THE EFFECTIVENESS OF A CUSTOM MADE LIGHT GUIDE TIP FOR CURING COMPOSITE RESINS

ABSTRACT:

Light guide (LG) tips are expensive to replace. Custom made light guide (CMLG) tips may offer a suitable replacement for the light guide tip supplied by the manufacturer. This study compared the effectiveness and cost of a custom made light guide to a manufacturer made light guide (MMLG) tip.

INTRODUCTION:

The use of Light Emitting Diode (LED) dental light curing apparatus for the photo-initiation of light cured composites is well known to the dental profession. The light guide tip forms part of this apparatus and is responsible for the transmission and distribution of light energy from the LED source to the surface of the composite restoration. These conventional light guide tips are extremely fragile and replacement is expensive. Light guide tips used for preclinical training at academic institutions are often damaged beyond repair due to operator negligence. The effect of different light guide tips from various manufacturers on the compressive strength of dental composites, has been studied.[1,2,3] The effect of a custom made light guide tip on the compressive strength has however, not been investigated. An alternative custom made light guide tip may offer a suitable replacement light guide tip if this product can be shown to be as effective as the light guide tip made by a dental manufacturer.

OBJECTIVES:

1. To compare the effectiveness of a new custom made light guide tip to the light guide tip of a manufacturer, by comparing the compressive strength of composite specimens.
2. To compare the cost of the light guide tips.

MATERIALS & METHODS:

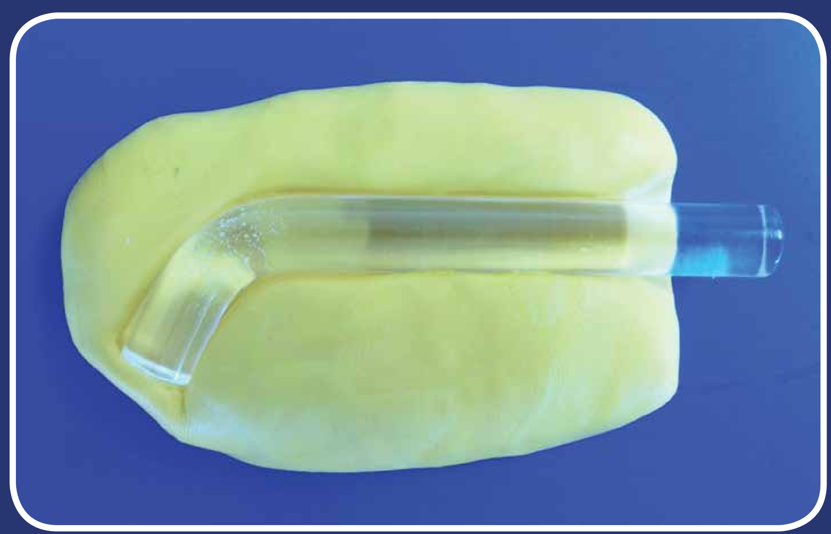


Figure 1: 10 cm acrylic rod (8 mm in diameter), shaped into a 145 degree angle.

Figure 2: Composite specimens packed into Teflon moulds.

Figure 3: Instron machine with composite specimen mounted into Bencor Multi-T device.

1. A 2 m acrylic rod (PLEXIGLAS, Bedfordview, South Africa), 8 mm in diameter, was sectioned into 10 cm rods.
2. Each rod was shaped into a 145 degree angle using heat from a bunsen burner and a custom mould made from polysiloxane lab putty (COLTENE, Essex, United Kingdom), and customized into a light guide tip (Figure 1). The rod was then finished (pumice and water) and polished (acrylic polish) in a Gamberini Polishing Machine (Gamberini corporation, Cambridgeshire, United Kingdom).
3. The CMLG was fitted into a custom made coupling (black insulation tape) that connected it to the LED SLC-V IIIc Dental Curing Light (Hangzhou corporation, Zhejiang Province, China).
4. Filtek Supreme XTE (A1) (3M ESPE) and Z 100 (A1) (3M ESPE) composite was packed into machined circular teflon moulds (Figure 2) and light cured to form composite specimens (composite stubs: 4mm in diameter, 5mm in length).
5. Four groups of ten composite specimens (light cured for 60 seconds on each side) were created using the Teflon moulds.
6. Ten Z100 specimens were light cured with a CMLG and ten Z 100 specimens were light cured with a light guide tip of a manufacturer.
7. Ten Filtek Supreme XTE specimens were light cured with a CMLG and ten Filtek Supreme XTE specimens were light cured with a light guide tip of a manufacturer.
8. The LG was placed directly onto the cellophane strip placed directly over the composite specimen. The specimens were light cured for 1 minute on each side.
9. The compressive strength of the specimens were tested, with the specimens mounted into a Bencor Multi-T device (Danville Engineering, San Ramon CA, U.S.A) and then placed in a Instron machine (Norwood corporation, Massachusetts, U.S.A), at a crosshead speed of 0.5 mm/min (Figure 3). Max compressive load was measured in MPa.
10. Results were analysed using the Students' t-test. Comparison of the cost was done by comparing the quote for the manufacturers light guide tip to the total cost involved in the manufacturing of the CMLG using a comparison of incremental cost equation ratio (ICER)

