

**A Comparative Evaluation of Pulp Chamber Temperature
Rise associated with Polishing of Light Cured Composite
Restorations Using 2 Different Polishing Systems**

- An In-vitro study

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CERTIFICATE

Certified that the dissertation on **A COMPARATIVE EVALUATION OF PULP CHAMBER TEMPERATURE RISE ASSOCIATED WITH POLISHING OF LIGHT CURED COMPOSITE RESTORATIONS USING 2 DIFFERENT POLISHING SYSTEMS - An In-vitro study** done by **Dr. ABHISHEK SINGH**, part II Post Graduate student (MDS), Branch III : Conservative Dentistry & Endodontics, Saveetha Dental College and Hospitals, Chennai submitted to The Tamil Nadu Dr. M.G.R. Medical University in partial fulfillment for the M.D.S. degree examination in February 2005, is a bonafide research work done under my guidance and supervision.

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INTRODUCTION

Composite resin is presently used primarily as a direct esthetic restorative material. The esthetics of these tooth-coloured restorations is heavily dependent on surface finish¹.

Finishing refers to the gross contouring or reducing of the restoration to obtain the desired anatomy. Polishing refers to the reduction of the roughness and scratches created by the finishing instrument. Residual surface roughness of restorations encourages plaque accumulation, which may result in gingival inflammation, superficial staining and secondary caries². The finished surface apart from esthetics also affects the longevity of the restoration as well as its biocompatibility with the oral tissues^{3, 4}.

The surface of resin composites can be finished and polished using a variety of instruments such as burs, discs, pastes⁵. Abrasive disks are used for gross reduction, contouring, finishing and polishing. Most types of disks are coated with aluminium oxide abrasive with moisture –resistant backings/paper backings.

The finishing and polishing involves contouring the restoration with 12 –flute carbide /30-100 micron diamond burs or coarse abrasive disks, followed by fine and extra fine diamond burs, white stones, disks and finally polish with extra fine abrasive coated disks/rubber coated disks, cups or points. Some

systems also employ an aluminium oxide/diamond extra fine paste for polishing. Some operators prefer to work without coolant in an intermittent/ continuous manner due to the difficulties in controlling water cooling when flexible disks are used⁶. It is possible that the temperature reached in this manner could be detrimental to the pulp⁷. Little research has been conducted to determine whether these working methods result in detrimental changes in the pulp.

For many years the possibly damaging effects of temperature increases on the pulp tissue during restorative treatment procedures like polishing has been a matter of concern to dentistry. According to Zach & Cohen⁸, a temperature increase of 5.6 degree Celsius causes irreversible damage to healthy pulps. In addition, irritated pulps can be damaged by even lower increases in temperatures.

Polishing of composite resin can produce potentially injurious temperature rise within the pulp chamber. Studies done evaluating temperature rise in the pulp chamber during high-speed tooth preparation with diamond burs have shown upto 4 degree Celsius temperature rise in 30 seconds⁹.

The aim of this study was to establish the pulp chamber temperature rise produced during polishing of cured composite resin using a dry and a wet polishing system and the effect of time and polishing technique on the temperature rise.

REVIEW OF LITERATURE

WILLIAM LEFKOWITZ¹⁰ et al in **1958** studied the pulp response to cavity preparation. Cavity preparations were done using intermittent slow-speed, high-speed, airbrasive, ultrasonics. Histologic examinations were performed on prepared teeth at 24 hours, 1 week, and 1 month. Intermittent low-speed and high-speed demonstrated no signs of pulp injury while the peripheral ends of odontoblastic processes were amputated 0.5-1.0 mms. Furthermore, the findings in this study establish that the traumatic injury to the pulp is minimal and reversible when the optimum cavity depth and thermogenesis are respected. This study illustrated that a remaining dentin thickness (RDT) of 0.8 or greater may be sufficient to prevent pulpal injury during cavity preparation in intact teeth, and the use of any methods of cavity preparation are biologically acceptable methods as measured by pulp response.

