder, material, and duration. The model included interaction terms for powder type and material, and powder type and duration to see if differences in powder type varied based on material or duration.

Statistical Analysis of Roughness

Six AP powders (EMS Classic® sodium bicarbonate [EMS, Geneva, Switzerland], KaVo Prophy Pearls® [KaVo Dental GmbH, Biberach, Germany], calcium carbonate, EMS Soft® glycine, Dentsply Prophy Jet® sodium bicarbonate [Dentsply Co. York, PA, USA] Dentsply Jet Fresh® aluminum trihydroxide, Osspray SYLC® calcium sodium phosphosilicate [novamin, GSK, Weybridge, UK]) were used on three different materials (hybrid composite, glass ionomer, and human enamel) for three different time durations (one second, two seconds, or five seconds). Five samples were used for each combination of powder, material, and time duration. The outcome measure evaluated was the change in roughness (roughness prior to treatment vs. roughness following treatment). The purpose of the analysis was to determine if there were differences between types of air polishing abrasive, materials, and duration of polishing with respect to the mean change in roughness.

RESULTS

Based on the ANOVA model, overall there were statistically significant interactions between the type of powder and material (p < 0.0001), type of powder and time (p < 0.0000), and time and type of material (p < 0.0000).

Roughness Evaluated With Profiometry

To better understand differences in the mean change in roughness, separate one-way ANOVA models were run for type of powder by material, type of powder by time, and material by time.

Type of Powder by Material

Regarding roughness, based on the ANOVA model the interactions between the treatment material and brand of air polishing powders were statistically significant (Table III). In other words, there were statistically significant differences between the brands/types of powders for each of the materials treated; hybrid composite, enamel, and glass ionomer.

Hybrid Composite

Regarding the specific effects of each of the brands of AP powders on the abrasion of the hybrid composite samples treated, there was no statistically significant difference between the change in surface characterization produced by the EMS glycine and the EMS sodium bicarbonate on the hybrid composite samples. Among all of the powders, the EMS glycine and EMS sodium bicarbonate powders produced the least amount of abrasion of the surface characterization of the hybrid composite samples treated.

The KaVo calcium carbonate, Dentsply aluminum trihydroxide, and Dentsply sodium bicarbonate powders did not produce statistically significantly different effects from each other on the surface characterization of the hybrid composite samples. However, each one of these powders produced statistically significantly greater changes in the abrasion of the surface characterization of the hybrid composite than did the EMS glycine or EMS sodium bicarbonate powders.

The effects of the Osspray calcium sodium phosphosilicate air polishing powder on the abrasion of the surface characterization of the hybrid composite were statistically significantly different from all of the other powders utilized in the study. The Osspray calcium sodium phosphosilicate produced the greatest amount of abrasion (loss of surface material) of all of the air polishing powders on the hybrid composite samples.

Enamel

The effects of the EMS glycine and the EMS sodium bicarbonate produced statistically significant abrasive effects on the surface characterization of the enamel samples that were similar to each other. The EMS glycine and the EMS sodium bicarbonate proved to be the least abrasive air polishing powders to enamel. Dentsply sodium bicarbonate, KaVo calcium carbonate, and the Dentsply aluminum trihydroxide powders produced statistically significant abrasive effects on the surface characterization of the enamel samples that were similar to each other. While these powders were not statistically significantly different from each other, they were more abrasive than the EMS glycine and EMS sodium bicarbonate powders (Table III).

The Osspray calcium sodium phosphosilicate air polishing powder produced abrasive effects on the surface characterization of the enamel that were statistically different from all other and proved to be the most abrasive of all of the air polishing powders to enamel (Table III).

Table III: Outcome of material and type of powder: change in roughness (Ra-μm)

