

# THE DETERIORATION OF TEETH IN LIQUIDS

**AIM:** To determine the effects of deterioration of teeth in different liquids.

## BACKGROUND INFORMATION

The human tooth is covered in a layer of tissue that is called enamel. The enamel tissue is known to be one of the hardest tissues in the human body and is a translucent substance (able to see through it). Enamel covers the visible part of the tooth (not covered by gum) and is used as protection against daily uses such as chewing, biting and grinding. Enamel is tough but it can still chip and crack even erode and it cannot repair itself due to it not having any living cells.

Erosion of teeth and the enamel happens due to acid and sugar levels in foods and drinks. Some things that cause erosion are:

- Soft drink consumption.
- Fruit juices.
- High sugar diets.
- Medications.
- Acid reflux.
- Environmental wear (friction, wear and tear, grinding, chewing).

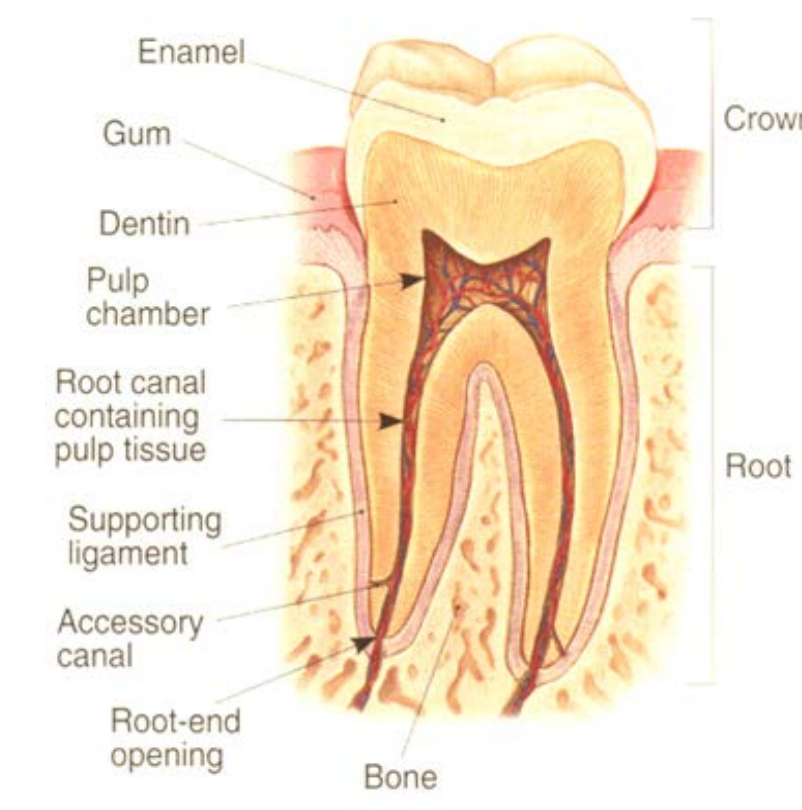
Due to the enamel being translucent you are able to see through it and see the dentin which is the main portion of a tooth. The dentin is what determines the colour of the tooth which is generally either white, off-white, grey, yellowish. The enamel is able to become stained through continuous consumption of coffee and tea, cola, red wine, fruit juices and cigarettes. This can be cleaned off the teeth though by dental professionals. When teeth do erode it makes the teeth more vulnerable to decay and erosion. This can then cause sensitive teeth, rough edges with cracks and chips, smooth shiny surfaces due to mineral loss, yellowed teeth and or dents and cupping. Enamel erosion can be fixed in some cases but it does depend on the case. Tooth bonding can fix a tooth that has been effected by erosion and improve the view of teeth that have been chipped or cracked even discoloured. If the enamel on a tooth has been significantly eroded then a dental professional may consider putting the tooth in a crown to prevent any further damage to the effected tooth.

## HYPOTHESIS

- The higher the sugar content within the 5 different drinks the bigger the reaction towards the teeth.