RESULTS:

The results are graphically illustrated in Figure 4 and Figure 5. There were no significant differences between the compressive strength (MPa) values of the CMLG and the light guide tip of the manufacturer ($p > 0.05$). The light guide tip of the manufacturer costs R 1150.00 compared to the custom made light guide tip which costs R 5.00.

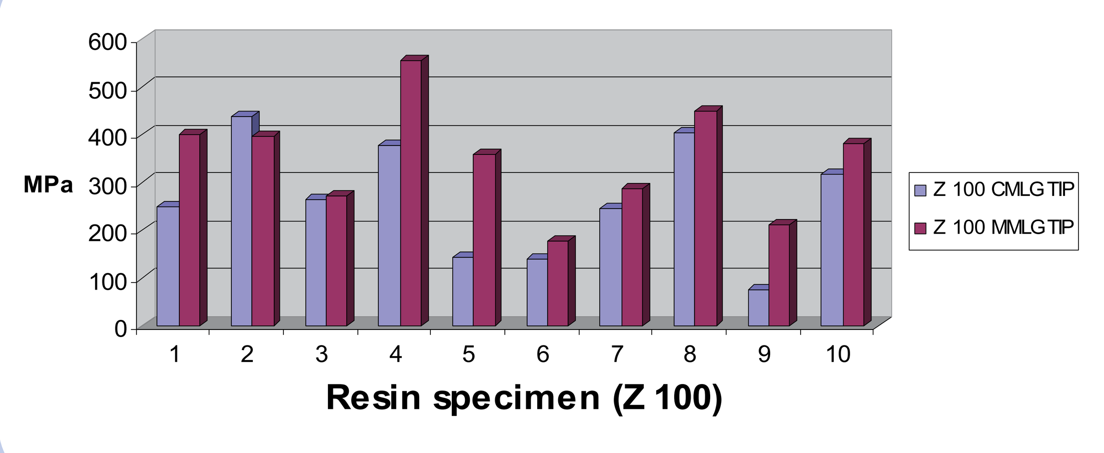


Figure 4: Graphical illustration of compressive stress results for Z100

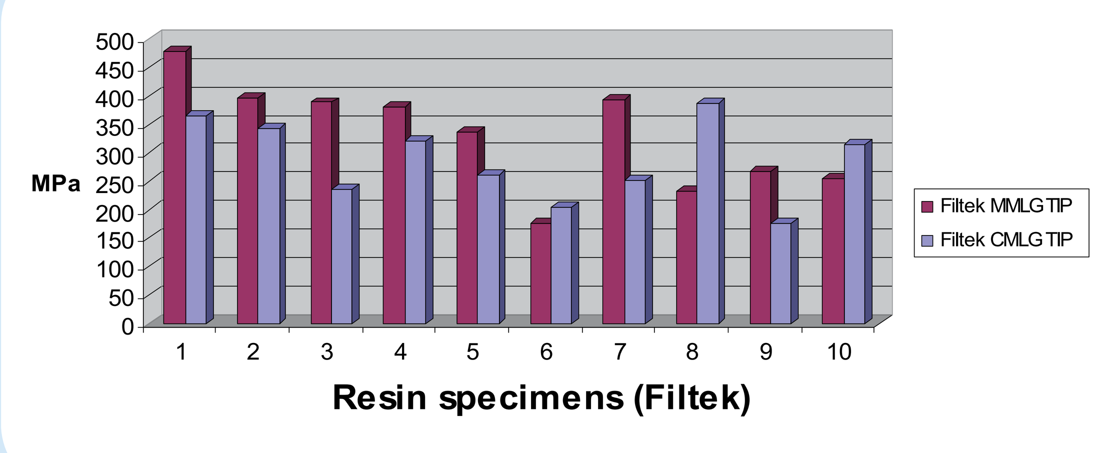


Figure 5: Graphical illustration of compressive stress results for Filtek

CONCLUSION:

The effectiveness of the CMLG did not differ significantly from the light guide tip of the manufacturer. Damaged light guide tips can be replaced immediately by the CMLG without compromising the clinical activities of the operator. The CMLG costs significantly less than the manufacturer made light guide tip.