<table>
<thead>
<tr>
<th>Material</th>
<th>Powder</th>
<th>N</th>
<th>Mean</th>
<th>Std Dev</th>
<th>Median</th>
<th>Minimum</th>
<th>Maximum</th>
<th>Grouping</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hybrid Composite</td>
<td>EMS glycine</td>
<td>15</td>
<td>0.10</td>
<td>0.03</td>
<td>0.10</td>
<td>0.00</td>
<td>0.14</td>
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<tr>
<td></td>
<td>EMS sodium bicarbonate</td>
<td>15</td>
<td>0.34</td>
<td>0.06</td>
<td>0.31</td>
<td>0.24</td>
<td>0.43</td>
<td>A</td>
</tr>
<tr>
<td></td>
<td>KaVo calcium carbonate</td>
<td>15</td>
<td>0.73</td>
<td>0.12</td>
<td>0.72</td>
<td>0.48</td>
<td>0.91</td>
<td>B</td>
</tr>
<tr>
<td></td>
<td>Dentsply aluminum trihydroxide</td>
<td>15</td>
<td>0.77</td>
<td>0.10</td>
<td>0.77</td>
<td>0.54</td>
<td>0.92</td>
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<tr>
<td></td>
<td>Dentsply sodium bicarbonate</td>
<td>15</td>
<td>0.84</td>
<td>0.22</td>
<td>0.83</td>
<td>0.58</td>
<td>1.42</td>
<td>B</td>
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<tr>
<td></td>
<td>Osspray calcium sodium phosphosilicate</td>
<td>15</td>
<td>2.29</td>
<td>0.51</td>
<td>2.27</td>
<td>1.59</td>
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<td>Enamel</td>
<td>EMS sodium bicarbonate</td>
<td>14</td>
<td>0.04</td>
<td>0.04</td>
<td>0.03</td>
<td>0.01</td>
<td>0.14</td>
<td>A</td>
</tr>
<tr>
<td></td>
<td>EMS glycine</td>
<td>15</td>
<td>0.05</td>
<td>0.04</td>
<td>0.04</td>
<td>0.01</td>
<td>0.16</td>
<td>A</td>
</tr>
<tr>
<td></td>
<td>Dentsply sodium bicarbonate</td>
<td>15</td>
<td>0.09</td>
<td>0.12</td>
<td>0.06</td>
<td>0.02</td>
<td>0.51</td>
<td>AB</td>
</tr>
<tr>
<td></td>
<td>KaVo calcium carbonate</td>
<td>15</td>
<td>0.31</td>
<td>0.16</td>
<td>0.30</td>
<td>0.09</td>
<td>0.56</td>
<td>B</td>
</tr>
<tr>
<td></td>
<td>Dentsply aluminum trihydroxide</td>
<td>15</td>
<td>0.38</td>
<td>0.24</td>
<td>0.29</td>
<td>0.12</td>
<td>0.93</td>
<td>B</td>
</tr>
<tr>
<td></td>
<td>Osspray calcium sodium phosphosilicate</td>
<td>15</td>
<td>1.49</td>
<td>0.39</td>
<td>1.41</td>
<td>0.87</td>
<td>2.17</td>
<td>C</td>
</tr>
<tr>
<td>Glass Ionomer</td>
<td>EMS glycine</td>
<td>15</td>
<td>2.23</td>
<td>0.25</td>
<td>2.21</td>
<td>1.79</td>
<td>2.67</td>
<td>A</td>
</tr>
<tr>
<td></td>
<td>Dentsply aluminum trihydroxide</td>
<td>15</td>
<td>2.47</td>
<td>0.47</td>
<td>2.34</td>
<td>1.89</td>
<td>3.23</td>
<td>AB</td>
</tr>
<tr>
<td></td>
<td>Osspray SYLC calcium sodium phosphosilicate</td>
<td>15</td>
<td>2.49</td>
<td>0.70</td>
<td>2.26</td>
<td>1.81</td>
<td>4.40</td>
<td>AB</td>
</tr>
<tr>
<td></td>
<td>EMS sodium bicarbonate</td>
<td>15</td>
<td>2.54</td>
<td>0.32</td>
<td>2.46</td>
<td>1.95</td>
<td>3.13</td>
<td>AB</td>
</tr>
<tr>
<td></td>
<td>KaVo calcium carbonate</td>
<td>15</td>
<td>2.84</td>
<td>0.39</td>
<td>2.82</td>
<td>2.29</td>
<td>3.78</td>
<td>BC</td>
</tr>
<tr>
<td></td>
<td>Dentsply sodium bicarbonate</td>
<td>14</td>
<td>3.02</td>
<td>0.36</td>
<td>2.99</td>
<td>2.52</td>
<td>3.68</td>
<td>C</td>
</tr>
</tbody>
</table>

*For each material listed abrasives with the same letter are not significantly different.
### Table IV: Hybrid composite, pairwise comparisons of type of powder

<table>
<thead>
<tr>
<th>Powder</th>
<th>Dentsply aluminum trihydroxide</th>
<th>Dentsply sodium bicarbonate</th>
<th>EMS glycine</th>
<th>EMS sodium bicarbonate</th>
<th>KaVo calcium carbonate</th>
<th>Osspray calcium sodium phosphosilicate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dentsply aluminum trihydroxide</td>
<td>0.952</td>
<td>&lt; 0.0001</td>
<td>&lt; 0.0001</td>
<td>&lt; 0.0001</td>
<td>0.9981</td>
<td>&lt; 0.0001</td>
</tr>
<tr>
<td>Dentsply sodium bicarbonate</td>
<td>0.952</td>
<td>&lt; 0.0001</td>
<td>&lt; 0.0001</td>
<td>0.7835</td>
<td>&lt; 0.0001</td>
<td></td>
</tr>
<tr>
<td>EMS glycine</td>
<td>&lt; 0.0001</td>
<td>&lt; 0.0001</td>
<td>0.0759</td>
<td>&lt; 0.0001</td>
<td>&lt; 0.0001</td>
<td></td>
</tr>
<tr>
<td>EMS sodium bicarbonate</td>
<td>&lt; 0.0001</td>
<td>&lt; 0.0001</td>
<td>0.0759</td>
<td>&lt; 0.0001</td>
<td>&lt; 0.0001</td>
<td></td>
</tr>
<tr>
<td>KaVo calcium carbonate</td>
<td>0.9981</td>
<td>0.7835</td>
<td>&lt; 0.0001</td>
<td>0.0003</td>
<td>&lt; 0.0001</td>
<td></td>
</tr>
<tr>
<td>Osspray calcium sodium phosphosilicate</td>
<td>&lt; 0.0001</td>
<td>&lt; 0.0001</td>
<td>&lt; 0.0001</td>
<td>&lt; 0.0001</td>
<td>&lt; 0.0001</td>
<td></td>
</tr>
</tbody>
</table>