DRINK	SUGAR CONTENT (Per 100ml)
'Coca Cola' coke	10.6 g
'Daily Juice' orange juice	8.3 g
'Carona' alcohol	0 g
'Dairy Farmers' full cream milk	4.8 g
'Mountain Spring' bottled water	0 g

## THE HUMAN TOOTH

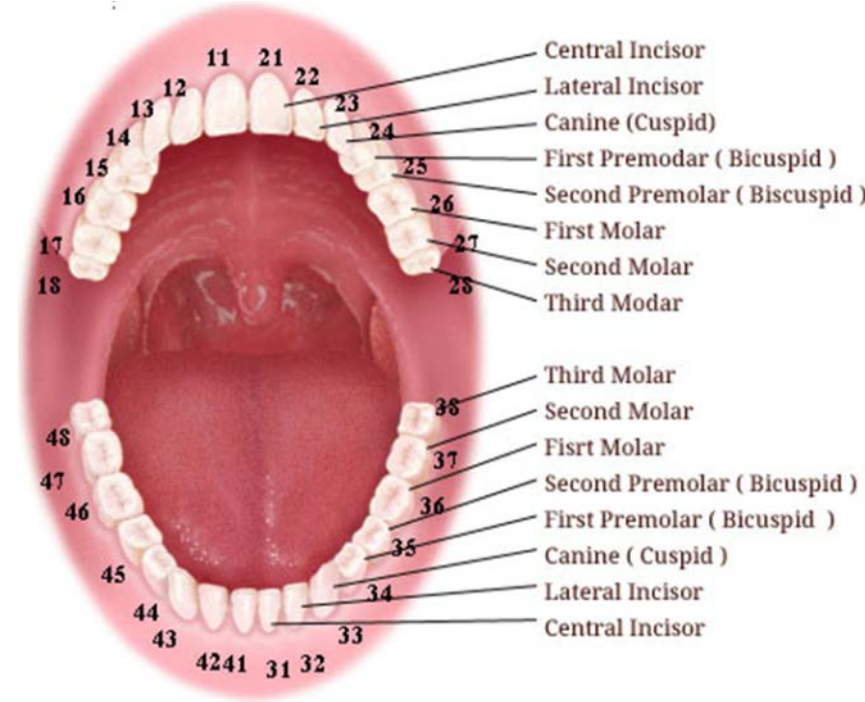


## VARIABLES.

CONTROLLED.	DEPENDANT	INDEPENDANT
<ul style="list-style-type: none"> <li>• Volume of liquid.</li> <li>• Size of teeth.</li> <li>• Colour of teeth.</li> <li>• Temperature of refrigerator.</li> <li>• Type of cup.</li> </ul>	<ul style="list-style-type: none"> <li><input type="checkbox"/> Ten similar size and coloured teeth.</li> <li>• All ten averaging around 5mm in length from top to bottom.</li> <li>• All an off-white colour at the start of the experiment.</li> <li>• All teeth are either central incisors, lateral incisors or canines (cuspid).</li> <li>• The teeth were from two different persons.</li> <li><input type="checkbox"/> The teeth are measured with a ruler and the colour is by a tooth colour chart. The type of each tooth was decided by a chart and several characteristics that matched.</li> <li><input type="checkbox"/> The charts used were supplied by a dentist.</li> </ul>	<ul style="list-style-type: none"> <li><input type="checkbox"/> Five different drinks.</li> <li>1. Coca Cola coke.</li> <li>2. Daily Juice orange juice.</li> <li>3. Dairy Farmers full cream milk.</li> <li>4. Corona beer (alcohol).</li> <li>5. Mountain Spring bottled water.</li> <li><input type="checkbox"/> This is measured by a measuring jug, 200ml of liquid which are then separated into 100ml of each liquid with the same measuring jug. Repeated for each.</li> </ul>

## EQUIPMENT

- 10x similar shaped teeth
- 5x 200ml of different liquids (orange juice, water, milk, alcohol, coke)
- 5x cups
- 5x sealable containers.
- Refrigerator
- Spoon(s)
- Camera
- Tweezers
- Ruler
- Measuring jug



