Thermal changes in teeth while using air pressure handpiece with and without coolant.

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Introduction

It is known that heat is produced during preparation of primary and permanent teeth using air driven handpieces because of frictional forces produced from the bur, transferred through the tooth structures reaching the pulp. Because irreversible pulpal changes begin when pulpal temperatures increase 5.5 Celsius or when it reaches 42.4 Celsius, it is recommended to use water coolant during preparation to decrease the thermal changes and prevent pulpal damage. The aim of this investigation is to quantify internal thermal changes during preparation of primary and permanent teeth using air driven handpieces with and without coolant.

Hypothesis

There is no difference in internal dental thermal temperatures during preparation of primary and permanent teeth using air driven handpieces with and without coolant.

Material & Methods

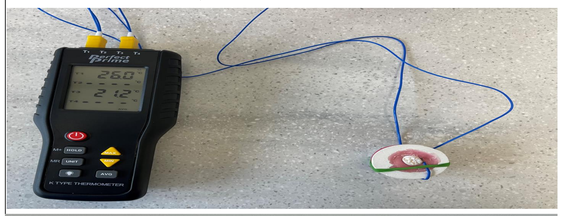
60 extracted teeth (30 primary and 30 permanent) were collected and stored in 1:1 $NaOCl/H_2O$ solution. The roots of the teeth were cut off and the pulp chamber is exposed from the root side. K- type continuous reading digital thermometer was used. A custom-made mount with notches and elastic bands were used to support the tooth and the sensor probes during the tooth preparation. Teflon tape was used to stabilize the tooth in the mount and insulate the sensors from the coolant during preparation.

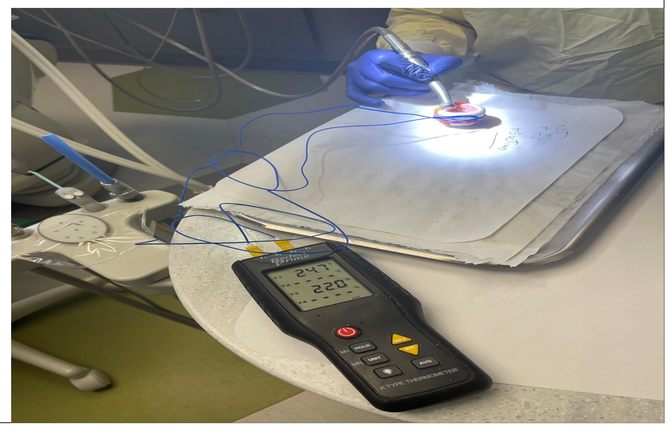
Crude class II preparations were completed in primary and permanent teeth in 6 different preparation conditions using air pressure high and low speed handpieces, and new single use carbide burs. Each group and test condition is coded with number and letter.

Material & Methods

Experimental Conditions: ***(Paired group tests have same colors)***

1- Test A - Permanent teeth - Dry condition only (without coolant)
2- Test B - Primary teeth - Dry condition only (without coolant)
3- Test C – Permanent teeth – Wet condition only (with coolant)
4- Test D – Primary teeth – Wet condition only (with coolant)
5- Test E – Permanent teeth – Dry condition + Continuous air (without coolant)
6- Test F – Primary teeth – Dry condition + Continuous air (without coolant)
7- Test G – Permanent teeth – Wet condition + Continuous air (with coolant)
8- Test H – Primary teeth – Wet condition + Continuous air (with coolant)
9- Test I – Permanent teeth – Dry condition + Continuous air + Continuous high-volume suction (without coolant)
10-Test J – Primary teeth – Dry condition + Continuous air + Continuous high-volume suction (without coolant)
11-Test K – Permanent teeth – Wet condition + Continuous air + Continuous high-volume suction (with coolant)
12-Test L – Primary teeth – Wet condition + Continuous air + Continuous high-volume suction (with coolant)





Results

This was an ***In-vitro study*** quantifying the internal temperature In 60 primary and permanent teeth with and without coolant in 6 different experimental conditions.

1- After analysis using SPSS, there was a difference in the internal temperature during preparation with and without coolant in the paired groups ***except*** while using ***continuous air*** and ***continuous high-volume suction*** in both dentitions (Independent T test P: 0.44 for permanent teeth tests, p: 0.41 for primary teeth tests).

2- No difference in thermal changes in all preparation conditions between primary and permanent teeth except in test G and test H which may need further investigations.

Results

3- When all groups were analyzed together no differences were found in the internal temperature during preparation with and without coolant.

4- The thermal changes in all tests (average thermal changes of all tests is -0.8) did not reach the point causing irreversible changes in the pulp tissue as the highest raise in temperature is 1.5 Celsius and that in Test A (dry condition only without coolant in permanent teeth).

Discussion

Our goal was to investigate heat produced during preparation of primary and permanent teeth using air driven handpieces, and if there is a difference, is that difference reaching the point causing irreversible pulpal changes in permanent and primary teeth. After running the SPSS tests, we found that there was statistically significant difference between using coolant and without using coolant except while using continuous air and high-volume suction without coolant, in addition temperature increase did not reach the critical point of irreversible pulpal damage in all tests.

Conclusion

Generally, water coolant is indicated during preparation of primary and permanent teeth using air driven handpieces

If there is a circumstance in which the use of water coolant is contraindicated, the use of continuous air and high-volume suction Is indicated.

Under controlled conditions using new burs at no time did temperature increase to the 5.5 Celsius threshold for irreversible pulpal changes.

References:

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