R TERRELL WEITMAN¹⁴ in **1975** studied the effectiveness of several composite finishing techniques in producing a plaque resistant surface (both clinically and in the laboratory). 11 groups of Class V composites were finished with 4 finishing techniques (carbide finishing burs, white stones, brown and green finishing stones with aluminium oxide and brown and green finishing stones with zirconium silicate). Laboratory measurements revealed that aluminium oxide slurry produced the smoothest surface however composite surfaces were covered with plaque after 24 hours regardless of the finishing technique uses.

Aluminium oxide slurry was thought to produce a smoother surface than zirconium silicate due to the 1 micron particle size and the incorporation of quartz with a Moh hardness greater than 7.

HENRY O TROWBRIDGE¹⁶ et al in 1980 investigated the response of teeth to thermal stimulation. Heat and cold tests were done in teeth scheduled for orthodontic extraction and the sensory response time (elapsed time between application of agent and response) was recorded. The teeth were extracted and mounted with placement of a thermistor probe positioned so that the tip was flush with the surface of enamel. The results of this study indicate that the sensory response to thermal stimulation occurs before there is a temperature change in the region of the Pulp-Dentin Junction.

WAYNE T WOZNIAK⁴ et al in 1985 studied the effect of finishing and polishing on colour and gloss of composites with different fillers. A conventional composite (Concise), small particle composite (Prisma-Fil) and three macro-filled composites (Silar, Durafiland Zeon) were used in this study. Finishing and polishing was done with 600 grit-silicon carbide paper on a polishing wheel at 3500 rpm. Composites cured adjacent to Mylar strips were used as controls. A spectrophotometric colorimeter and glossometer were used to record the tristimulus color values and gloss respectively. A surface analyzer was used to record the surface profiles. Filler particle size and shape were also examined by scanning electron microscopy and optical microscopy. All composites polished

with silicon carbide showed statistically significant higher tristimulus values than Mylar finished composite surfaces indicating strong reflection from a specific part of visible spectrum and hence appear lighter (whiter). Polishing also resulted in significant decrease in gloss (less for macro-filled composite due to filler particle size). Surface profile tracing showed that gloss was related to surface roughness of polished surface. In general, polished composites tended to appear lighter, whiter and less glossy and this change is relevant when using composites in restorative dentistry.

ALAN A BOGHOSIAN²⁰ et al in **1987** studied rotary finishing of microfilled and small-particle hybrid composite resins with coarse, fine tungsten carbide and diamond burs. 2 light-cured composites – SILUX (with pre-polymerized particles), Herculite XR were used in this study. Finishing was done using 12 fluted and 30 fluted tungsten carbide and 25, 15 micron diamond burs. The specimens were cut using the above on a specially designed platform with the specimen advancing at a constant rate. 48 cut surfaces were examined randomly under SEM. The results indicated that carbide burs caused a disrupted surface on the microfilled resin due to the higher concentration of BIS/GMA causing occlusion of the carbide bur. Carbide burs (12, 30 flute) however produced smoother surfaces on hybrid composite. Diamond burs did not disrupt the surface on micro-filled and small surface hybrid composite. The results of this study suggest selecting carbide finishing burs for hybrid composites and diamond burs for micro-filled composites.

HAROLD E GOODIS⁹ et al in **1988** studied the temperature gradients at DEJ and PDJ within the tooth during cavity preparation. Thermistors attached to telethermometers were placed at the DEJ and PDJ and cavity preparation performed under operating microscopic guidance. The penetration of the bur was done at the mesio buccal line angle 2 mms above the crest to DEJ crest and in the central groove 2 mms above the PDJ crest. The results indicated a rise of 10-degree Celsius in 1 minute with no coolant. The temperature rise was less when air, water was used as a coolant. The method in this study was intended to give a more accurate way of measuring the pulpal effects of tooth reduction procedures. Furthermore, remaining dentin thickness (RDT) played an essential role of dissipating heat between the enamel, dentin and pulp as evident from the variations between temperature rise recorded at the dentin-enamel junction (DEJ) and PDJ.