### Table V: Enamel, pairwise comparisons of type of powder

<table>
<thead>
<tr>
<th>Powder</th>
<th>Dentsply aluminum trihydroxide</th>
<th>Dentsply sodium bicarbonate</th>
<th>EMS glycine</th>
<th>EMS sodium bicarbonate</th>
<th>KaVo calcium carbonate</th>
<th>Osspray calcium sodium phosphosilicate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dentsply aluminum trihydroxide</td>
<td>0.0033</td>
<td>0.0005</td>
<td>0.0005</td>
<td>0.9299</td>
<td>&lt; 0.0001</td>
<td></td>
</tr>
<tr>
<td>Dentsply sodium bicarbonate</td>
<td>0.0033</td>
<td>0.9939</td>
<td>0.9891</td>
<td>0.0562</td>
<td>&lt; 0.0001</td>
<td></td>
</tr>
<tr>
<td>EMS glycine</td>
<td>0.0005</td>
<td>0.9939</td>
<td>1.0000</td>
<td>0.0120</td>
<td>&lt; 0.0001</td>
<td></td>
</tr>
<tr>
<td>EMS sodium bicarbonate</td>
<td>0.0005</td>
<td>0.9891</td>
<td>1.0000</td>
<td>0.0112</td>
<td>&lt; 0.0001</td>
<td></td>
</tr>
<tr>
<td>KaVo calcium carbonate</td>
<td>0.9299</td>
<td>0.0562</td>
<td>0.0120</td>
<td>0.0112</td>
<td>&lt; 0.0001</td>
<td></td>
</tr>
<tr>
<td>Osspray calcium sodium phosphosilicate</td>
<td>&lt; 0.0001</td>
<td>&lt; 0.0001</td>
<td>&lt; 0.0001</td>
<td>&lt; 0.0001</td>
<td>&lt; 0.0001</td>
<td></td>
</tr>
</tbody>
</table>

### Table VI: Glass ionomer, pairwise comparisons of type of powder

<table>
<thead>
<tr>
<th>Powder</th>
<th>Dentsply aluminum trihydroxide</th>
<th>Dentsply sodium bicarbonate</th>
<th>EMS glycine</th>
<th>EMS sodium bicarbonate</th>
<th>KaVo calcium carbonate</th>
<th>Osspray calcium sodium phosphosilicate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dentsply aluminum trihydroxide</td>
<td>0.0090</td>
<td>0.6762</td>
<td>0.9862</td>
<td>0.1920</td>
<td>1.0000</td>
<td></td>
</tr>
<tr>
<td>Dentsply sodium bicarbonate</td>
<td>0.0090</td>
<td>&lt; 0.0001</td>
<td>0.0312</td>
<td>0.8449</td>
<td>0.0170</td>
<td></td>
</tr>
<tr>
<td>EMS glycine</td>
<td>0.6762</td>
<td>&lt; 0.0001</td>
<td>0.4066</td>
<td>0.4017</td>
<td>0.9979</td>
<td></td>
</tr>
<tr>
<td>EMS sodium bicarbonate</td>
<td>0.9982</td>
<td>0.0312</td>
<td>0.4066</td>
<td>0.4017</td>
<td>0.9979</td>
<td></td>
</tr>
<tr>
<td>KaVo calcium carbonate</td>
<td>0.1920</td>
<td>0.8449</td>
<td>0.0314</td>
<td>0.5979</td>
<td>0.2741</td>
<td></td>
</tr>
<tr>
<td>Osspray calcium sodium phosphosilicate</td>
<td>1.0000</td>
<td>0.0170</td>
<td>0.5979</td>
<td>0.9979</td>
<td>0.2741</td>
<td></td>
</tr>
</tbody>
</table>

### Table VII: Time and type of powder, outcome: change in roughness (Ra-μm)

<table>
<thead>
<tr>
<th>Time</th>
<th>Powder</th>
<th>N</th>
<th>Mean</th>
<th>Std Dev</th>
<th>Median</th>
<th>Minimum</th>
<th>Maximum</th>
<th>Grouping*</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>EMS glycine</td>
<td>15</td>
<td>0.76</td>
<td>1.05</td>
<td>0.08</td>
<td>0.00</td>
<td>2.61</td>
<td>A*</td>
</tr>
<tr>
<td></td>
<td>EMS sodium bicarbonate</td>
<td>15</td>
<td>0.96</td>
<td>1.20</td>
<td>0.28</td>
<td>0.01</td>
<td>3.13</td>
<td>A</td>
</tr>
<tr>
<td></td>
<td>Dentsply aluminum trihydroxide</td>
<td>15</td>
<td>1.09</td>
<td>0.88</td>
<td>0.77</td>
<td>0.15</td>
<td>2.51</td>
<td>A</td>
</tr>
<tr>
<td></td>
<td>Dentsply sodium bicarbonate</td>
<td>15</td>
<td>1.17</td>
<td>1.23</td>
<td>0.67</td>
<td>0.02</td>
<td>3.02</td>
<td>A</td>
</tr>
<tr>
<td></td>
<td>KaVo calcium carbonate</td>
<td>15</td>
<td>1.18</td>
<td>1.13</td>
<td>0.65</td>
<td>0.09</td>
<td>3.01</td>
<td>A</td>
</tr>
<tr>
<td></td>
<td>Osspray calcium sodium phosphosilicate</td>
<td>14</td>
<td>1.75</td>
<td>0.47</td>
<td>1.86</td>
<td>0.87</td>
<td>2.29</td>
<td>A</td>
</tr>
<tr>
<td>2</td>
<td>EMS glycine</td>
<td>15</td>
<td>0.79</td>
<td>1.06</td>
<td>0.10</td>
<td>0.01</td>
<td>2.67</td>
<td>A</td>
</tr>
<tr>
<td></td>
<td>EMS sodium bicarbonate</td>
<td>14</td>
<td>0.96</td>
<td>1.07</td>
<td>0.39</td>
<td>0.01</td>
<td>2.46</td>
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</tr>
<tr>
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<td>Dentsply aluminum trihydroxide</td>
<td>15</td>
<td>1.03</td>
<td>0.85</td>
<td>0.73</td>
<td>0.12</td>
<td>2.47</td>
<td>A</td>
</tr>
<tr>
<td></td>
<td>Dentsply sodium bicarbonate</td>
<td>15</td>
<td>1.25</td>
<td>1.09</td>
<td>0.67</td>
<td>0.17</td>
<td>3.01</td>
<td>A</td>
</tr>
<tr>
<td></td>
<td>KaVo calcium carbonate</td>
<td>15</td>
<td>1.34</td>
<td>1.38</td>
<td>0.83</td>
<td>0.04</td>
<td>3.68</td>
<td>A</td>
</tr>
<tr>
<td></td>
<td>Osspray calcium sodium phosphosilicate</td>
<td>15</td>
<td>1.81</td>
<td>0.43</td>
<td>1.81</td>
<td>1.09</td>
<td>2.39</td>
<td>A</td>
</tr>
<tr>
<td>3</td>
<td>EMS glycine</td>
<td>15</td>
<td>0.84</td>
<td>1.08</td>
<td>0.12</td>
<td>0.04</td>
<td>2.53</td>
<td>A</td>
</tr>
<tr>
<td></td>
<td>EMS sodium bicarbonate</td>
<td>15</td>
<td>1.06</td>
<td>1.23</td>
<td>0.38</td>
<td>0.02</td>
<td>3.03</td>
<td>A</td>
</tr>
<tr>
<td></td>
<td>Dentsply aluminum trihydroxide</td>
<td>15</td>
<td>1.44</td>
<td>1.31</td>
<td>0.91</td>
<td>0.03</td>
<td>3.56</td>
<td>AB</td>
</tr>
<tr>
<td></td>
<td>Dentsply sodium bicarbonate</td>
<td>15</td>
<td>1.45</td>
<td>1.28</td>
<td>0.83</td>
<td>0.30</td>
<td>3.78</td>
<td>AB</td>
</tr>
<tr>
<td></td>
<td>KaVo calcium carbonate</td>
<td>15</td>
<td>1.749</td>
<td>1.14</td>
<td>0.88</td>
<td>0.34</td>
<td>3.23</td>
<td>AB</td>
</tr>
<tr>
<td></td>
<td>Osspray calcium sodium phosphosilicate</td>
<td>15</td>
<td>2.66</td>
<td>0.71</td>
<td>2.67</td>
<td>1.57</td>
<td>4.40</td>
<td>C</td>
</tr>
</tbody>
</table>