REFERENCES

1. Price RB, Shortall AC and Palin WM. The Contemporary Issues in Light Curing. Operative Dentistry 2013; 39(1):4-14.
2. Galvao MR, Caldas SGFR, Bagnato VS, de Souza Rastelli AN and de Andrade MF. Evaluation of degree of conversion and hardness of dental composites photo-activated with different light guide tips. Eur J Dent 2013; 7(1): 86-93.
3. Galvao MR, Caldas SGFR, Calabrez-Filho, Campos EA, Bagnato VS, Rastelli ANS and Andrade MF. Compressive strength of dental composites photo-activated with different light guide tips. Laser Phys 2013; 23(1): 1-5.
4. Mahn E. Clinical criteria for the successful curing of composite materials. Rev. Clin.Periodoncia Implantol.Rehabil.Oral 2013;6(3): 148-153.

Arnold S*[1], Bookhan V[1], De Wet FA[1], Brandt PD[1] and Ballyram R[2].

[1]Department of Odontology, Faculty of Health Sciences, University of Pretoria,

[2]Department of Operative Dentistry, Oral Health Centre, Sefako Makgatho University.

UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA

EFFECT OF VARIOUS POLISHING SYSTEMS ON ROUGHNESS OF TWO COMPOSITES

INTRODUCTION:

The surface roughness of composite restorations is of great importance in the ultimate success and longevity of the restorations. It has an influence on plaque accumulation on the composite surface. If the surface of the composite restoration is not smooth, the accumulation of plaque can have serious secondary effects, for example secondary caries at the restoration-tooth interface. A rough restoration can also cause gingival irritation and periodontal disease. Surface roughness plays an important part in the aesthetics of the restoration and the wear of the opposing dentition. Rough restorations will be uncomfortable to the sensory feeling of the patient's tongue.

OBJECTIVE:

To evaluate the surface roughness of a nanocomposite and a microhybrid composite after polishing the composites with different polishing systems.

MATERIALS AND METHODS:

The composites used in this study were Filtek™ Supreme XTE (3M ESPE, St Paul, MN, USA) and Z100™ (3M ESPE, St Paul, MN, USA) . Thirty-five composite samples were made from each of the two composites (Fig. 1). Uncured composite was placed into an aluminium ring mould, 10mm X 2mm. Both the upper and lower surfaces of the composite were covered with mylar strips and glass plates, before the specimens were cured for 40 seconds from both sides. Samples were randomly divided into 7 groups. The groups were: 1. Mylar strip (control); 2. Sof-lex™finishing and polishing discs (Fig 2); 3. Sof-lex™Spiral Wheels (Fig 3); 4. Dura-White stone (Fig 4); 5. Intensiv Unigloss Cellbrush (Fig 5); 6. Enhance®/Prisma®Gloss™ polishing paste (Fig 6); Sof-lex™Spiral Wheels combined with Zircon-Brite (Fig. 7). The polishing of the specimens was performed by a single operator according to manufacturer's instructions.

After curing of the composite samples, all the samples, except for the control groups, were finished with a red label finishing diamond bur ISO 806 314 249 514 012 (Dentsply/Maillefer, Ballaigues, Switzerland), followed by a yellow label finishing diamond bur (ISO 806 314 249 504 012) (Dentsply/Maillefer, Ballaigues, Switzerland).

The mean surface roughness of each specimen was determined using a Surftest SJ 210 profilometer (Mitutoyo, Tokyo, Japan). Three readings (in different directions) were collected from each specimen. Data was statistically analyzed using ANOVA. Scanning Electron Microscope (JEOL JSM-5800 LV, Tokyo, Japan) photos were taken of representative samples under 500 and 1000 times magnification.

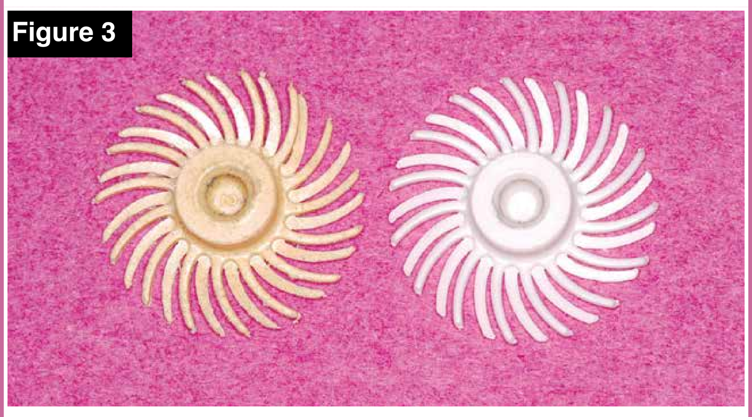
Figure 1

Composite sample being removed from the ring mould, after being cured between two glass plates under a Mylar strip.