PETER OTTL²² et al in **1988** studied the relationship between different grits of fine diamond burs on the temperature response within the pulp chamber during tooth preparation with a turbine. Temperature rise was measured in a freshly extracted tooth using a NiCrNi thermocouple inserted apically. The results indicated a maximal temperature elevation within the pulp to be 3.2 degree Celsius, the most pronounced rise in temperature occurred with ultra coarse burs. Furthermore, this study confirmed the benefits of short intervals between grinding steps and a cooling water temperature between 30 –32 degree Celsius due to the insulating properties of residual dentin as well as use of coolant.

W H RAAB⁷ et al in **1989** studied the changes in the blood flow within the dental pulp as a reaction to thermal stimuli between 17°C and 57 °C. The blood flow changes were studied using Laser Doppler Flowmetry. The results indicated that temperatures below 31 °C resulted in a reduction and temperatures above 43 °C in an increase in blood flow. Furthermore, temperatures higher than 49 °C caused irreversible damage to the pulps microcirculation. The reduction in the blood flow was attributed to the afferent rather than the sympathetic innervation of the tooth pulp (as explained by using experimental nerve blocks.)

H.CH. LAUER²³ et al in **1990** studied the heat production in the pulp chamber during tooth preparation. The turbine and the high-speed angled drive systems were used to prepare intact third molars with the use of cooling water (temperature 29-34 degree Celsius). The result demonstrated that preparation with cooling water temperatures of 29.8 to 33.7 °C with either turbine or high-speed angled system did not produce an increase in temperature in the pulp chamber after 3 grinding steps. Furthermore, at temperatures above 40 °C there was a clear relationship between the relative increase in temperature of pulp chamber and the temperature of cooling water. The temperature rise was attributed to the remaining dentin thickness, which was diminishing during preparation and this study suggested that an increase of 1°C rise in the temperature of cooling water can increase the pulp temperature by 1°C. Conversely, the

temperature of pulp was shown to diminish with use of cooling water between 29.8- 33.7 °C due to rapid dissipation of heat.

W.W. DODGE²⁴ et al in **1991** compared the wet and dry finishing and polishing of 4 composites (Herculite, Visio-Dispers, Silux, Prisma-Fil) and evaluated the surface smoothness, surface hardness and colour stability. The aluminium-oxide impregnated disks (Sof-Lex) were used for finishing and polishing and profilometer, Knoop hardness tester and tristimulus colorimetry were used to evaluate the composites. The results indicated no difference in surface smoothness between wet and dry finish of Prisma- Fil, Silux or Herculite while wet finished Visio-Dispers was rougher than the dry finished (may be attributed to the presence of smear layer formed due to excess surface temperature exceeding the glass transition point as a result of being dry polished). There was no statistical difference between wet and dry finishing on the surface hardness. Dry finishing proved superior for Herculite, Prisma-Fil with regard to colour stability. Dry finishing of Silux produced colour change (reason may be product related). This study found that dry finishing was superior or equal to wet finishing (except for colour change for Silux).

HAROLD E. GOODIS¹ et al in **1991** evaluated the histological pulp response to temperature probe placement in the *Macaca Fascicularis* monkey. First and second premolars and molars in three quadrants were used in this study. The fourth quadrant was used as a control. An opening was made in the mesio buccal line angle 1 mm above gingival crest to DEJ and another opening in

the midline of the buccal surface 1-mm above gingival crest to DPJ. The probes were positioned in place with composite resin and a MO cavity prepared in each tooth. Temperatures were recorded using a thermocouple and cavities sealed with cavit. The animal was sacrificed and specimens of each tooth were prepared and decalcified with 5% formic acid sodium citrate. Histological examination indicated inflammatory response in some sections and was evident when RDT was less than 1 mm. RDT > 1 mm showed no response. Inflammatory response included an initial phase of dilatation and congestion of blood vessels with subsequent edema fluid, odontoblastic displacement into the tubules.