*For each material listed abrasives with the same letter are not significantly different.
For material and time. There was no statistically significant difference in the mean change in roughness on the composite samples between the time durations (p = 0.34). Likewise, there was no statistically significant difference in the mean change in roughness of enamel between the time durations (p = 0.18). Conversely, there was a statistically significant difference in the mean change in roughness in the glass ionomer samples between the time durations (p < 0.0001). The treatment of the glass ionomer for five seconds resulted in a surface that was statistically significantly rougher than the effects produced by the powders at one and two seconds. This is due to the fact that the glass ionomer is the softest of the three study material samples.

Roughness Visually Evaluated With Scanning Electron Microscopy
The SEM photomicrographs were used to evaluate the clinical significance of the effects of AP powders on restorative materials and enamel. No measurements were made of volumetric loss, as any disruption of the surface characterization was considered to be clinically significant and represented volumetric loss, and thus a violation of the integrity of the restorative materials and/or enamel. Short of an actual clinical trial, adding SEM analysis provided

Table VIII: Five-seconds, pairwise comparisons of type of powder

<table>
<thead>
<tr>
<th>Powder Type</th>
<th>Osspray sodium bicarbonate</th>
<th>Dentsply sodium bicarbonate</th>
<th>EMS glycine</th>
<th>EMS sodium bicarbonate</th>
<th>KaVo calcium carbonate</th>
<th>Dentsply aluminum trihydroxide</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dentsply aluminum trihydroxide</td>
<td>0.0692</td>
<td>0.0508</td>
<td>0.0005</td>
<td>0.0031</td>
<td>0.0524</td>
<td>0.0692</td>
</tr>
<tr>
<td>EMS glycine</td>
<td>1.0000</td>
<td>1.0000</td>
<td>0.6936</td>
<td>0.9342</td>
<td>0.0524</td>
<td>1.0000</td>
</tr>
<tr>
<td>EMS sodium bicarbonate</td>
<td>0.8985</td>
<td>0.9373</td>
<td>0.9956</td>
<td>0.9342</td>
<td>0.0005</td>
<td>0.8985</td>
</tr>
<tr>
<td>KaVo calcium carbonate</td>
<td>1.0000</td>
<td>1.0000</td>
<td>0.6936</td>
<td>0.9342</td>
<td>0.0005</td>
<td>1.0000</td>
</tr>
</tbody>
</table>

*For each material listed abrasives with the same letter are not significantly different.

Glass Ionomer
The interaction between material and type of powder assessment was the greatest with the glass ionomer, due to the inherent roughness of the glass ionomer and the fact that glass ionomer is the softest of all materials that were treated with the AP powders utilized in this study. The Dentsply sodium bicarbonate powder produced the greatest change in the surface characterization (smooth to rough) of the glass ionomer. However, statistically the effects were not entirely different than the changes brought about by Dentsply aluminum trihydroxide, KaVo calcium carbonate, Osspray calcium sodium phosphosilicate, or the EMS sodium bicarbonate.

Pairwise comparisons were calculated to determine if there was a statistically significant difference in the mean change in roughness of the treated materials between the powder types (p < 0.0001). For each material treated, (enamel, the hybrid composite, and the glass ionomer), there was a statistically significant difference in the mean change in roughness between the powder types (p < 0.0001). For each material treated in the study. The SEM photomicrographs were used to evaluate the clinical significance of the effects of air polishing on each type of material treated in the study.