Figure 2

Sof-lex™ disc: course, medium, fine and extra-fine (3M ESPE, St Paul, USA).

Figure 3



Sof-lex™ Spiral Wheels (3M ESPE, St Paul, USA).

Figure 4

Dura-White Stone (Shofu Inc., Kyoto, Japan).

Figure 5

Intensiv Unigloss Cellbrush (Intensiv SA, Montagnola, Switzerland).

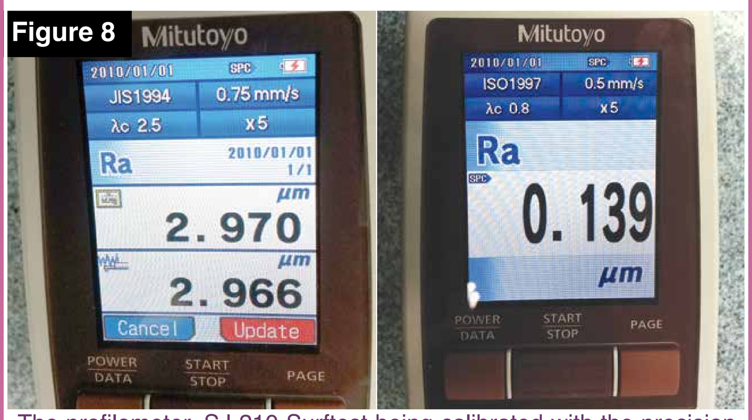
Figure 6

Enhance® system with Prisma® Gloss™ polishing paste (Dentsply, Milford, USA).

Figure 7

Zircon-Brite (Dental Ventures of America, Corona, USA).

Figure 8

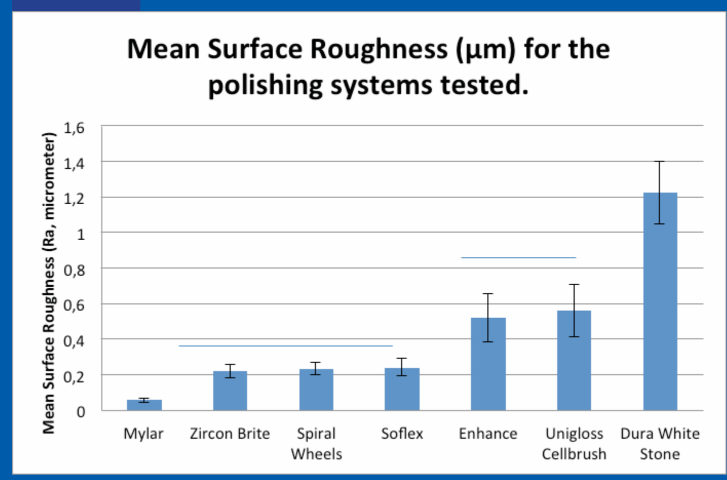


The profilometer, SJ 210 Surftest being calibrated with the precision specimen on the left, and a composite disc that is being read on the right hand side.

RESULTS:

Statistically significant differences in surface roughness were observed between the following groups: Z100™ and Filtek™ SupremeXTE with the polishing systems combined ($p=0.005$); Control group vs. all the polishing systems; Sof-lex™ vs. Dura –White stone, Unigloss Cellbrush, Enhance®/Prisma®Gloss™($p < 0.0001$); Spiral Wheels vs. Dura-White stone, Unigloss Cellbrush, Enhance®/Prisma®Gloss™ ($p < 0.0001$); Dura-White stone vs. Unigloss Cellbrush, Enhance®/Prisma®Gloss™, Spiral Wheels/Zircon-Brite ($p < 0.0001$); Unigloss Cellbrush vs. Spiral Wheels/Zircon-Brite ($p<0.0001$); Enhance®/Prisma®Gloss™ vs. Spiral Wheels/Zircon-Brite ($p < 0.0001$).

Table 1



A pictorial presentation of the differences in surface roughness in μm between the polishing systems tested in this study can be seen in Table 1. Polishing systems with the same black bar are not statistically different.

The composite's surface roughness's differed significantly ($p=0.005$) after polishing. Table 2 depicts the differences in mean surface roughness in micrometer between the two composites after polishing.

Some of the significant Scanning Electron Microscope images at 500 X magnification findings can be seen in Figures 9 – 15.