G. P. STEWART²⁵ et al in **1991** studied the temperature rise produced by finishing of restorations utilizing 4 variations (viz., restorative material, finishing agent, finishing time and depth of dentin under the restoration. Class V preparations were restored with amalgam, composite or glass ionomer cement. Finishing was done with wet pumice and cup, wet pumice and brush, a grit rubber polishing point and an aluminium oxide coated disc. Finishing time was continuous or intermittent for 1 minute and then dentin thickness was 0.5 to 3.0 mm. The results indicated that amalgam produced the highest temperature rise, while composite and glass ionomer were no different than the untreated tooth. Aluminium oxide discs produced the largest temperature rise; wet pumice with a brush produced the least rise in temperature. Furthermore, temperature rise increased almost

linearly with continuous finishing. Thickness of dentin was only significant for amalgam (at 0.5 and 1.0 mms)

J.L. FERRACANE²⁸ et al in **1992** studied the sub surface defects created during the finishing of composites. The materials used were a microfilled (Silex Plus) and Hybrid composites (P50, Herculite). The composite specimens were finished with a 12 fluted carbide bur or fine diamond within 3 minutes of light curing and subsequently stained with silver nitrate. Microscopic evaluation revealed that significant penetration of stain occurred in the unfinished as well as in the finished surfaces. The extent of dye penetration area was less than 10 microns being greatest for microfill composites. This was attributed to the high in-vivo wear rate of posterior composites. The results showed that only a very limited sub-surface damage may be created in certain composites during the initial contouring of a restoration and may be a function of differences in degree of cure, quality of adhesion, size and volume of fillers.

E. BERASTEGUI⁴⁸ et al in **2003** studied the surface roughness of finished and polished composite resins using different techniques including Arkansas stone burs, eight-blade tungsten-carbide burs, diamond burs and aluminium oxide disks. Profilometric analysis was carried out to ascertain the smoothest surface. the results of the study ascertained that micro-filled composite resins provided a better finish with aluminium oxide disks which was attributed to their ability to cut the filler particle and the matrix equally. The planar motion of the disk was also contributory to the smoother surface

I. ANIC²⁹ et al in **1992** studied the temperature changes in enamel tissue and the pulp chamber under the influence of a CO₂ laser at 0.5,1,1.5,2,4,6W and exposure times of 0.5,10,15,20,30 seconds and a focal spot size of 1 and 1.5 mms. Temperature probe measurements with a digital thermometer, X-ray diffraction analysis and scanning electron microscopy was done to determine the change in temperature, surfaces. The results indicated rise of 3.5 and 4.1 degree C with a 4 W, 1-mm focal spot size wave for 15 seconds and 30 seconds respectively. 1W, 1.5-Mm spot size wave for 10 and 20 seconds produced a temperature rise of 4.0 and 8.0 degree C respectively after 30 seconds. SEM showed craters with needle shaped formations, which were attributed to micro-explosions of vaporized steam or by rapid cooling and solidification of the molten enamel after laser irradiation. Furthermore, concluding from temperature changes, powers of 1 W upto 1 second would not cause irreversible pulp tissue changes. Under in vivo conditions the pulp-dentin complex would be subject to the greater thermal conductivity.

H E GOODIS³⁰ et al in **1993** evaluated the effect of glass ionomer liners in limiting temperature rise during composite placement with visible light-curing lamps. The results indicated that neither chemical nor light cured glass ionomer liners limited the amount of pulp chamber temperature rise. The exposure time of the light-curing lamp played the greatest role in pulpal temperature rise regardless of glass ionomer liner, indicating the

potential thermal insults to the pulp despite the use of a lining material.

ANIL N.³⁴ et al in **1996** studied the temperature changes in the pulp chamber 1 minute after application of heat of 0,40,60,80 °C to composite and amalgam cores and the period of time necessary for the temperature in the pulp chamber to return to 36°C after 1 minute. The results showed that for both amalgam and composite cores, the lowest increase in the pulp temperature was established after the 40°C heat application. Furthermore, higher temperature for a short duration might cause less pulpal damage due to dissipation of heat by the tooth and inherent intrinsic moisture control of dentin. Prolonged periods of temperature rise cause inflammation and pulp death.