1. Collect all the needed equipment cups, liquids, teeth etc.
2. Measure 200ml of the five different liquids.
3. Separate the 200ml into 100ml for each five liquids.
4. Put one 100ml of each five liquids into five cups and the rest into five separate sealable containers. (These will be refills after 2 weeks due to evaporation). Label each with the name of the five different liquids in each.
5. Place two teeth into each of the five cups of different liquids and leave (refrigerated) for 4 weeks, checking weekly and recording changes (size, colour) and at the end of the 4 weeks check the strength of each tooth by pushing down on it with a spoon.
6. Construct a table and graph showing your results in a clear manner after the completion of the 4 weeks.



## VALIDITY

- Validity can be controlled by controlling all of my variables (the teeth, amount of liquid, etc.) in my experiment except for the five types of liquid I use.

## ACCURACY

- The accuracy of my experiment can be controlled by using teeth that are of similar size and colour.

## RELIABILITY

- The reliability of my experiment can be improved and controlled by repeating the experiment and averaging the results to find the best and most accurate result.

WEEK	SIZE (nearest mm)	COLOUR
1	Tooth 1: 5mm Tooth 2: 5mm	Tooth 1: Browning, A4 in colour. Tooth 2: Browning, A4 in colour.
2	Tooth 1: 5mm Tooth 2: 4mm	Tooth 1: Dark brown. Tooth 2: Dark brown. • At this point the colour was not charted on the dental colour chart.
3	Tooth 1: 4mm Tooth 2: 3mm	Tooth 1: solid dark brown colour. Tooth 2: solid dark brown colour.
4	Tooth 1: 3mm Tooth 2: 2mm	Tooth 1: solid dark brown colour. Tooth 2: solid dark brown colour.

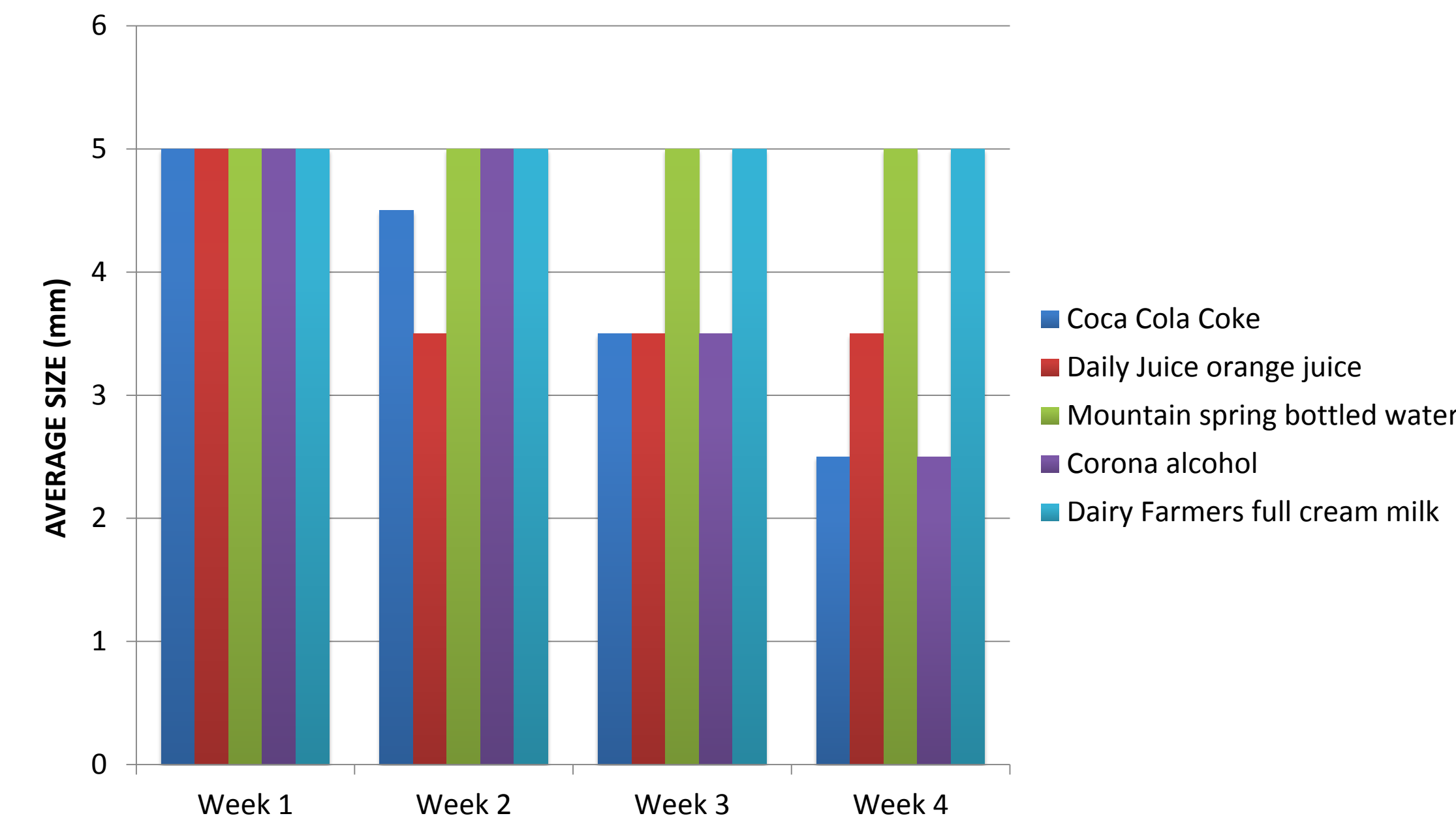
WEEK	SIZE (nearest mm)	COLOUR
1	Tooth 1: 5mm Tooth 2: 5mm	Tooth 1: off white, A3 in colour. Tooth 2: off white, A3 in colour.
2	Tooth 1: 3mm Tooth 2: 4mm	Tooth 1: white, B2 in colour. Tooth 2: white, B1 in colour.
3	Tooth 1: 3mm Tooth 2: 4mm	Tooth 1: white, B1 in colour. Tooth 2: white, B1 in colour.
4	Tooth 1: 3mm Tooth 2: 4mm	Tooth 1: white, B1 in colour. Tooth 2: white, B1 in colour.