Table 2

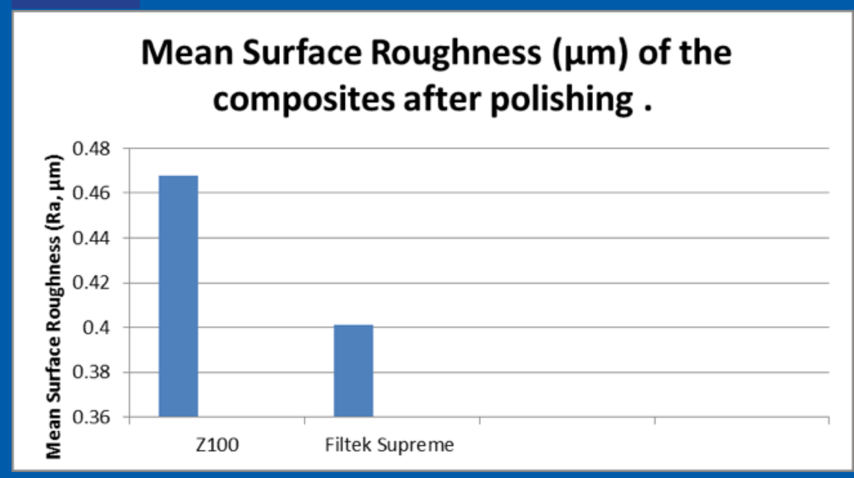
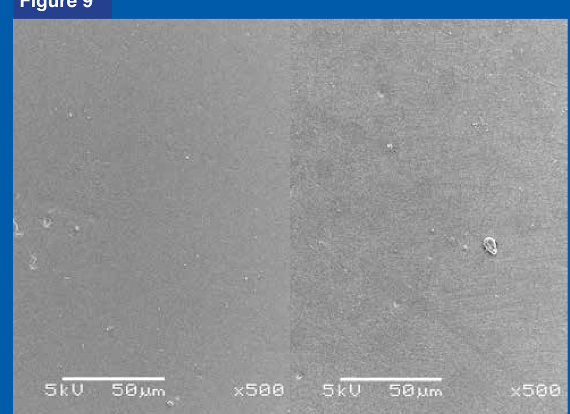
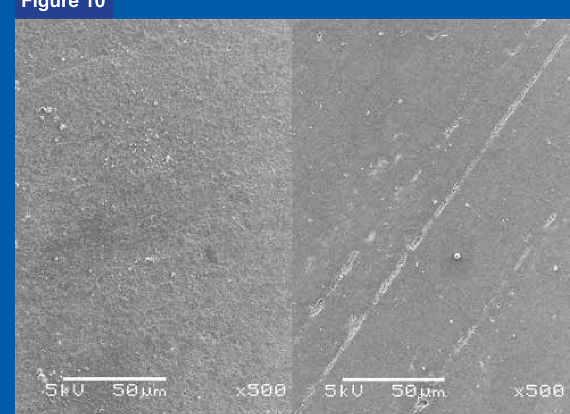


Figure 9



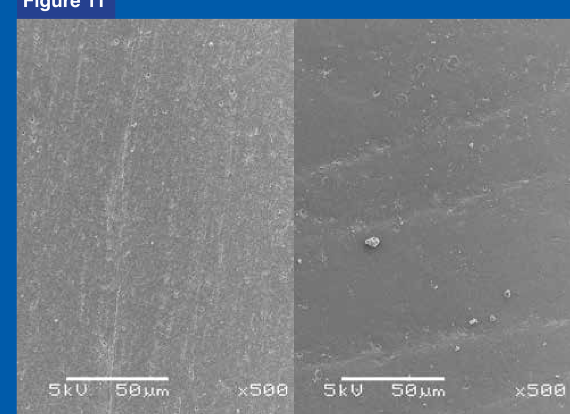
Left: Z100 cured under a Mylar polyester strip. The composite surfaces appeared quite smooth, but showed small protruding particles and irregularities on the surface, possibly small filler particles that protruded from the resin matrix.
Right: Filtek Supreme XTE, also cured under a Mylar strip. Both composite surfaces appeared quite smooth, but showed small protruding particles and irregularities on the surface, possibly small filler particles that protruded from the resin matrix.