BARRY A. KAPLAN³⁵ et al in **1996** studied the effect of three polishing systems on the surface roughness of 4 hybrid composites (Pertac, APH, Herculite, and Z100). They were polished with various systems including Enhance, Kerr composite finishing kit, MFS/MPS polishing kit. Profilometric and S.E.M. studies revealed that MFS/MPS gave superior polish for three of the four composites tested. Furthermore, the Enhance system gave the poorest polish with all four composites tested. MFS/MPS system was thought to give a better polish due to the diamond abrasives, which produced gouging, which was not as deep as the carbide systems.

E MIZRAHI³⁶ et al in **1996** studied the tooth surface at the bracket/ tooth interphase and pulp chamber temperatures

developed during electro-thermal bonding. Temperatures were recorded with 5 and 7.5 A current applied as a 1-second pulse with time intervals between pulses of 1,2,3,4 seconds. The results showed a rise of 43.3 °C- 53.6 °C with a 5 A current, 77.5-85.9 °C with a 7.5 A current. The pulp chamber temperature rise was evaluated for mandibular incisors, premolars, and molars. The rise in temperature was 2.1 °C (5A) and 2.8 °C (7.5A) for mandibular incisors and 0.9-1.6 °C for premolars. The variation in temperature rise was attributed to the variable dentin thickness between sample teeth. On the basis of current evidence, the increase in pulp chamber temperature during electro-thermal bonding may be considered to be clinically safe.

S.O HONDRUM² et al in **1997** studied the finishing and polishing of 3 materials used for Class V restorations viz., composite resin, glass ionomer and resin-modified glass ionomer. Seven methods of polishing including Matrix only, Sof-Lex disks, Composite finishing, Enhance System, Two Strip MPS system and contouring burs were used. Surface roughness and gloss (reflectance) quantified the results. The results indicated that glass ionomer surface was roughest followed by resin modified glass ionomer and composite resin. Furthermore, the original matrix smoothness and gloss could not be reproduced with any contour, finishing, polishing techniques tested.

A.U.J. YAP³⁹ et al in **1998** studied the effects of immediate and delayed finishing and polishing procedures on the surface characteristics (surface roughness and hardness) of tooth

coloured restorations including a micro-filled, heavy filled, a polyacid modified composite resin and a resin modified glass ionomer cement. 84 specimens disks (12 control, 72 experiment divided into 2 groups). Group 1 was immediately polished while Group 2 was stored for 1 week and polished using the Enhance System, White stones and Super-Snap. The specimen surfaces were subjected to profilometric and microhardness testing. The results concluded that finishing/polishing was generally not influenced by polishing time with regard to surface roughness while delayed finishing/polishing resulted in a surface of similar or greater hardness compared to immediate finishing/polishing or control group.

CHRISTOPHER D.J EVANS⁴⁰ et al in **1999** studied the effects of tooth preparation on pressure measured in the pulp chamber. 20 premolar teeth were collected and assigned randomly to 2 groups. The teeth were mounted on a pressure transducer and the pulp chambers were filled with saline. Preparation was done using diamond and tungsten carbide burs under wet and dry conditions. The results of pressure change indicated that at 0-1 mm RDT dry cutting with diamond and carbide burs produced a mean positive pulpal pressure of 12 kPA and 6 kPA. Wet cutting produced 0.6 and 0.5 kPA respectively. Tooth preparation causes movement of fluid from pulp towards tooth apex due to the fractional heat of cutting (causing fluid expansion). Also, the difference in pressure can be due to a thicker smear layer in dry cutting causing packing of debris. Diamond burs produce significantly more impaction of debris into tubules hence

produce more significant pressure changes. Based on this study it may be concluded that significant pressure changes occur in the pulp during tooth preparation of extracted teeth when the RDT is less than 2 mms.

P.E. MURRAY⁴¹ et al in **2000** evaluated pulp responses as a function of remaining dentin thickness (RDT) of 98 Class V preparations of 49 teeth of 31 patients aged between 10-16 years. Teeth were restored and extracted for orthodontic reasons after 3-89 days and light microscopy was done to record the number of odontoblasts, pulp inflammation and repair. This study concluded that a remaining dentin thickness (RDT) mediates a powerful influence on underlying pulp tissue vitality. Furthermore, following restoration a remaining dentin thickness (RDT) of 0.5 mm or greater is necessary to avoid evidence of pulp injury.