WEEK	SIZE (nearest mm)	COLOUR
1	Tooth 1: 5mm Tooth 2: 5mm	Tooth 1: off white, A1 in colour. Tooth 2: off white, A1 in colour.
2	Tooth 1: 5mm Tooth 2: 5mm	Tooth 1: off white, A1 in colour. Tooth 2: off white, A1 in colour.
3	Tooth 1: 5mm Tooth 2: 5mm	Tooth 1: off white, A1 in colour. Tooth 2: off white, A1 in colour.
4	Tooth 1: 5mm Tooth 2: 5mm	Tooth 1: off white, A1 in colour. Tooth 2: off white, A1 in colour.

WEEK	SIZE (nearest mm)	COLOUR
1	Tooth 1: 5mm Tooth 2: 5mm	Tooth 1: off white, A2 in colour. Tooth 2: off white, A2 in colour.
2	Tooth 1: 5mm Tooth 2: 5mm	Tooth 1: yellowing, A3 in colour. Tooth 2: yellowing, A3.5 in colour.
3	Tooth 1: 4mm Tooth 2: 3mm	Tooth 1: yellow, B4 in colour. Tooth 2: yellow, B4 in colour.
4	Tooth 1: 2mm Tooth 2: 3mm	Tooth 1: yellow, B4 in colour. Tooth 2: yellow, B4 in colour.

WEEK	SIZE (nearest mm)	COLOUR
1	Tooth 1: 5mm Tooth 2: 5mm	Tooth 1: off white. Tooth 2: off white.
2	Tooth 1: 5mm Tooth 2: 5mm	Tooth 1: off white. Tooth 2: off white.
3	Tooth 1: 5mm Tooth 2: 5mm	Tooth 1: off white. Tooth 2: off white.
4	Tooth 1: 5mm Tooth 2: 5mm	Tooth 1: off white. Tooth 2: off white.