Evaluation of surface characterization provides a visual quantitative analysis of the effects of AP powders on restorative materials and enamel. No measurements were made of volumetric loss, as any disruption of the surface characterization was considered to be clinically significant and represented volumetric loss, and thus a violation of the integrity of the restorative materials and/or enamel. Short of an actual clinical trial, adding SEM analysis provided
important and more comprehensive evaluation of the effects of these AP powders on the samples of the restorative materials and enamel. An actual clinical trial would be unethical since harm to subject’s restorations on enamel could occur.

Scanning electron photomicrographs were taken of all study samples of restorative materials and enamel after treatment with each of the air polishing powders for all treatment times; one second, two seconds, and five seconds. For the majority of the SEM photomicrographs, there was no significant visual difference between the effects of the air polishing powders on the restorative materials and enamel.

Further, any visual effects of the AP powders on the study samples after treatment with the powders for five seconds mirrored the effects seen at one and two seconds of treatment. Therefore, it was determined to include the SEMs of the samples treated for five seconds in this report as this provided an exaggerated amount of treatment time. The five seconds of treatment time, as stated previously, is approximately the equivalent of an individual having their teeth air polished twice per year for five years.

SEM: Treatment Outcomes
All SEM treatment outcomes are based on the SEMs of the three materials, hybrid composite, enamel, and glass ionomer, which were treated with each of the six air polishing powders for five seconds.

Hybrid Composite
The SEM photomicrographs of the hybrid composite treated with the six air polishing powders can be seen in Figures 5a-5f. Changes in the surface characterization of the hybrid composite after treatment with each of the powders revealed that the least amount of change in surface characterization was found on the hybrid composite treated with the EMS glycine, followed by EMS sodium bicarbonate. The greatest amount of change in the surface characterization of the hybrid composite was caused by Osspray calcium sodium phosphosilicate, followed by KaVo calcium carbonate. Analysis of the SEM photomicrographs revealed that the powders that caused the least to the greatest amount of disruption in the surface characterization in the hybrid composite samples were EMS glycine, EMS sodium bicarbonate, and Osspray calcium sodium phosphosilicate.

Human Enamel
The SEM photomicrographs of the human enamel treated with the six air polishing powders can be seen in Figures 6a-6f. An analysis of the changes in the surface characterization of the enamel after treatment with each of the powders revealed that the least amount of change in surface characterization was found on the enamel that was treated with the EMS glycine, followed by Dentsply sodium bicarbonate. The greatest amount of change in the surface characterization of the enamel was created by the Osspray calcium sodium phosphosilicate, with less by KaVo calcium carbonate. Analysis of the SEM photomicrographs revealed that the powders that caused the least to the greatest amount of disruption in the surface characterization in the enamel samples were EMS glycine, Dentsply sodium bicarbonate, EMS sodium bicarbonate, Dentsply aluminum trihydroxide, KaVo calcium carbonate, and Osspray calcium sodium phosphosilicate.

Glass Ionomer
The SEM photomicrographs of the glass ionomer treated with the six air polishing powders can be seen in Figures 7a-7f. An analysis of the changes in the surface characterization of the glass ionomer after treatment with each of the powders revealed that the...
least amount of change in surface characterization was found on the glass ionomer that was treated with the EMS glycine, followed by the Dentsply sodium bicarbonate air polishing powder.

The greatest amount of change in the surface characterization of the glass ionomer was created by the Osspray calcium sodium phosphosilicate, with less change by KaVo calcium carbonate. Analysis of the SEM photomicrographs revealed that the powders that caused the least to the greatest amount of disruption of the surface characterization in the glass ionomer samples were EMS glycine, EMS sodium bicarbonate, Dentsply sodium bicarbonate, KaVo calcium carbonate, Dentsply aluminum trihydroxide, and Osspray calcium sodium phosphosilicate. The Dentsply sodium bicarbonate, KaVo calcium carbonate, and Dentsply aluminum trihydroxide were very close in value for the disruption of the surface characterization of the glass ionomer. There is little discernable difference in the amount of volumetric loss caused by each of these three air polishing powders.

Clinical Trends
The scanning electron photomicrographs (SEMs) were used to determine the clinical significance of treating each of the study sample surfaces with the AP powders. By comparing each of the study sample surfaces and the amount of change

Figures 6a-6f: Scanning electron photomicrographs of enamel treated for five seconds with the indicated air polishing powder.

Figures 7a-f: Scanning electron photomicrographs of glass ionomer treated for five seconds with the identified air polishing powder.
brought about to the surface characterization by the powders, there was clearly a trend as to the amount of change that occurred associated with each, which can be seen in Table X. Clearly the EMS glycine and EMS sodium bicarbonate, respectively, brought about the least amount of change in surface characterization. The greatest amount of change in the surface characterization was brought about by the Osspray calcium sodium phosphosilicate, which caused excessive removal of the hybrid composite, human enamel, and glass ionomer sample materials. In some instances the Osspray calcium sodium phosphosilicate (novamin) removed all of the restorative material leaving a hole in the sample, as can be seen in the respective SEM photomicrographs.

The remaining three powders, Dentsply sodium bicarbonate, KaVo calcium carbonate, and Dentsply aluminum trihydroxide, caused clinically significant, detrimental changes in the surface characterization. While the Dentsply sodium bicarbonate caused clinically significant and detrimental changes in the hybrid composite and glass ionomer materials, it was compatible with human enamel. However, the EMS sodium bicarbonate powder was slightly less abrasive to human enamel than the Dentsply sodium bicarbonate powder. The KaVo calcium carbonate and Dentsply aluminum trihydroxide caused clinically significant detrimental changes to the hybrid composite, glass ionomer, and human enamel. Any disruption in the surface characterization of the restorations violates the integrity of that restoration in that it represents volumetric loss of the restorative material.

DISCUSSION
The purpose of this study was to investigate the effects of commercially available air polishing powders on the surface characterization of a hybrid composite, a glass ionomer, and human enamel using a highly standardized protocol. This is the only research found in the literature to date that has been conducted on air polishing powders that utilized a standardizing device so that the treatment times were exact. A custom mounting jig and shutter device were fabricated to standardize the treatment procedures. The shutter exposure time was controlled by a customized computer program so that the exposure times of the powder, air, and water stream were an exact one, two, and five seconds. The handpiece was secured according to universal treatment instructions so that the nozzle would be 3-5 mm and in a constant circular motion.

The scanning electron photomicrographs offered excellent visual documentation on the effects of the various powders on the surface characteristics of the study samples. The visual SEM effects were supported by the results of profilometry.

CONCLUSION
There are no universal standards for the formulations of air polishing powders. Even though more than one manufacturer makes and distributes AP powders that are identified by their primary ingredient, the powders differ among manufacturers. In this study, it was found that the Dentsply sodium bicarbonate powder differs greatly in abrasion potential from the EMS sodium bicarbonate powder, which was statistically and clinically significantly less abrasive. Therefore, dentists and dental hygienists need to be aware that air polishing powders differ in their formulations from manufacturer to manufacturer, and should expect different results from powders made by different manufacturers.

The results of this research indicate that there are air polishing powders that are significantly less abrasive than others, even with similar ingredients, specifically sodium bicarbonate. It also appears that foresthetic restorations, EMS glycine and EMS sodium bicarbonate were satisfactory. Based on the results of this study, esthetic restorations should not be air polished with Dentsply sodium bicarbonate, Dentsply aluminum trihydroxide, KaVo calcium carbonate, or Osspray calcium sodium phosphosilicate air polishing powders. Moreover, based on these results, it is the recommendation of these investigators that Dentsply aluminum trihydroxide, KaVo calcium carbonate, and Osspray calcium sodium phosphosilicate not be used as air polishing powders due to their highly abrasive nature, which resulted in clinically significant damage to the surface characterization of enamel, hybrid composite, and glass ionomer. Dentsply sodium bicarbonate is compatible with enamel and other restorative materials (amalgam, gold, porcelain); however, not with esthetic restorative materials. The SEM photomicrographs were used to determine the clinical significance of treating each of the study sample surfaces with the air polishing powders by comparing each of the study sample surfaces and the amount of change brought about to the surface characterization by the air polishing powders, there is clearly a trend as to the amount of change that occurred associated with each of the air polishing powders, which can be seen in Table X. Clearly, the EMS glycine and EMS sodium bicarbonate brought about the least amount of change in surface characterization. The greatest amount of change in the surface characterization was brought about by the Osspray calcium sodium phosphosilicate, which caused a complete disruption in the surface characterization of the hybrid composite, human enamel, and glass ionomer. In some instances, the Osspray calcium sodium phosphosilicate (novamin) removed all of the restorative material leaving a hole in the sample, as can be seen in the respective SEM photomicrographs. The KaVo calcium carbonate and Dentsply aluminum trihydroxide caused clinically significant detrimental changes to the hybrid composite, glass ionomer, and human enamel.

The Dentsply sodium bicarbonate caused clinically significant and detrimental changes in the hybrid composite and glass ionomer materials; however, it is compatible with human enamel.

REFERENCES

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<th>Table X: Summary of results of the effects of the air polishing powders on hybrid composite, human enamel and glass ionomer samples</th>
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<td>Air Polishing Powder</td>
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<tr>
<td>Least change in surface characterization</td>
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<tr>
<td>EMS glycine</td>
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<td>EMS sodium bicarbonate</td>
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<tr>
<td>Dentsply sodium bicarbonate</td>
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<td>KaVo calcium carbonate*</td>
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<tr>
<td>Dentsply aluminum trihydroxide</td>
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<tr>
<td>Greatest change in surface characterization</td>
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<tr>
<td>Osspray calcium sodium phosphosilicate</td>
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**Guided Biofilm Therapy** leads the paradigm shift in professional prophylaxis based on the latest scientific findings. In doing so it follows insights gained by employing the **AIR-FLOW®** method in this process, with the following findings:

- Improves visibility of calculus
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✓ With a granule-metric size of only 14µm, the **AIR-FLOW®PLUS** powder represents the most finely grained particle in the world of dentistry.

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✓ The best solution in professional tooth cleaning.

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The University of the Western Cape (UWC) held its graduation and awards ceremony on 18 and 19 December 2017. During the event, the University proudly announced its 100% pass rate, ascribing it to the students’ hard work bearing fruits.

Several dental companies and organisations were involved in sponsoring awards that acknowledge students for their overall academic performance, including Johnson&Johnson, Oral B, Colgate, Ivodent, Wright Milners, New Age Radiology, Paedodontic Society of South Africa, OHASA and the UWC.

Dr Prince (Clinical Dean) with Jason Arendse (Professional Conduct Award)

Dean Professor Osman and Aude Katzen (Top academic student)

Gail Smith and Stephanie Masella (Student who won the OHASA Research Prize).

Barbara Johnson (J&J) with Basheera Jaffer (Passion for the Profession Award)

Ms Gordon and El Mari Verwey (Department Prize for Diligence)
The Eastern Cape branch had our first Breakfast Meeting on 27 January 2018 at the Intercare Learning Centre, Walmer, Port Elizabeth. Mr Konrad van Staden (Clinical Psychologist) was the speaker and delivered the presentation: “The diagnosis and treatment of the substance using patient – Understanding addiction in our society.” All our members enjoyed the topic and participated in the topical discussion session afterwards.

Our full day CPD seminar will take place on 5 May at the Radisson Hotel. We are in the process of finalising speakers and will share more detail shortly.

Our branch also plans to do the Level 3 First Aid course through St John in May this year. They are willing to accommodate us over two weekends so we do not have to be away from work for a whole week. We will make details available to members as soon as possible.

Our committee for the term 2018 to 2020 are:
Shaya Pillay – Chairperson
Sanmari Botha – Treasurer
Mart-Marie Potgieter – CPD Coordinator
Marie Ferreira – Branch Representative
Compliments of the season to you and your families!
I hope you’re all enjoying being back at work and
the beginning of 2018 — a year that we trust will be
successful and prosperous for all dental professionals
(Oral hygienists, dental assistants and dentists).

Your ongoing support of OHASA motivates the
committee to operate optimally and we thank every
single one of you for providing the best healthcare
to patients and giving our profession the dignity
it deserves.

This newsletter stipulates a few important details
for your information and for your diaries.

Congratulations to the following members
who are the 2018-2020 OHASA Gauteng branch
committee members:

- **Chairperson:**
  Mmakaoka (Kaokie) Sepuru
  (kaokie.11sepuru@gmail.com)

- **Vice-Chairperson:**
  Alma Olivier (@alimcl.olivier4@gmail.com)

- **Secretary to Chair:**
  Suné Combrink (sune_mm@yahoo.com)

- **Secretary to Vice-chair, Finance:**
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- **Dental traders, Charity:**
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- **Dental traders, Promotional work:**
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- **Seminar speakers:**
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- **Finance:**
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- **Printing, Promotional work:**
  Chanté Wannenburg
  (chantewan@gmail.com)

I wish you all the best over your three-year term
and let us strive to become the best branch in
South Africa, promoting oral health and guiding
fellow oral hygienists where ever assistance is
required in our field.

**PLEASE DIARISE THE FOLLOWING DATES:**

**1st OHASA seminar:**
17 March 2018 – Full day Gauteng branch
seminar at NG Lynnwood church, Pretoria

**2nd OHASA seminar:**
9 June 2018 – Full day Gauteng branch seminar
at 3M, Woodmead

**3rd OHASA seminar:**
15 September 2018 – Full day Gauteng branch
seminar at NG Lynnwood church, Pretoria

**IMPORTANT REMINDER:**
2018 IS THE YEAR OHASA TURNS 40!
We are planning a celebration for this milestone
so keep abreast of all the details in the upcoming
newsletters and seminars.

This is also the year we need to implement more
social responsibility events that involve all members
and non-members in our profession. We need more
integration and awareness to be raised regarding
the high caries prevalence amongst children in
impoverished areas. We need more oral health
awareness to be showcased on print media, digital
media and radio. The more people are exposed to
oral health awareness, the better equipped we will
make our patients and their families and friends.

Yours faithfully

Mmakaoka Kaokie Sepuru (072 902 4115)
OHASA Gauteng Branch Chairperson
(2018-2020)
FOCUS ON: KATHY DALLOWAY, KZN CHAIRPERSON

Kathy graduated from Glasgow Dental Hospital in 1985 as a Registered Dental Hygienist and returned to her home town of Harare, Zimbabwe where she practised oral hygiene in three large private dental practises for 14 years, before moving to Durban in March 2000.

After studying further at University of Durban, Westville she joined a private practice with Drs Philip Jeary and Evan Mexon in Durban North, followed by a specialist practice in Musgrave Park with Dr Miki Baranyay. It was here that she gained experience in cutting edge cosmetic and reconstructive dentistry.

Kathy now works in independent practice, passionately educating both young and old about the link between oral health and overall health, while helping them achieve vibrant, healthy smiles.

COURSE IN THE EXPANDED SCOPE OF PRACTICE (2013)

The University of the Western Cape invites Oral Hygienists to a Course in the Expanded Scope of Practice (2013). The course includes the following procedures:

- Sealant restorations (PRR);
- Periodontal splinting;
- Tooth whitening techniques and procedures;
- Fabrication of vacuum formed mouth guards; and
- The Oral Hygiene Process of Care.

Date: 18-22 June 2018. Applications are currently open. Application forms are attached and are also available through the University of the Western Cape, Oral Hygiene Department and OHASA.

Cost: R5 000. Note that seats are limited. Deadline for application indicating your interest is 6 April 2018. Upon receipt of your application, a registration form with details of payment will follow. Contact Ms Kelly Stuurman at 021 937 3162 or email kstuurman@uwc.ac.za
OHASA WC wishes all members and your families a blessed 2018. Also, a warm WC welcome to our new OHASA president Angelique Kearney. We are looking forward to working with her to make OHASA even greater. Our sincere thanks go to Stella Lamprecht, our immediate past president: Stella you are a gem and we wish you well for the future. Your commitment to the profession is unwavering and we are all eternally grateful for the support and guidance you gave us through the years. We know we can count on your support in future; not only for members, but also being there for Angelique if she needs a helping hand. Thank you for your tremendous contribution to OHASA and the oral hygiene profession.

This year our association is 40 years old. We will be celebrating our association with pride. Our annual Breakfast Meeting is scheduled for 24 February 2018 at Belmont Square Conference Centre in Rondebosch. It will be an important branch meeting as we will nominate and accept new portfolios for our branch committee.

Our two full day seminars are scheduled for 12 May 2018 and 6 October 2018 respectively.

Thank you to all the traders for their continuous support. As the outgoing Chairperson of the Western Cape branch, I want to thank you all for allowing me to lead you over the past years. While not always easy, I can truly say it was a very rewarding experience. Thank you to the branch and CPD committee for all your hard work and dedication – we are truly a mean team. Thanks to all previous committee members that over the last 40 years made OHASA what it is today. Let us build on what we have to make OHASA even greater as we celebrate our 40 years and beyond. We are entering a new era with lots of opportunities let us be proud of our profession.

Love, light and peace
Gail Smith
AN IN VITRO COMPARISON OF THE EFFECTS OF VARIOUS AIR POLISHING POWDERS

1. The limiting requirements of an ideal polishing powder include:
   a. Ability to remove dental staining without damaging the oral hard and soft tissues
   b. Physiologically incompatible with digestive health
   c. Mucosal impaction
   d. All of the above

2. Mr X a 55 year old patient presents for a prophylactic appointment. His main complaint is excessive dental staining due to a smoking habit. On taking his medical history you note that he suffers from numerous chronic co-morbidities, including, hypertension, diabetes and renal dysfunction. The polishing powder that would be contraindicated for use in this patient is:
   a. Aluminium trihydroxide
   b. Calcium carbonate
   c. Sodium bicarbonate
   d. Calcium sodium phosphosilicate

3. The efficacy of an air polishing powder in removal of dental staining and biofilm is primarily determined by the particle:
   a. Size
   b. Shape
   c. Hardness
   d. Weight

4. Intra-oral examination and radiographic findings for Mr X indicate a healthy dentition with no carious lesions and presence of intact occlusal amalgam restorations on the first molars. Using only the primary determinant for stain removal in selection of an air polishing powder, which of the following products would be most likely to remove Mr X’s dental staining?
   a. Glycine
   b. Calcium carbonate
   c. Aluminium trihydroxide
   d. Calcium sodium phosphosilicate

5. If Mr X however presented with multiple hybrid composite restorations, which air polishing powder would you be least likely to use due to the potential for the powder to abrade the restorations?
   a. Glycine
   b. Calcium carbonate
   c. Aluminium trihydroxide
   d. Calcium sodium phosphosilicate

DENTAL IMPLICATIONS OF BISPHOSPHONATE

1. Which of the following statements is incorrect with respect to the mechanism of action of bisphosphonates:
   a. Inhibition of bone resorption
   b. Decreased remodelling of the alveolar bone
   c. Osteoclast apoptosis
   d. Increased angiogenesis

2. Bisphosphonate therapy is frequently used in management of patients with:
   a. Osteopetrosis
   b. Metastatic bone malignancies
   c. Paget’s Disease
   d. Both b and c

3. Which of the following factors is not implicated in the pathophysiology of osteonecrosis of the jaw (ONJ):
   a. Genetic predisposition
   b. Pro-inflammatory effect
   c. Modification of the oral microbial flora
   d. Reduced bone vasculature

4. Radiographic features of dentinogenesis imperfecta don’t include:
   a. Well defined pulp chamber
   b. Well defined lamina dura
   c. Thin, elongated roots
   d. Cervical constriction

5. Which of the following recommendations by various international bodies relating to the dental management of paediatric patients with osteogenesis imperfect type III due to start or currently on bisphosphonate therapy is incorrect:
   a. Dental procedures must only be undertaken once high dose bisphosphonate therapy is achieved
   b. Discontinuation of bisphosphonate therapy 8-15 days prior to minor treatment or 4 months prior to more invasive procedures
   c. Antibiotic prophylaxis
   d. No precautions

6. If a paediatric patient with osteogenesis imperfect type III on bisphosphonate therapy requires dental treatment, the incorrect procedure to follow would be:
   a. Avoid treatment
   b. Potential risk of ONJ to be discussed with the parent/caregiver and informed consent obtained
   c. Maintenance of good oral hygiene
   d. Regular post treatment follow-up and immediate referral if any symptoms of ONJ become evident
NEGIGENCE VS. MALPRACTICE

1. Medical negligence refers to unintentional harm whereas malpractice refers to a breach of the duty of care or intentional harm.
   True or False.

2. Which of the following would not establish negligence in a legal situation:
   a. Defendant had a duty to the claimant
   b. Defendant did not adhere to prescribed standard of conduct
   c. Negligent conduct was cause of harm incurred by the claimant
   d. It can not be proven that the claimant suffered harm

3. Which of the following factors, related to the defendant, would be taken into consideration in establishing negligence:
   a. The context
   b. Knowledge
   c. Activity
   d. All of the above

4. Which of the following would not establish malpractice in a legal situation:
   a. The defendant is a licensed professional
   b. The defendant upheld his/her duty of care to the claimant
   c. The defendant’s mistakes and poor treatment (breach of duty of care) lead to an injury
   d. Injury lead to physical, emotional or financial damage to the claimant

5. In the medical/dental setting the law makes special allowances for newly qualified clinicians.
   True or False.

DO EARLY VISITS REDUCE TREATMENT AND TREATMENT COSTS FOR CHILDREN?

1. In a 2012 study examining deidentified data (42,532 records) provided by Church Street Health Management that operates across the USA providing dental care to children from low income backgrounds, the percentage of children that fell into the early starter category (i.e. first dental visit <4 years old) was:
   a. 20%
   b. 40%
   c. 60%
   d. 80%

2. The difference in average cost in dental treatment between the late and early starter groups over an eight-year follow-up period was:
   a. $350.12
   b. $355.12
   c. $360.12
   d. $365.12

3. Within the early and the late starter groups, the treatment category that incurred the lowest cost over the eight year follow-up was:
   a. Fillings
   b. Crowns
   c. Pulpotomies
   d. Extractions

4. Complete the following. On average, children categorised as early starters, had _____ less dental crown treatments over eight years than the late starter group.
   a. 1.19
   b. 0.69
   c. 0.85
   d. 0.70

5. Findings of this study demonstrate that delaying the first dental visit until school age or presence of the mixed dentition approximately doubled dental treatment costs.
   True or False.
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Date of preparation: February 2017, GCSAE/CHSEN0/0150/16(1)
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