CECILIA P TURSSI⁴² et al in **2000** evaluated the effect of finishing and polishing techniques on surface roughness of resin based composites. 40 cured specimen disks were finished and polished using Sof-Lex disks, Sof-Lex disks followed by Prisma-Gloss, Enhance points, Enhance points followed by Prisma-Gloss. Profilometric analysis showed that Sof-Lex disks with subsequent use of Prisma-Gloss provided superior results for finishing and polishing of composite, while Enhance points used alone showed the least favourable results. The use of polishing paste seems to reduce surface roughness and may be attributed to the surface temperature exceeding the glass transition point as a result of being dry polished.

T F WATSON⁴³ et al in **2000** studied the cutting dynamics, enamel cracking and tooth temperature associated with the use of high and low torque handpieces. Images of dynamic interactions between burs and enamel were recorded at video rate using a confocal microscope. Heat generation was measured using thermocouples placed into the pulp chamber of extracted premolars, when cutting occlusal and cervical cavities with diamond and carbide burs- high and low torque handpieces. Although no differences were recorded for temperature rise during cavity preparation, a distinct stalling occurred with the use of heavy loads while cutting. The speed increasing handpiece was shown to be better able to cope with increased loading. Furthermore, the use of three jet handpieces caused a net cooling of teeth. The use of diamond burs had a relative increase in temperature compared to carbide burs due to greater contact between the diamond grit and the enamel hence producing more frictional heat.

C LIEU⁴⁴ et al in **2001** measured and compared peak temperatures during polymerization of 5 provisional restoration resins. The materials were 2 self-curing resins (Integrity and Protemp) and 3 dual cure resins (Iso-temp, TCB dual cure and Provipont DC). The temperature rise of the different resins was recorded every 10 seconds over a 10-minute period. The result showed higher increase in temperatures with self-curing resins (33.8-35.6 degree C) when compared to dual-cure resins (29.4-29.5 degree C). The reduction in temperature elevation with dual

cure resins was attributed to the exothermic reaction occurring at different times- chemical followed by light curing.

R W LONEY⁴⁵ et al in **2001** studied the effect of high output light-curing on temperature transfer through resin composite and dentin. Temperatures were directly recorded (40 seconds for Optilux; 3 seconds for Apollo Plasma Arc curing light) at the tip of the light guide through a sandwich composed of a 1 mm thick pre-cured cylinder of resin composite and dentin (0.58 or 1.45 mm thick). The mean temperature rise ranged from 1.8 –26.4 °C. For each light, the maximum temperature was recorded at the curing tip and the minimum through the composite and dentin 1.45 mm specimens. This study highlights the effect of dentin thickness in reducing the rise in intra-pulpal temperature during curing with curing lights.

BRUNO CAVALCANTI⁴⁶ et al in **2002** evaluated the efficiency of 3 different water flows for 2 different tooth preparation techniques to determine which are safe for use. Thermocouples were placed in the pulpal chamber of 30 bovine teeth and 1 of 2 techniques was used- a low load intermittent or a high load tooth preparation technique without intervals. Water flows of 0, 30 and 45 ml/ minute were used. The results indicated maximum temperature rise of 16.40 °C with high load, no cooling and 0.04 °C with low load intermittent preparation. Furthermore, the use of 30 or 45 ml/minute spray cooling produced minimal temperature rise. The results of this study also highlight the relationship between generated heat and the loading, cutting techniques applied.

V. SRIMANEEPPONG⁴⁷ et al in **2002** investigated the pulp space pressure and temperature changes after application of Nd: YAG laser (1W, 3W) and high speed diamond bur on dentin surface. The pulp pressure and temperature changes were measured using a pressure transducer and a thermocouple respectively. Regardless of the remaining dentin thickness (RDT), laser irradiation and high-speed diamond bur use generated an increase in pulpal space pressure and temperature. These changes increased with an increase in laser power. Both pulpal space pressure and temperature changes were proportional to increase in laser density and decrease in RDT highlighting the essential insulating properties of dentin and the relationship of RDT and pulp pressure and temperature changes.