## RATE OF DETERIATION OF TEETH IN DIFFERENT LIQUIDS



## TWO POTENTIAL IMPLICATIONS ON SOCIETY:

- Provides knowledge to the effects of peoples favorite drink on their teeth.
- Shows the correlation of the sugar levels in the five different drinks with the level of enamel erosion.

## FURTHER EXPLORATION:

- Testing it with cleaning on regular bases to see the effects of tooth paste to reduce erosion.
- See the effects that a group of rotting teeth have on the rate of deterioration of each other.

## WEAKNESSES OF THE EXPERIMENT:

- Not testing the natural way of brushing with toothpaste twice a day instead they are sitting in the stagnant liquids for 24 hours 7 days a week.
- Limitations on the accuracy of my results due to lack of equipment. (cannot test density, exact mass, etc.)

## STRENGTHS OF THE EXPERIMENT:

- It is reliable due to multiple teeth used.
- It is also reliable because I kept all the variables controlled besides my independent (the different liquids) and the dependent (the amount of deterioration).

## CONCLUSION

With the increase of sugar within 100ml of each of the five liquid the deterioration and erosion of the sizing and coloration of teeth increases.

My hypothesis was both accepted but then rejected due to the lowest amount of erosion occurring to the water with 0g of sugar per 100ml and the highest amount of erosion from the teeth submerged in coke with 10.6g of sugar per 100ml but then also the corona with 0g of sugar per 100ml had the same result as the coke.

Further exploration can be conducted by studying the effects of different elements in drinks (carbohydrates, fats, etc.) on teeth and distinguishing which part of drinks has the most damage on teeth also the effects on teeth deteriorating and the rate of deterioration. Due to surrounding teeth could be explored as well as deterioration with daily brushing of toothpaste.

## DISCUSSION

- To conclude my experiment I checked density by pushing down on each tooth with the back of a spoon. As this is not the most accurate method of testing this I chose to record the data as either hard to break, moderately hard to break, easy to break and can't break.

	Coca Cola Coke	Daily Juice Orange Juice	Mountain Spring Bottled Water	Corona alcohol	Dairy Farmers Full Cream Milk
TOOTH 1	Easy to break	Easy to break	Did not break	Easy to break	Did not break
TOOTH 2	Easy to break	Moderate to break	Did not break	Easy to break	Did not break

## Observations and Ideas

- The teeth with the most deterioration were the teeth that ended up being the easiest to break and the teeth that did not break did not have any deterioration over the 4 weeks.
- I would like to repeat this part of the experiment with more accurate equipment to see the exact density of each tooth before the 4 weeks and after the 4 weeks.
- It was interesting to see with the orange juice teeth that the one that had deteriorated 1 mm more than the other was easier to break even though the teeth hadn't changed that much to each other.

## OBSERVATIONS and Ideas

- Over the 4 weeks the teeth in the coke and alcohol and one in the juice became less solid and hard and turned into a more glutinous object that was easy to break when force was applied. Leaving me to believe that through the deterioration process the structure of the tooth must break down also forcing the tooth to not being able to complete its job in the human body.
- The coke teeth and the teeth in the alcohol both had the same effect and at the end both were the most deteriorated teeth which leaves me to believe that there is other factors of the drink that contribute to the deterioration of the teeth within their liquid. Due to the coke having the most sugar and the Corona alcohol have no sugar.
- Due to the teeth sitting in the liquids for 4 weeks straight I am now curious to see the effects of toothpaste on teeth that do make contact to these liquids and to set up an experiment that can replicate the traditional eating drinking and brushing patterns that would commonly happen in real life.
- I would now also like to repeat the experiment and test with either different drinks or maybe do an investigation into the density of deteriorating teeth.
- I did not think that corona alcohol would have the same effect as the coke I was surprised to see that the juice didn't do more damage to the tooth due to it have a high sugar level which again supports my idea that there is another factor in the drinks that has a effect on the tooth's deterioration.