Figure 10



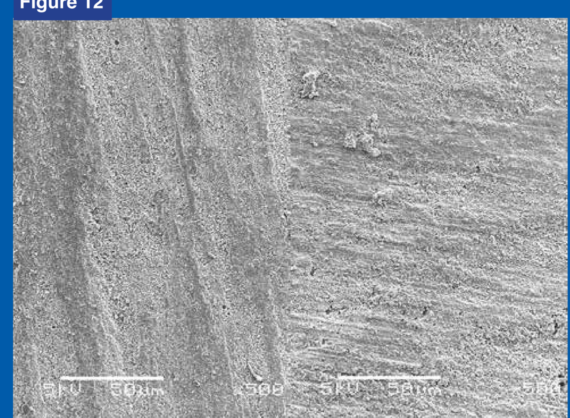
Left: Z100™ polished with Sof-lex™XT discs (C, M, F, SF). The image showed quite smooth surfaces with only a few scratch lines and irregularties. Protruding filler particles is visible on the surface.
Right: Filtek™ Supreme XTE polished with Sof-lex™XT discs (C,M,F,SF). Scratch lines and protruding filler particles are visible.

Figure 11



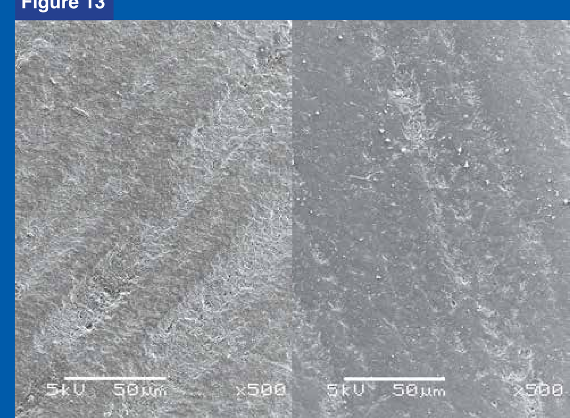
Left: Z100™ polished with Sof-lex™ Spiral Wheels. A few scratch lines and small voids were present. Protruding particles were also noted.
Right: Filtek™ Supreme XTE polished with Sof-lex™ Spiral Wheels™. Surface is relatively smooth, with protruding nano-clusters and smaller filler particles visible on the surface.

Figure 12



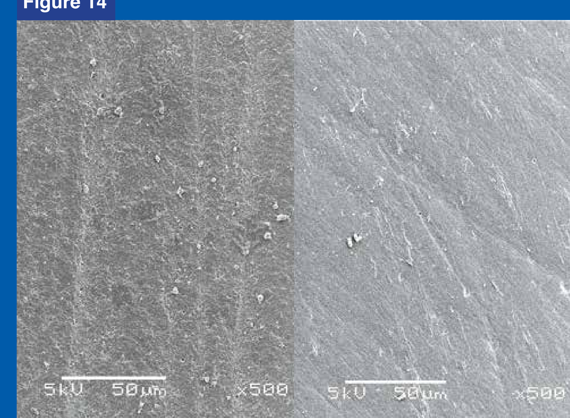
Left: Z100™ polished with Dura- White Stone. Very rough, wavy and uneven appearance. Clear crests and valleys are visible.
Right: Filtek™ Supreme XTE polished with Dura-White Stone. Very wavy and uneven, rough appearance.

Figure 13



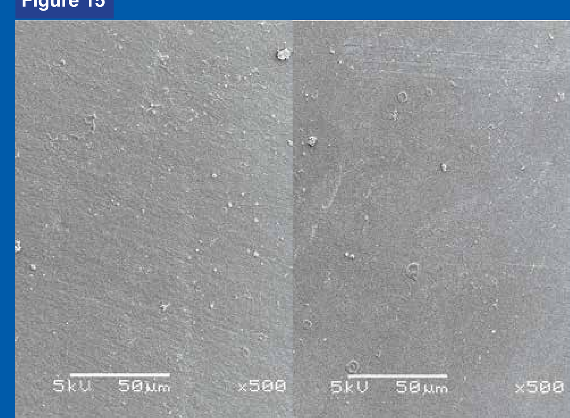
Left: Z100™ polished with Intensiv Unigloss Cellbrush. The composite has a wavy appearance with clear crests and valleys.
Right: Filtek™ Supreme XTE polished with Intensiv Unigloss Cellbrush. Very wavy, uneven surface, with viods, protruding filler particles and debris visible.

Figure 14



Left: Z100™ polished with Enhance® system. Voids and surface irregularities were visible, possibly due to the plucking effect of the polishing systems. Protruding filler particles and debris were also visible on the surface.
Right: Filtek™ Supreme XTE polished with Enhance® and Prisma Gloss polishing paste. Wavy appearance, composite smear lines and protruding filler particles visible on the surface.

Figure 15



Left: Z100™ polished with Sof-lex™ Spiral Wheels followed by Zircon-Brite. Surface appears smooth, with few protruding filler particles, and small scratch lines visible.
Right: Filtek™ Supreme XTE polished with Sof-lex™ Spiral Wheels™ followed by Zircon-Brite. The surface is very smooth, with protruding filler particles of different sizes visible.