G OZGUNALTAY⁵⁰ et al in **2003** evaluated the effect of various finishing and polishing procedures on the surface roughness of 3 new tooth coloured restorative materials (hybrid composite FILTEK Z250, packable composite FILTEK P60 and an ormocer DEFINITE). The finishing and polishing was carried out using diamond bur/ silicone polishers, diamond bur/ Soflex discs, carbide bur/ silicone polishers and carbide bur/ Soflex disks. Surface roughness tester and Scanning electron microscopy were used to assess roughness and surface topography respectively. The results showed that the use of carbide burs with Sof –Lex disks produced the smoothest surface. This was attributed to the ability of aluminium oxide disks to cut the filler particle and matrix equally. The planar motion of the disk may also

contribute to the smoother surface. Furthermore, the finishing diamond burs were more efficient in removing material from composite surface but tended to leave a more irregular surface due to their high cutting efficiency and should thus be used for gross removal and contouring

BRUNO N CAVALCANTI⁴⁹ et al in **2003** studied the temperature increases produced by a high-speed dental handpiece with those produced by the Er: YAG laser. 30 bovine mandibular incisors were selected and Class v preparations were completed to a depth of 2.0 mms. Preparations were performed using high-speed handpiece without water cooling, with water-cooling and Er: YAG non-contact with water-cooling. Temperature rise was measured using a thermocouple. Temperature increases of 11.64+/- 4.35 C and 0.96+/- 0.71 C was observed for non-cooled and water-cooled handpiece preparations. The Er: YAG laser had an average temperature rise of 2.69 +/- 1.12 C. The effects of water coolant were shown to be statistically significant. The water flow modifies the ablation rate of dental tissues and a water flow rate of 4.5-ml/ minute is adequate to control temperature and maintain the ablation capacity.

PETER E MURRAY⁴¹ et al in **2000** studied the in-vivo postoperative pulpal and repair responses. Standardised Class V restoration preparations were cut in 27 1st or 2nd Premolars without exposing the pulp (patient age 9-17 years). The restored teeth were extracted for orthodontic reasons and the tertiary dentin was analyzed histo-morphometrically. The results indicated the formation of tertiary dentin matrix, which was co-

related to the Remaining Dentin Thickness (RDT). A 1-mm decrease in RDT increased the reactionary dentin matrix by 1.187 mm². The reactionary dentin formation seemed to increase with age and was thought to be mediated by analogous molecular and cellular interactions. This study demonstrated a quantitative relationship between the RDT and the stimulation of reactionary dentinogenesis. The mean area of reactionary dentin is a restoration with RDT 1.5 mm was estimated to be 10.6% of the amount formed beneath a restoration with 0.5-mm RDT.

SUMMARY

This study was conducted to compare and evaluate the pulp chamber temperature rise associated with the polishing of light cured composite veneer restorations using 2 different polishing systems (Astropol, Shofu Super -Snap kit).

40 extracted maxillary central incisors were used in this study. They were randomly divided into 4 groups-Groups I, II (Dry Continuous, Intermittent respectively) and Groups III, IV (Wet, Continuous, Intermittent respectively).

Groups I, II were polished with the Shofu System and Groups III, IV were polished using Astropol System. The temperature rise was recorded within each group and the remaining dentin thickness (RDT) was measured after sectioning of the teeth.

The results indicated:

1. There were significant differences in the temperature rise between the dry and the wet systems.
2. The correlation of the temperature rise and the remaining dentin thickness was significant for the dry, intermittent group and was dependent on application time of the disks.
3. Remaining dentin thickness is an important factor in regulating the magnitude of temperature rise during polishing of restorations.

CONCLUSION

The following conclusions can be made from the results of this study:

- Wet polishing procedures (moisture in the field of operation) produce minimal temperature rise during polishing and cause minimal thermal insults to the pulp during the polishing procedure.
- Dry, continuous polishing with flexible disks may result in detrimental increases in the temperature within the pulp chamber and must be avoided.
- The remaining dentin thickness (RDT) plays a vital direct role in modulating the insulating thermal properties of the pulp.

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