CONCLUSION:

Filtek Supreme XTE™ displayed significantly better polishability than Z100™. Some polishing systems produced statistically smoother surfaces than others. The smoothest surface was obtained after curing under a mylar strip. The smoothest surface after polishing was the Zircon-Brite/Spiral Wheel combination, followed by Sof-lex Spiral Wheels and Sof-lex polishing discs. These systems did not differ significantly from each other, but did give significant smoother surfaces than Enhance, Intensiv Unigloss Cellbrush and Dura-White Stone.

ACKNOWLEDGEMENTS:

To the Pameijer Fellowship (IADR) and DFT fund (SADA) who provided financial assistance and to 3M ESPE who sponsored some of the materials used in this study.

Kritzinger, D.
Faculty of Health Sciences, Department of Odontology
University of Pretoria

UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA

Clinical Associates: A COST EFFECTIVE STRATEGY?

A case-study regarding the cost-effectiveness of training and employing clinical associates for the Mpumalanga province in South Africa

Research question

What is the **cost-effectiveness** for a province in South Africa of investing in training and employing **Clinical Associates**, compared to investing in training and employing more **Medical Practitioners**?

Intro

Focus

Cost
- Training
- Employment

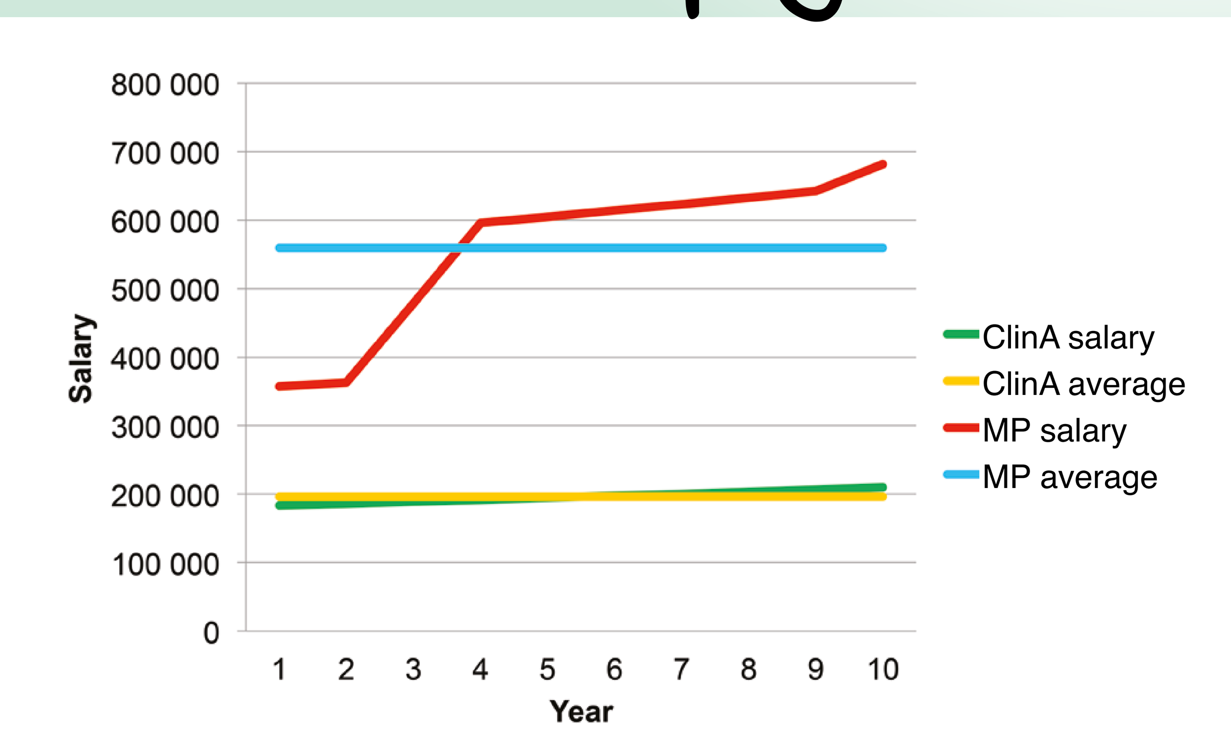
Effect
- Scope of Practice
- Quality
- MP time saved
- Retention

Cost of Training

BCMP (clinical associate)		MBChB (medical practitioner)	
Year 1	119.765	Year 1	122.305
Year 2	84.685	Year 2	123.955
Year 3	96.380	Year 3	118.725
		Year 4	119.615
		Year 5	122.110
		Year 6	124.275
Total	*300.850*	*Total*	*730.985*

Bursaries 2015: province Mpumalanga

Cost of Employment



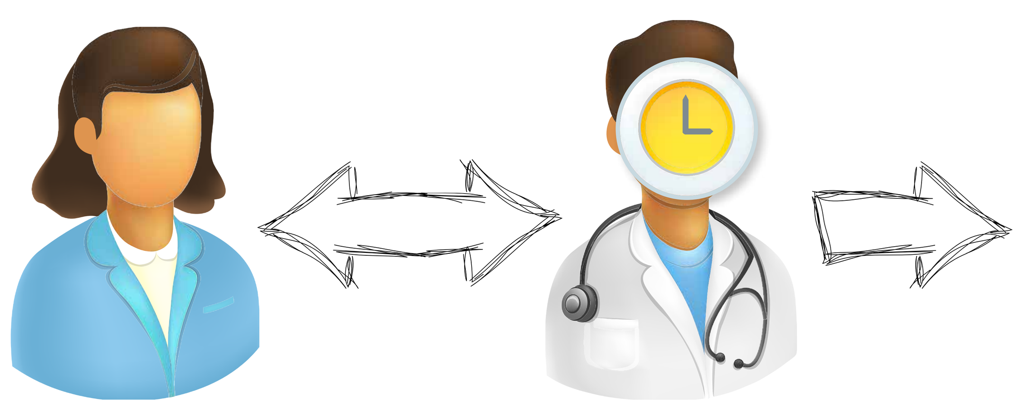
Output

Scope of Practice
- clinical associates can perform any act delegated by the supervising medical practitioner in accordance with the education, training and experience of the clinical associate

Quality of Care
- Consensus: same quality of care as higher level workers when provided that they receive adequate training, support and supervision

Retention
- 53.4% of students prefer to work rural by free choice
- Mozambique: after 20 years 88% still rural
- Important to keep investing

Output - MP time saved



Workload ⇩
Time ⇧
MP needed ⇩

Routine: 60 min work	45 min saved	75%
Varied: 60 min work	30 min saved	50%

In 2015 there are 500 qualified clinical associates in South Africa.

Clinical associates are trained, and allowed to, perform the most common procedures in a district hospital as well as any act delegated by the supervising medical practitioner in accordance with their education, training and experience. Thus, legally they can be very versatile and are allowed to take over most of the routine tasks of the medical practitioner.

A literature review by the World Health Organization concludes: "Overall, however, the existing evidence suggests that where mid-level cadres received appropriate and adequate training and continue to be supported, their performance is close to or even better than that of their professional counterparts."

Summary of Case Study

Province Mpumalanga: 585 vacant posts for medical practitioners in public sector in 2010.
Suppose: the province decides to invest an additional R10 million in training more healthcare workers.

	Assumption	Extra budget allows to train*:	This will fill potentially:	Total employment costs **:	Costs per filled vacant MP post:
Train MPs	None	13,7 clinicians: • 13,7 MPs • 0 CAs	13,7 vacant MP posts	7,7 million rand per year	559.397 rand per year
Train MPs and CAs	"CA can free up 50% MP time"	22,5 clinicians: • 7,5 MPs • 15 CAs	15,0 vacant MP posts	7,1 million rand per year	476.027 rand per year
Train MPs and CAs	"CA can free up 75% MP time"	22,5 clinicians: • 7,5 MPs • 15 CAs	18,9 vacant MP posts	7,1 million rand per year	377.800 rand per year

CAs=Clinical Associates, MPs=medical practitioners
* based on bursaries for BCMP and MBChB students
** based on average salary for Clinical Associates and Medical Practitioners

Conclusion

The training and employing of clinical associates is potentially a cost-effective strategy for a province to meet the increasing demand for healthcare workers in rural areas. Clinical associates can perform routine tasks for medical practitioners, without losing quality of care, and therefore free up time for medical practitioners. Costs, per filled vacant MP post, of training and employing a combination of clinical associates and medical practitioners are less than only training and employing medical practitioners. This strategy will, however, only succeed if clinical associates receive adequate training, support and supervision and if the province keeps investing in them.

References:
Clinical Associates: a cost-effective strategy?
A literature review and case-study regarding the cost-effectiveness of training and employing clinical associates for the Mpumalanga province in South Africa.

Dr Martin Bac (Family Physician), Dr Murray Louw (Family Physician), J.M.A. Hamm, arts (Maastricht), P.C. Hamm-van Bodegraven, MSc CPsA (Maastricht)
Faculty of Health Sciences, Department of Family Medicine
University of Pretoria

UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA