4.3 STANDARDS FOR TOOTHPASTES

4.3.1 Australian Standard for Toothpastes
AS 2827 - 1985

This standard specifies requirements for toothpastes intended for use with a brush for the cleaning of natural teeth. Such toothpastes may contain therapeutic additives. The Standard covers definitions, composition, physiochemical properties, packaging and marking and includes a number of appendices for testing methods and substances which may be included in toothpastes.

Composition

Basic requirements -

The composition of the toothpaste shall be such that:

(a) no toxin or irritant reaction is caused in the mouth;
(b) allowing that amounts may be inadvertently ingested, no harmful effects will result from normal use; and
(c) the toothpaste will comply with relevant Commonwealth and State legislation governing health, safety and therapeutic claims.

Therapeutic additives

(a) Additives other than fluorine derivatives - at the time of manufacture, the amount of such additives shall be not more than 115 percent or less than 85 percent of the amount stated on the label.

(b) Fluorine derivatives as additives - the total fluorine content shall not exceed 100μg/g (tolerance limits 90% to 110%). The water soluble fluorine derivative determined as fluoride ion shall be not less than 600μg/g within one year of manufacturer.

Physiochemical properties

(a) pH value - the pH value of the toothpaste shall be within the range 4.2 to 10.5.
(b) Abrasive properties - abrasivity shall not exceed the following limits when measured by either the radio-tracer or the surface profile method.

i. For dentine, 2 times the reference paste.
ii. For enamel, 4 times the reference paste.

(c) General texture - the toothpaste shall readily disperse during oral use and be free of foreign particles or agglomerated lumps.

(d) Consistency (for tubed products) - within a temperature range of 5°C to 35°C the toothpaste shall not readily flow out of a tube if the tube is left on its side with the cap off, and when applied to a toothbrush, complying with AS 1032, the bulk of it shall not immediately sink between the bristles, neither shall the toothpaste, after application, roll off the brush during normal handling.

(e) Dispensing from container - the toothpaste shall nearly completely dispense in a smooth manner within a temperature range of 5°C to 35°C.

(f) Physical stability - during normal conditions of storage or when heated to a temperature of 45 ±2°C for a period of 28 days, the toothpaste shall not undergo phase separation, gassing, fermentation or otherwise deteriorate aesthetically.

The latest Australian Standard for Toothpastes (AS 2827 - 1985) is given in full in Appendix 5.
4.3.2 British Standard for Toothpastes

BS 5136 - 1981

The British Standard specifies requirements and test methods for abrasivity, lead content and general properties of toothpastes, for use with a brush in the manual cleaning of natural teeth.

1. Composition - the toothpaste shall not contain sucrose or other readily fermentable carbohydrates.

2. Toxicity - the toothpaste shall not contain ingredients in sufficient concentration to cause a toxic or irritant reaction when used in the oral cavity, nor shall it be otherwise harmful in normal use.

3. Lead content - the lead content of the toothpaste, when tested shall not exceed 5mg/kg (5 ppm).

4. pH value - the pH value of the toothpaste, determined at a temperature of 23±1°C shall be neither below 4.5 nor above 10.5.

5. Abrasivity - shall not exceed the following limits:
   For dentine:  2 x the abrasivity of the standard reference paste.
   For enamel:  4 x the abrasivity of the standard reference paste.

6. Consistency - the toothpaste shall be free of lumps or particles which are palpable in the mouth as separate or discrete particles.

7. Extrusion from tube - the bulk of the toothpaste shall extrude from the container in a continuous mass at a temperature of 10°C, without application of excessive force.

8. Stability - the toothpaste shall not segregate, ferment or deteriorate during normal conditions of storage and use.

9. Container - the toothpaste shall be packed in a container that shall not corrode, deteriorate, or cause contamination of the toothpaste during normal conditions of storage and use.
5 TOOTHPASTE USE IN AUSTRALIA

5.1 HISTORY OF RECOMMENDATIONS FOR TOOTHPASTES

In 1830, Henry Jeanneret of Sydney (Surgeon and Dentist) had given the following hints about dentifrice to preserve teeth in one of his monographs.

"Charcoal is a good dentifrice when unadulterated and finely pulverised, as is also very finely levigated chalk, mixed with an equal proportion of charcoal, and with the half of its weight of powdered cinnamon. The best prepared powder, if improperly used, will injure the teeth, and that without effecting the object of keeping them clean tobacco and root are often made use of as tooth powders, but if long continued they impart a yellow tinge to the enamel, which it is almost impossible to remove" (Jeanneret 1830).

Louis Eskell of Sydney (1860) recommended the following as a good dentifrice:

R Bol. Armen:
P Oss Sepiae.
P Iridis florent: aa j
P.G. Myrrhae.
P. Casiae aa fs.
M, fiat Pulvis Dentrif

He claimed the dentifrice was pleasant to the palate, free from all admixture of acid, and when levigated with care, presents an almost impalpable powder, a point of the utmost importance in all such preparations, of whatever they may be compounded. It may be used with confidence, and will be found to clean the teeth thoroughly, rendering them as white as they ought to be made by any artificial process (Eskell 1860).
In 1864, Hugh Paterson of Sydney recommended the following powders for:

Ordinarily strong and good teeth -

Precipitated chalk
Powdered cinchona bark
of each equal parts by bulk, to be used with soap.

Delicate teeth -

Precipitated chalk, one ounce
Powdered orris root, half an ounce
Powdered borax, two drachms
The borax should be reduced to an impalpable powder before being well mixed with the other ingredients.

And where the teeth are tender at the necks, or the gums, spongy, take as a tooth powder -

Precipitated chalk, one ounce
Tannic acid, well powdered, one drachm
Carefully mixed

The writer did not recommend many of the tooth powders in daily use, simply because he did not know their composition. Some of the toothpastes the writer believed to contain cream of tartar, which would be decidedly injurious to delicate teeth. Camphorated chalk is pleasant to use, but treacherous in its effects - it is apt to make the teeth very brittle and cause them to crumble away. Charcoal is not good, as it is apt to contain silex - with the exception of areca nut charcoal, which should be got if it can be procured (Paterson 1864).

The Australian Health Society (Melbourne) had suggested in 1881 that:

"all prepared tooth powders and pastes be avoided although occasionally a little unscented soap may be used, followed by the application of precipitated chalk, which offers sufficient resistance to polish the enamel without scratching it, and, being an alkali, counteracts the acids, which are the active agents of decay. Camphorated chalk may be used by adults, and has the advantage of being a good breath disinfectant" (Moon 1881).
George Shaddock Pressy of Victoria (1883) has indicated that:

"camphorated chalk, a more dangerous agent than camphor could not easily be selected, for besides acting immediately on the enamel of the teeth, it is next to insoluble in water, and so, instead of being easily washed away, the particles remain concealed between them. Thus it may be continually observed among persons in the habit of using any preparations containing camphor, that their teeth decay chiefly on their lateral edges between each other, that is, on their mesial and distal surfaces. It would be difficult to analyse all the numerous dentifrices with which manufacturers have furnished the toilet table but among others, Rowland's odonto and cherry toothpaste undoubtedly deserve the first place. For general use in Australia, the writer recommended nothing better than equal parts of charcoal and prepared chalk, which should be reduced to the finest possible powder. "It will be found cool, and extremely clean to the mouth, and may be rendered more palatable by the addition of a few drops of otto of roses" (Pressy 1883).

Webb (1885) of Melbourne in his treatise said that:

"any wash that is recommended for whitening the teeth, is either incapable of accomplishing it, or does it at the expense of integrity of the enamel. Powders should contain no acid, and no gritty substances, such as charcoal, silex, pumice stone, cuttle fish bone etc, should enter into their composition. Many of the ingredients in medicated powders, which are useful in diseased conditions by reason of their astringent and tonic properties, are objectionable because of their insolubility, and the liability on this account to become a source of irritation to the gums, by lodgment between them and the teeth. Another objection which applies more or less to such dentifrices is the persistent astringent or bitter taste which they leave in the mouth, and which is strongly disliked by many, especially by children. When needed, agents adapted to the cleansing of the teeth by mechanical action may be combined with others possessing remedial qualities but when the gums are healthy, a medicated dentifrice is not required. A mechanical agent, pleasant to the taste and agreeable in odour, possessing a hardness necessary for the removal of slight accumulations of tartar, without liability to injure the enamel, and soluble in the fluids of the mouth, is all that is necessary" (Webb 1885).

W Theo Shanasy of Adelaide (1900) suggested that:

"dentifrice should be a powder. He believed that liquid dentifrices and all preparations containing soap defeat the very object in view, for the reason that they cause the brush to glide over the teeth like a lubricant, instead of possessing slight friction".
He suggested the avoidance of charcoal, wood ashes, acids of all kinds; baking soda, if much used injures the gums, and toothpastes are always doubtful preparations (Shanasy 1980).

In the proceedings of first Australian Dental Congress held in Sydney in 1907, Ernest Deck said that -

"A suitable toothpowder is always indicated, as being a decided help to remove the glutinous plaques that so soon form upon the teeth. Such powder, under the name of 'Calox', can from extended personal experience, be recommended as very efficient. This tooth powder, the synthesis of which is due to Dr EC Kirk, is a new departure in the way of powders, having incorporated a proportion of calciumdioxides which, when brought in contact with the fluids of the mouth, gives off oxygen-nascent oxygen being an effective destroyer of decomposing matter and bacterial life; the by product, being anti-acid, neutralises any local acid formation such as is associated with caries and erosion" (Deck 1907).
5.2 TYPES AND COST OF TOOTHPASTES AVAILABLE

A warning was given in 1980 by Dr Elizabeth Fanning, Reader in Preventive Dentistry at Adelaide University who was a member of the Australian Standards Association (ASA) Committee. Dr Fanning said that the ASA was deeply concerned with the abrasive action of some pastes.

"Thousands of Australians in their striving for a dazzling smile, are causing their teeth irreparable damage by doing what their dentists advise - brushing regularly".

The abrasives, calcium carbonate, calcium phosphate, sodium phosphate and sodium metaphosphate, wear down tooth enamel and leave the nerves of the dentine beneath painfully sensitive to hot and cold and vulnerable to decay. Worse still, are the pumice and aluminium polishing agents found in "smokers" toothpaste. Fanning was also concerned about the sugar content in some pastes, with taste being a vital marketing pull for manufacturers.

Other ASA members had pointed to the dangers of chloroform, the generator of the "tingling" sensation left by pastes such as Aquafresh, because of its relation to cancers in laboratory rats. They wanted its content reduced to a maximum of 4 percent.

According to Fanning, the food and drug legislation only covered the toxicity of pastes, so the effectiveness of most brands in Australian stores is not known.
Persons were advised to use brands containing fluoride from the larger companies (Colgate, Ipana, Macleans) and to steer clear of "gimmicky" ones and those with fruity flavours, and to use soft brushes which effectively remove plaque around gums (Fanning 1980).

Widespread use of advertising by manufacturers, much of it with some co-operation from the dental profession, and development of products has put forward acceptable products to the market. Fluoride dentifrices were introduced in the late 1950's and early 1960's and were widely used in the 1970's and by 1980 accounted for 82 percent of the market (FDI/WHO 1985).

There is a multitude of different types and brands of toothpastes available to the public. There are toothpastes with fluoride, without fluoride, tartar control formulas and with desensitising agents. Most of the brands have regular, mint and gel types. Today the trend is selection of toothpastes with fluoride. For the purchaser the most important characteristic of a toothpaste is taste and cost. The products are advertised extensively in Australia, especially through television, newspapers, post box advertisements, pamphlets and radio.

A list of 54 different toothpastes used in Australia in 1982 was prepared by staff of Choice Magazine as part of one of their products (Choice 1982). There are numerous types of toothpastes available on the Australian market now. The most widely used toothpastes and their comparative costs have been obtained for Sydney (January 1987) by the writer through visiting the major retail outlets. The findings are presented on Table 23 (Karunanathan 1987b).
**Comments**

There were 43 brands (89 types) of toothpastes available on the Australian market in fluoride, gel, regular, and mint forms. All the brands were not available in every shop.

Aim's tartar build up and Colgate's tartar control formula are the latest arrivals with the claim "reduce tartar build up in between dental visits".

The prices have markedly increased from 1981 to 1987. The highest price increase was observed in Nicodent which was priced $0.99 in 1981 and $5.23-$7.65 in 1987. The lowest price increase was observed for No Frills toothpaste and Soul's toothpaste.

All prices varied from supermarket to supermarket and the highest price for the same products was observed in pharmacies.
TABLE 23

Types and cost of toothpastes available on the Sydney market - 1987

Source: Karunanthan (1987b)

<table>
<thead>
<tr>
<th>Brand</th>
<th>Size gm</th>
<th>Price $ 1981</th>
<th>Price $ 1987</th>
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</thead>
<tbody>
<tr>
<td>Aim</td>
<td>110</td>
<td>0.91</td>
<td>1.45-1.75</td>
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<tr>
<td>Aim Gel</td>
<td>120</td>
<td>1.83</td>
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<tr>
<td>Aim Pump</td>
<td>150</td>
<td>1.89</td>
<td></td>
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<tr>
<td>Aim (reduces tartar build up)</td>
<td>140</td>
<td>1.83</td>
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<tr>
<td>Aquafresh</td>
<td>120</td>
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<td>Herbal &amp; Mineral</td>
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<td>1.25</td>
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<td>0.65</td>
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<td>Ipana fluoride</td>
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<td>Jack &amp; Jill mint f</td>
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<td>80</td>
<td>2.14</td>
<td>3.63-4.50</td>
</tr>
<tr>
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<td>Sarakan</td>
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<td>2.83</td>
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<td>Sigma</td>
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<td>Soul's children</td>
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<td>Brand</td>
<td>Size gm</td>
<td>Price $</td>
<td>1981</td>
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<td>Soul's fluoride plus 2</td>
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</tr>
<tr>
<td>Soul's fluoride without flavour</td>
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<td>1.20</td>
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<td></td>
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<tr>
<td>colour or saccharin</td>
<td>100</td>
<td>1.20</td>
<td></td>
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<tr>
<td>Spearmint toothpaste with fluoride</td>
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<td>0.79</td>
<td></td>
</tr>
<tr>
<td>Vicco</td>
<td>50</td>
<td>0.92</td>
<td></td>
</tr>
<tr>
<td>Vitaplex citrament</td>
<td>100</td>
<td>1.40</td>
<td></td>
</tr>
<tr>
<td>Vitaplex spearmint</td>
<td>100</td>
<td>1.31</td>
<td></td>
</tr>
<tr>
<td>Woolworths regular</td>
<td>140</td>
<td>0.63</td>
<td></td>
</tr>
<tr>
<td>Woolworths fluoride mint</td>
<td>140</td>
<td>0.81</td>
<td></td>
</tr>
<tr>
<td>Yves Rocher apple</td>
<td>50</td>
<td>1.40</td>
<td></td>
</tr>
<tr>
<td>Yves Rocher wild mint</td>
<td>75</td>
<td>1.90</td>
<td></td>
</tr>
</tbody>
</table>
5.3 STUDIES

5.3.1 Published Studies

(a) The use of fluoride dentifrices in the control of dental
caries: A preliminary report of a clinical trial
Fanning, Gotjamanos, Vowles, Cellier and Simmons (1967)

The effectiveness of a dentifrice in the prevention of dental decay
can be assessed only by means of controlled clinical trials, and this
was the purpose of the study.

The caries reducing effects of two dentifrices, dentifrice A
containing 0.4 percent stannous fluoride and dentifrice B containing
0.76 percent sodium monofluorophosphate, were studied over a two year
period. The performances of these dentifrices were compared with that
of dentifrice C, a control dentifrice with an identical formula to
dentifrice A except that it contained no stannous fluoride. In order
to conduct the test under the conditions usually existing at home, the
dentifrices were used permissively and toothbrushing was not
supervised.

The dental caries increments in the three groups, as measured by the
average number of new decayed tooth surfaces over a two year period,
are given in Table 24. Examination of these data discloses that in
the first year of the trial none of the incremental differences
between groups using different dentifrices is statistically
significant. On the other hand, during the second year, and over the
two year period, the increase in caries is significantly lower in the
groups using dentifrices A and B. The groups using dentifrices
containing 0.4 percent stannous fluoride and 0.76 percent sodium monofluorophosphate showed 30 percent and 25 percent fewer new carious surfaces respectively than the control dentifrice C. There are no significant differences between the group using dentifrice A and that using dentifrice B.
TABLE 24

A comparison of the effects of three dentifrices

Source: Fanning, Gotjamanas & Vowles (1967)

<table>
<thead>
<tr>
<th>Treatment*</th>
<th>Mean DMF Surface Increment</th>
<th>First Year</th>
<th>Second Year</th>
<th>First &amp; Second Years</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dentifrice A</td>
<td></td>
<td>5.64</td>
<td>6.44**</td>
<td>9.67**</td>
</tr>
<tr>
<td>Dentifrice B</td>
<td></td>
<td>5.36</td>
<td>6.84**</td>
<td>9.76**</td>
</tr>
<tr>
<td>Dentifrice C</td>
<td></td>
<td>5.65</td>
<td>9.14</td>
<td>12.23</td>
</tr>
<tr>
<td>Standard error of mean</td>
<td></td>
<td>±0.18</td>
<td>±0.24</td>
<td>±0.31</td>
</tr>
<tr>
<td>Replicates per treatment</td>
<td></td>
<td>595</td>
<td>422</td>
<td>422</td>
</tr>
</tbody>
</table>

* Dentifrice A contains 0.4% stannous fluoride; dentifrice B contains 0.76% sodium monofluorophosphate; dentifrice C is the control.

** Differs from dentifrice C at P<0.001
If
What is in toothpaste?
McGonigal (1982)
All the different brands of toothpastes were purchased from shops by a
team from Choice Magazine in 1982. Some 54 brands of toothpastes were
tested for their ingredients. Questionnaires were also sent to the
manufacturers or distributors of all the brands which were tested.
Table 25 gives the results of their tests.

Chloroform
Chloroform is sometimes used in toothpaste as a flavouring to give a
"zing" or astringent effect. The test found slight traces of
chloroform in a few brands.

Note
After some studies showed that chloroform was cancer causing in
animals, the American Food and Drug Administration banned the
use of chloroform in drug and cosmetic products, including
toothpastes, in July 1976.

After examining all the evidence Australian Authorities decided
against banning chloroform but the current Australian Standard
for toothpastes restricts it to a maximum of 4 percent. The
British Standard limits the maximum level of chloroform to 0.5
percent.

Sugars
The Australian Standard prohibits the use of sucrose or any other
readily fermentable carbohydrate (glucose or fructose) in toothpaste.
None of the brands tested had sugar in them. Some of the
manufacturers who replied to the survey indicated that they use
saccharin as a sweetener while others rely on sorbitol which is a non
fermentable carbohydrate.
Acidity and Alkalinity

Acidity and alkalinity are measured on a pH scale from 0 to 14. The lower the figure below 7, the more acid and the higher above 7 the more alkaline. The Australian Standard sets a fairly wide acceptable range for toothpaste from 4.2 to 10.5.

A couple of toothpastes were too acidic and have been rated "not recommended" in the overall rating. They were Floran (pH 3.2) and Soul's Stannous Fluoride (pH 3.3).

Fluoride

The levels of fluoride were tested in 1978 (Choice Magazine, March 1978). In every case, fluoride was found but not in excessive levels.

Colours

It has been established that some colourings which are permitted as food additives in Australia may have an adverse effect, particularly on children. Every toothpaste made specifically for children had colours added. This is to make the ritual of tooth cleaning a more pleasant tasks for kids.

The colours found were:

Amaranth - a red colouring, can give allergic or respiratory reactions and is said to be linked with hyperactivity in children. Some experiments have shown that it can cause a variety of cancers and it has caused still births in rats. After some controversy it was banned in the USA by the Food and Drug Administration (FDA) in January 1976. It is permitted in some foods in Canada and is a permitted food colour
in UK and the European community. In Australia, it was approved by
the National Health and Medical Research Council (NHMRC) in June 1978.

**Brilliant blue FCF** - is a coal tar derivative. There is some evidence
that it may cause tumours, allergic reactions and child hyperactivity.
It is permitted by most authorities and has been approved by NHMRC.

**Carmosine** - is a red colouring which is approved by the NHMRC. It is
a permitted food colouring in the UK.

**Erythrosine, Sunset Yellow and Tartrazine** - are linked with allergic
reactions and hyperactivity. It has been estimated that about 100,000
people in the US are allergic to tartrazine. Since July 1981, the FDA
has required that foods containing tartrazine must state this on the
label.

**Note**

The main dye in Gordon Moores' cosmetic toothpaste could not be
readily identified but definitely was not on the list approved
for foods. Most manufacturers of coloured toothpastes have added
colours to make the product more appealing but one brand had
colouring as an active ingredient. Gordon Moores' is a cosmetic
toothpaste which is bright red. It contains a dye intended to
stain your gums red so your teeth look whiter by contrast.
Alternatively, some may suspect you of having a chronic case of
gingivitis.

Whatever one may think of the cosmetic angle, there is a health risk
in using a toothpaste which can cover up the early signs of gum
disease.
Abrasives

The abrasive function of toothpaste is most important. A toothpaste should not be too abrasive. Hardness is measured according to Moh's Scale which goes from 1 (talc) to 10 (diamond). Although tooth enamel is quite hard (5.5 to 7) the roots are soft being only about 3.5 to 5. Tests have shown that, although there are quite large variations within groups, tooth powders as a class are more abrasive than toothpastes which in turn are more abrasive than liquid polishes.

The test method used checks whether the toothpaste will scratch glass, which rates about 5.5 on Moh's Scale. The test does not allow grading of the degree of abrasiveness, only whether a particular brand is too abrasive or not. Only one toothpaste failed the test - Dentie, an expensive Japanese toothpaste which is jet black.

Figure 9 shows the electron microscopic pictures of abrasives in Pearl Drops, and Dentie with the large boulder like particles evident for Dentie.

Will it keep?

One of the requirements of the Australian Standard is that, even when heated to 45°C and kept there for 24 days, toothpaste must not form gas, separate or ferment. The container must also withstand the temperature. This test is particularly relevant for some parts of Australia.
The toothpastes which failed the test are:

- Jack & Jill - banana
- Jack & Jill - pineapple
- Jack & Jill - raspberry
- Yves Rocher - wild mint

All of these had started to gas or separate - and the Forhan's products changed colour and became darker.

**Nozzle contamination**

Some toothpaste tubes which have metal screw threads for the cap can develop a grey metallic sludge around the nozzle. This is caused by the abrasive of the toothpaste grinding away some of the metal from the nozzle. As this is aluminium it is unlikely to have any harmful effects in the quantities which may be ingested. However, the offending brands are listed in Table 25.

**Viscosity**

Viscosity is a measurement of flow - in this case the Australian Standard says that the toothpaste should not flow out of a tube left on its side or, when applied, immediately sink into the bristles of the toothbrush. On the other hand, it should not be so firm that it can roll off the brush under normal use. Smile fluoride was the only toothpaste which failed the test - it sank into the bristles.

**Delivery**

How much toothpaste can you get out of the tube?

The Australian Standards requirement says that it should nearly all come out "without the application of abnormal force". It was found
that 78 percent of Smile regular and 61 percent of Smile fluoride could be dispensed. There were wide variations in the consistency of Smile products from one container to the next. Other poor performers in the test were Pearl Drops tooth polish (74%) and Pearl Drops fluoride tooth polish (76%).

The amount recovered in each brand of toothpaste is listed in Table 25. Each product is listed within order of the price paid per gram of claimed contents. Price should be compared with the amount recovered.

**Summary**

In summary, none of the toothpaste was found to have chloroform or sugar in it. A couple of toothpastes tested were too acidic and have been rated as not recommended. All fluoride toothpastes had adequate levels of fluoride but not excessive levels. Every toothpaste made specifically for children has colours added. Amaranth, brilliant blue, erythrosine, sunset yellow and tartrazine are food colours which have all been linked with allergic reactions and hyperactivity (but these have been approved for use in Australia). Tests have shown that, although there are quite large variations within groups in abrasiveness, tooth powders as a class are more abrasive than toothpastes which in turn are more abrasive than liquid polishes. Only one toothpaste failed the test for abrasiveness - Dentie.
### TABLE 25

Toothpastes tested by Choice Magazine

**Source:** Choice (1982)

<table>
<thead>
<tr>
<th>Brand</th>
<th>Manufacturer/Distributor</th>
<th>Price g(c)</th>
<th>Amount recovered (%)</th>
<th>Overall</th>
</tr>
</thead>
<tbody>
<tr>
<td>Spearmint</td>
<td>GJ Coles</td>
<td>0.39</td>
<td>88</td>
<td></td>
</tr>
<tr>
<td>Soul's Fluoride Plus</td>
<td>Soul Pattison</td>
<td>0.40</td>
<td>96</td>
<td>x (5)</td>
</tr>
<tr>
<td>Embassy Fluoride</td>
<td>GJ Coles</td>
<td>0.41</td>
<td>92</td>
<td></td>
</tr>
<tr>
<td>Embassy Mint</td>
<td>GJ Coles</td>
<td>0.41</td>
<td>95</td>
<td></td>
</tr>
<tr>
<td>No Name</td>
<td>Jewel Food Stores</td>
<td>0.46</td>
<td>93</td>
<td></td>
</tr>
<tr>
<td>No Frills</td>
<td>Franklins</td>
<td>0.49</td>
<td>98</td>
<td></td>
</tr>
<tr>
<td>Woolworths Fluoride</td>
<td>Woolworths</td>
<td>0.57</td>
<td>97</td>
<td>x (1a)</td>
</tr>
<tr>
<td>Cedel Peppermint</td>
<td>Cedel</td>
<td>0.59</td>
<td>94</td>
<td>x (2)</td>
</tr>
<tr>
<td>Cedel Spearmint</td>
<td>Cedel</td>
<td>0.59</td>
<td>95</td>
<td></td>
</tr>
<tr>
<td>Chem-mart</td>
<td>Chem-mart</td>
<td>0.64</td>
<td>93</td>
<td></td>
</tr>
<tr>
<td>Macleans Freshmint</td>
<td>Beecham</td>
<td>0.70</td>
<td>93</td>
<td></td>
</tr>
<tr>
<td>Macleans Mildmint</td>
<td>Beecham</td>
<td>0.70</td>
<td>95</td>
<td></td>
</tr>
<tr>
<td>Ipana</td>
<td>Bristol-Myers</td>
<td>0.72</td>
<td>98</td>
<td>x (5)</td>
</tr>
<tr>
<td>Ipana Mint</td>
<td>Bristol-Myers</td>
<td>0.75</td>
<td>96</td>
<td></td>
</tr>
<tr>
<td>Macleans Spearmint</td>
<td>Beecham</td>
<td>0.76</td>
<td>88</td>
<td></td>
</tr>
<tr>
<td>Colgate Fluorigard</td>
<td>Colgate-Palmolive</td>
<td>0.79</td>
<td>93</td>
<td>x (1a)</td>
</tr>
<tr>
<td>Aim</td>
<td>Rexona</td>
<td>0.83</td>
<td>96</td>
<td>x (1a)</td>
</tr>
<tr>
<td>Aquafresh</td>
<td>Beecham</td>
<td>0.83</td>
<td>97</td>
<td>x (1a)</td>
</tr>
<tr>
<td>Nyal Fluoride</td>
<td>Sterling Pharm</td>
<td>0.90</td>
<td>96</td>
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</tr>
<tr>
<td>Smile Fluoride</td>
<td>Hunters Products</td>
<td>1.00</td>
<td>61</td>
<td>x (4)</td>
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<tr>
<td>Soul Pattison F</td>
<td>Soul Pattison</td>
<td>1.20</td>
<td>96</td>
<td></td>
</tr>
<tr>
<td>Soul's Stannous F</td>
<td>Soul Pattison</td>
<td>1.29</td>
<td>91</td>
<td>x (6)</td>
</tr>
<tr>
<td>Floran</td>
<td>Creighton Pharm</td>
<td>1.33</td>
<td>92</td>
<td>x(1a)(6)</td>
</tr>
<tr>
<td>Floran Ha</td>
<td>Creighton Pharm</td>
<td>1.59</td>
<td>95</td>
<td></td>
</tr>
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</table>
TABLE 25 (continued)

<table>
<thead>
<tr>
<th>Brand</th>
<th>Manufacturer/Distributor</th>
<th>Price/Amount</th>
<th>Overall</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>g/(c) recovered (%)</td>
<td></td>
</tr>
<tr>
<td><strong>TOOTHPASTE WITHOUT FLUORIDE</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Woolworths Regular</td>
<td>Woolworths</td>
<td>0.45</td>
<td>95</td>
</tr>
<tr>
<td>Ultra Brite</td>
<td>Colgate-Palmolive</td>
<td>0.56</td>
<td>88</td>
</tr>
<tr>
<td>Kolynos</td>
<td>Int Home Products</td>
<td>0.58</td>
<td>109</td>
</tr>
<tr>
<td>Smile</td>
<td>Hunters Products</td>
<td>0.92</td>
<td>78</td>
</tr>
<tr>
<td>Healthy Life P/mint</td>
<td>Healthy Life</td>
<td>1.13</td>
<td>96</td>
</tr>
<tr>
<td>Vitaplex Spearmint</td>
<td>Healthy Life</td>
<td>1.31</td>
<td>87</td>
</tr>
<tr>
<td>Blackmore's</td>
<td>Blackmores Lab</td>
<td>1.39</td>
<td>91</td>
</tr>
<tr>
<td>Vitaplex Citramint</td>
<td>Healthy Life</td>
<td>1.40</td>
<td>82</td>
</tr>
<tr>
<td>Healthy Life -</td>
<td></td>
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<td></td>
</tr>
<tr>
<td>Comfrey mint</td>
<td>Healthy Life</td>
<td>1.58</td>
<td>85</td>
</tr>
<tr>
<td>Forhan's</td>
<td>Sheldon Drug Co</td>
<td>1.61</td>
<td>86</td>
</tr>
<tr>
<td>Yves Rocher Wild mint</td>
<td>Yves Rocher</td>
<td>1.81</td>
<td>94</td>
</tr>
<tr>
<td>Yves Rocher Apple</td>
<td>Yves Rocher</td>
<td>2.06</td>
<td>92</td>
</tr>
<tr>
<td>Dentie</td>
<td>Russell's Bulk Buys</td>
<td>2.59</td>
<td>93</td>
</tr>
<tr>
<td>Durban's</td>
<td>Dalton Pharm</td>
<td>2.95</td>
<td>88</td>
</tr>
<tr>
<td>Sarakan</td>
<td>Healthy Life</td>
<td>3.06</td>
<td>103</td>
</tr>
<tr>
<td><strong>CHILDREN'S FLUORIDE TOOTHPASTE</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Soul's Orange</td>
<td>Soul Pattison</td>
<td>0.40</td>
<td>88</td>
</tr>
<tr>
<td>Soul's Strawberry</td>
<td>Soul Pattison</td>
<td>0.40</td>
<td>93</td>
</tr>
<tr>
<td>Jack &amp; Jill Banana</td>
<td>Sigma</td>
<td>1.00</td>
<td>90</td>
</tr>
<tr>
<td>Jack &amp; Jill Pineapple</td>
<td>Sigma</td>
<td>1.00</td>
<td>87</td>
</tr>
<tr>
<td>Jack &amp; Jill Raspberry</td>
<td>Sigma</td>
<td>1.00</td>
<td>92</td>
</tr>
<tr>
<td><strong>MEDICINAL TOOTHPASTE</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vicco</td>
<td>Healthy Life</td>
<td>1.68</td>
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</tr>
<tr>
<td>Emoform</td>
<td>Arthur Bailey</td>
<td>2.25</td>
<td>94</td>
</tr>
<tr>
<td>Floran CSP</td>
<td>Creighton Pharm</td>
<td>2.52</td>
<td>88</td>
</tr>
<tr>
<td>Sensodyne</td>
<td>Stafford Miller</td>
<td>2.57</td>
<td>95</td>
</tr>
<tr>
<td>Parodontax</td>
<td>Healthy Life</td>
<td>3.02</td>
<td>90</td>
</tr>
<tr>
<td><strong>COSMETIC TOOTHPASTE</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gordon Moore's</td>
<td>Mimar</td>
<td>6.09</td>
<td>98</td>
</tr>
<tr>
<td>Brand</td>
<td>Manufacturer/Distributor</td>
<td>Price (g)</td>
<td>Amount recovered (%)</td>
</tr>
<tr>
<td>--------------</td>
<td>--------------------------</td>
<td>-----------</td>
<td>----------------------</td>
</tr>
<tr>
<td>S &amp; B</td>
<td>Scott &amp; Bowne (A'Asia)</td>
<td>1.11</td>
<td>89</td>
</tr>
<tr>
<td>Clinomycin</td>
<td>EC DeWitt &amp; Co</td>
<td>1.71</td>
<td>93</td>
</tr>
<tr>
<td>Denicotin</td>
<td>Dalton Pharm</td>
<td>3.70</td>
<td>88</td>
</tr>
</tbody>
</table>

**SMOKERS' TOOTHPASTE**

**TOOTH POLISH**

<table>
<thead>
<tr>
<th>Brand</th>
<th>Manufacturer</th>
<th>Price (g)</th>
<th>Amount recovered (%)</th>
<th>Overall</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pearl Drops Fluoride</td>
<td>Carter-Wallace</td>
<td>2.49</td>
<td>76</td>
<td>x (5)</td>
</tr>
<tr>
<td>Pearl Drops</td>
<td>Carter-Wallace</td>
<td>2.67</td>
<td>74</td>
<td>x(4)(5)</td>
</tr>
</tbody>
</table>

**FLUORIDE TOOTH POWDER**

<table>
<thead>
<tr>
<th>Brand</th>
<th>Manufacturer</th>
<th>Price (g)</th>
<th>Amount recovered (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Eucryl Regular</td>
<td>Salmond &amp; Spraggon</td>
<td>1.93</td>
<td>115</td>
</tr>
<tr>
<td>Eucryl Smokers</td>
<td>Salmond &amp; Spraggon</td>
<td>1.95</td>
<td>106</td>
</tr>
</tbody>
</table>

**Index**

\[ \text{x} \quad \text{ Unsatisfactory} \]

Not directly comparable with toothpaste

\[ \text{*} \quad \text{The numbers represent the test(s) in which the product was not satisfactory:} \]

1a unnecessary food colours
1b unknown colouring
2 stability
3 abrasiveness
4 viscosity
5 cohesive force
6 pH

Only products which were not satisfactory under 1b or 3 are "not recommended".
Electron microscopic pictures of abrasives in Pearl Drops and Dentie

Source: Choice (1982)

Two abrasives for tooth cleaning as seen by our technician through an electron microscope. Both photos were taken at the same magnification (130 times). The one on top shows the abrasive in Pearl Drops, the boulders, opposite, are in Dentie, the only toothpaste we found to be too abrasive.
Oral health care systems - An international collaborative study

World Health Organization (1985)

As previously mentioned, in section 3.4.1(i), this study presents results from a multi national study of oral health care consumers in three target groups: 8 to 9 year olds, 13 to 14 year old students and 35 to 45 year olds and dental care provides. One of the participants in this study was Australia and the local study was carried out in the Sydney area in 1973.

One of the questions in the questionnaire was whether or not the students used a fluoride toothpaste. Table 26 presents the use of fluoride toothpaste in student sample, 13-14 years the use of fluoride toothpaste and/or fluoride application in adult sample 35-44 years for the study.

In the student sample the use of fluoride toothpaste was predominant in Ontario, Sydney and Trondelag, where more than 70 percent in all subcategories used it. In Baltimore and Dublin, more than 50 percent in all subcategories used fluoride toothpaste and this was also the case for all but one of the subcategories in Canterbury. The use of a toothpaste containing fluoride was almost non existent in Yamanashi and less than a third of the students in the non metropolitan areas of Leipzig and Lodz used it. The greatest difference in use of fluoride toothpaste among the sub groups within the study areas ranged from 6 percent in Yamanashi to 30 percent in Lodz. Again, no systematic variation followed from the system characteristic of having a
targeted school dental service.

Only in Baltimore and Trondelag (except for non metropolitan students with a high social position) was there a consistent sex variation in the use of fluoride toothpaste. In Canterbury, Lodz, Ontario and metropolitan Leipzig, the use of fluoride toothpaste varied directly with the level of educational aspiration. In Dublin, for all but metropolitan females, there was also a similar variation by educational aspiration. For non metropolitan males a similar variation in the use of fluoride toothpaste was found in Baltimore, Hannover, Sydney and Trondelag, and high social position have been associated with higher use frequencies.

Generally, however, there was much less social variation connected with the use of fluoride toothpaste than there was for brushing behaviour. The enormous variation between the study areas clearly indicates that use of fluoride toothpaste was more related to the study areas than the social subcategories within the areas. However, there was no tendency indicating that the variation between areas was related to other aspects of the oral health care delivery system than the availability and marketing of toothpaste containing fluoride.

In the adult sample (35–44 years), as can be seen in Table 26, more than two thirds of the samples were using fluoride in toothpaste, or as an application by their dentist, in Baltimore, Dublin, Hannover, Sydney, Trondelag and metropolitan Ontario. There was consistently more use of fluoride in the metropolitan areas in Canterbury, Lodz and Ontario and a similar tendency in Leipzig, Sydney and Trondelag.
Females consistently used fluoride more frequently than males in Baltimore, non metropolitan Hannover, metropolitan Ontario, metropolitan Sydney and metropolitan Trondelag, while males did so in non metropolitan Leipzig. A consistent direct association between fluoride use and high social position was found in Baltimore, Leipzig, Lodz, non metropolitan Ontario, metropolitan Sydney, metropolitan Trondelag, as well as among females in Yamanashi.

In summary, for the student sample (13-14 years) in Sydney the use of fluoride toothpaste was predominant and more than 70 percent in all subcategories used it. There was no consistent sex variation or social variation in Sydney's student sample.

In the adult sample (35-44 years) more than two thirds of the samples were using fluoride in toothpaste, or as an application by their dentist in Sydney. There was consistently more use of fluoride in the metropolitan areas in Sydney. Females used fluoride more frequently than males. A consistent direct association between fluoride use and high social position was found for this adult sample in Sydney.
Use of fluoride toothpaste

Source: WHO International Collaborative Study (1985)

**Table 26**

(Student sample, 13-14 years)

<table>
<thead>
<tr>
<th>Study area</th>
<th>% of students using fluoride toothpaste</th>
<th></th>
<th></th>
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</tr>
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<td></td>
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<td>Female</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Social position</td>
<td>Social position</td>
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<tr>
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<td>Low</td>
<td>High</td>
<td>Total</td>
<td>Low</td>
<td>High</td>
</tr>
<tr>
<td>Baltimore</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Metro</td>
<td>64</td>
<td>70</td>
<td>68</td>
<td>73</td>
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<tr>
<td>Nonmetro</td>
<td>51</td>
<td>72</td>
<td>67</td>
<td>74</td>
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<tr>
<td>Ontario</td>
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<td></td>
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<td></td>
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<tr>
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(Adult sample, 35-44 years)

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<th>Study area</th>
<th>% using fluoride toothpaste and/or fluoride application</th>
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<td></td>
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<td></td>
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<td>Low</td>
<td>High</td>
<td>Total</td>
<td>Low</td>
<td>High</td>
</tr>
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<td>Leipzg</td>
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</table>
Prime Prospect Profiles is a single source marketing and media information service for Australian marketers and advertisers. Prime prospects are the people who, although they may be a minority, account for the majority of the quantity of product of service consumed. Prime prospect profiles provide marketers and advertisers with information which identifies their most important target market or prime prospects within a particular product or service group and highlights the advertising medium or media mix which will best reach them.

McNair Anderson has carried out questionnaire surveys on use of toothpaste covering the frequency of use and brands most often used by sex, state, capital cities and country areas for all persons above 13 years of age in Australia. Table 27 gives details of their study for female and male for the whole of Australia for the year 1985. Further details by State are included in Appendix 6.

Comment

In toothpaste users and non users there is no big difference between males and females. Some 8 percent of Australians do not use toothpaste and 55 percent of the population brush 8-14 times per week (medium). Only 15 percent of population brush heavily (15 times per week). Females brush more often than males. Colgate is the most popular brand among the users. Next comes Macleans and Aim.
TABLE 27

Use of toothpaste, frequency of use and brands most often used by sex, state, capital cities and country areas in all people above 13 years of age - 1985

Source: McNair Anderson (1986)

<table>
<thead>
<tr>
<th></th>
<th>Total</th>
<th>Sex</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>M</td>
</tr>
<tr>
<td>Sample size</td>
<td>14,719</td>
<td>7,008</td>
</tr>
<tr>
<td>Potential (000's)</td>
<td>12,378</td>
<td>6,137</td>
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<tr>
<td></td>
<td>100%</td>
<td>50%</td>
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<tr>
<td>Toothpaste user</td>
<td>11,450</td>
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</tr>
<tr>
<td></td>
<td>93%</td>
<td>91%</td>
</tr>
<tr>
<td></td>
<td>100%</td>
<td>49%</td>
</tr>
<tr>
<td>Non user</td>
<td>929</td>
<td>557</td>
</tr>
<tr>
<td></td>
<td>8%</td>
<td>9%</td>
</tr>
<tr>
<td></td>
<td>100%</td>
<td>60%</td>
</tr>
<tr>
<td>Frequency of use</td>
<td>1,742</td>
<td>685</td>
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<tr>
<td>Heavy (15 times per week)</td>
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<td>12%</td>
</tr>
<tr>
<td></td>
<td>100%</td>
<td>39%</td>
</tr>
<tr>
<td>Medium (8-14 times per week)</td>
<td>6,277</td>
<td>2,847</td>
</tr>
<tr>
<td></td>
<td>55%</td>
<td>51%</td>
</tr>
<tr>
<td></td>
<td>100%</td>
<td>45%</td>
</tr>
<tr>
<td>Light (1-7 times per week)</td>
<td>3,435</td>
<td>2,050</td>
</tr>
<tr>
<td></td>
<td>30%</td>
<td>37%</td>
</tr>
<tr>
<td></td>
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<td>60%</td>
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</table>
### TABLE 27 (continued)

Brands most often used:

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<th>Total</th>
<th>Sex</th>
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<tr>
<td></td>
<td></td>
<td>M</td>
</tr>
<tr>
<td>Colgate</td>
<td>6,256</td>
<td>3,109</td>
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<tr>
<td></td>
<td>55%</td>
<td>56%</td>
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<td>1</td>
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<tr>
<td>Macleans</td>
<td>1,998</td>
<td>948</td>
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<tr>
<td></td>
<td>17%</td>
<td>17%</td>
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<tr>
<td></td>
<td>2</td>
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</tr>
<tr>
<td>Aim</td>
<td>1,829</td>
<td>890</td>
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<td></td>
<td>16%</td>
<td>16%</td>
</tr>
<tr>
<td></td>
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<tr>
<td>Ipana</td>
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<td>Aquafresh</td>
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<td>2%</td>
</tr>
<tr>
<td></td>
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<td>4</td>
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<tr>
<td>Ultrabrite</td>
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<tr>
<td></td>
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</tr>
<tr>
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<td>6</td>
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<td>1%</td>
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<td>7</td>
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<tr>
<td>S &amp; B</td>
<td>64</td>
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<td>*</td>
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<tr>
<td>Generic/housebrands</td>
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<td>2%</td>
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<td>No particular/any</td>
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<td>Other</td>
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5.3.2 Unpublished Studies

(a) Toothbrush and Toothpaste Study
   by Richard Barnes & Associates - 1986

The following is an in depth analysis of findings of a questionnaire research study relating to toothpastes.

Question 1
Which products are recommended by dentists for dental sensitivity?

N = 309

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<tr>
<th></th>
<th>All brands recommended</th>
<th>Brands recommended most often</th>
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<tbody>
<tr>
<td></td>
<td>1985</td>
<td>1986</td>
</tr>
<tr>
<td>Sensodyne F</td>
<td>66</td>
<td>69</td>
</tr>
<tr>
<td>Sensodyne (regular)</td>
<td>53</td>
<td>48</td>
</tr>
<tr>
<td>Floran CSP</td>
<td>53</td>
<td>42</td>
</tr>
<tr>
<td>Protect</td>
<td>19</td>
<td>36</td>
</tr>
<tr>
<td>Thermodent</td>
<td>9</td>
<td>13</td>
</tr>
<tr>
<td>Emoform</td>
<td>6</td>
<td>2</td>
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<tr>
<td>Oroflugel</td>
<td>4</td>
<td>0</td>
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<tr>
<td>None</td>
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</tr>
</tbody>
</table>

The two Sensodyne products, with fluoride and the regular product, dominated the products recommended by dentists for dental sensitivity, and are still growing in popularity. These two products appear to be recommended more in Victoria, South Australia and Tasmania.
Question 2

Detailed ratings by dentists of brands of desensitising toothpastes on selected attributes. This table has been changed from the 1985 format to match the US format for more meaningful analysis.

N = 309

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<tr>
<th></th>
<th>Sensodyne F</th>
<th>Sensodyne regular</th>
<th>Emoform</th>
<th>Floran</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>(a) Effectiveness against hypersensitivity</strong></td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>Excellent/very good</td>
<td>38) 76</td>
<td>40) 79</td>
<td>1) 10</td>
<td>33) 58</td>
</tr>
<tr>
<td>Good</td>
<td>38)</td>
<td>39)</td>
<td>9)</td>
<td>25)</td>
</tr>
<tr>
<td>Fair/poor</td>
<td>10</td>
<td>14</td>
<td>3</td>
<td>9</td>
</tr>
<tr>
<td>Not enough information</td>
<td>13</td>
<td>7</td>
<td>87</td>
<td>32</td>
</tr>
<tr>
<td><strong>(b) Taste</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Excellent/very good</td>
<td>17) 52</td>
<td>6) 25</td>
<td></td>
<td>14) 37</td>
</tr>
<tr>
<td>Good</td>
<td>35)</td>
<td>19)</td>
<td>3</td>
<td>23)</td>
</tr>
<tr>
<td>Fair/poor</td>
<td>34</td>
<td>68</td>
<td>11</td>
<td>26</td>
</tr>
<tr>
<td>Not enough information</td>
<td>14</td>
<td>7</td>
<td>86</td>
<td>37</td>
</tr>
<tr>
<td><strong>(c) After taste</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Excellent/very good</td>
<td>16) 42</td>
<td>6) 23</td>
<td></td>
<td>13) 32</td>
</tr>
<tr>
<td>Good</td>
<td>26)</td>
<td>17)</td>
<td>1</td>
<td>19)</td>
</tr>
<tr>
<td>Fair/poor</td>
<td>38</td>
<td>60</td>
<td>10</td>
<td>26</td>
</tr>
<tr>
<td>Not enough information</td>
<td>19</td>
<td>16</td>
<td>89</td>
<td>43</td>
</tr>
<tr>
<td><strong>(d) Abrasion level</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Excellent/very good</td>
<td>14) 38</td>
<td>11) 31</td>
<td>1) 2</td>
<td>17) 38</td>
</tr>
<tr>
<td>Good</td>
<td>24)</td>
<td>20)</td>
<td>1)</td>
<td>21)</td>
</tr>
<tr>
<td>Fair/poor</td>
<td>29</td>
<td>43</td>
<td>6</td>
<td>13</td>
</tr>
<tr>
<td>Not enough information</td>
<td>33</td>
<td>26</td>
<td>92</td>
<td>48</td>
</tr>
<tr>
<td></td>
<td>Sensodyne F</td>
<td>Sensodyne regular</td>
<td>Emoform</td>
<td>Floran</td>
</tr>
<tr>
<td>--------------------</td>
<td>-------------</td>
<td>-------------------</td>
<td>---------</td>
<td>--------</td>
</tr>
<tr>
<td></td>
<td>%</td>
<td>%</td>
<td>%</td>
<td>%</td>
</tr>
<tr>
<td>(e) Fluoride content</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Excellent/very good</td>
<td>42) 71</td>
<td>6) 15</td>
<td>1) 2</td>
<td>19) 33</td>
</tr>
<tr>
<td>Good</td>
<td>29)</td>
<td>9)</td>
<td>1) 14)</td>
<td></td>
</tr>
<tr>
<td>Fair/good</td>
<td>5)</td>
<td>49)</td>
<td>3)</td>
<td>12)</td>
</tr>
<tr>
<td>Not enough information</td>
<td>23</td>
<td>36</td>
<td>95)</td>
<td>54)</td>
</tr>
<tr>
<td>(f) Overall rating</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Excellent/very good</td>
<td>32) 72</td>
<td>13) 57</td>
<td></td>
<td>25) 54</td>
</tr>
<tr>
<td>Good</td>
<td>40)</td>
<td>44)</td>
<td>3)</td>
<td>28)</td>
</tr>
<tr>
<td>Fair/poor</td>
<td>15)</td>
<td>35)</td>
<td>9)</td>
<td>12)</td>
</tr>
<tr>
<td>Not enough information</td>
<td>13</td>
<td>8)</td>
<td>87)</td>
<td>34)</td>
</tr>
</tbody>
</table>

Sensodyne F appears to have outstanding attributes relative to the products it was measured against. Its major advantages appear to be in taste, after taste and fluoride content.

(b) Study on use of fluoride toothpaste in first year dental students of the University of Sydney

Barnard (1985b)

As mentioned previously in section 3.4.2(d) a questionnaire survey was administered by Barnard to first year dental students of the University of Sydney during the period 1977-1985. This included questions on the use of fluoride toothpaste. One hundred percent of the 730 males and 284 females used fluoride toothpaste regularly.
5.4 MARKETING OF TOOTHPASTES

5.4.1 Market Situation

Toothpaste is not just toothpaste, or so the major manufacturers would have us believe. Flashy features like blue gels, anti plaque additives, and soft laminated tubes are attracting consumers and hotting up the scramble for sales in the $60 million market. In May 1983, Colgate Palmolive revealed its new star, Colgate Fresh Mint Gel. Fresh Mint proved a winner, capturing 17 percent of all sales in little over six months and pushing back competitors Aim and Macleans a few market share points (Sheahan 1984).

The shake up in toothpaste began when Rexona's Aim was launched in 1981. Aim attacked the leader, Colgate Palmolive, cutting their market share from 58.6 percent to 56.2 percent. "The Colgate Fresh Mint Gel has enormous appeal" said a spokesman for Colgate. "The gel has been especially successful with children, encouraging them to brush more". The gel toothpaste boosted Colgate's total market share by over 2 percent.

In the USA gel toothpastes have snared over 20 percent of the market since they were first introduced in the mid 1970's.

The laminate tube was first introduced by Aim and in toothpaste jargon it has a "memory". That is, when squeezed it bounces back into the same position, whereas the metal tubes buckle with use (Sheahan 1984).
According to 1983 research figures, the market shares are as follows:

(Sheahan 1984)

<table>
<thead>
<tr>
<th>Brand</th>
<th>Market Share</th>
</tr>
</thead>
<tbody>
<tr>
<td>Colgate</td>
<td>56.2%</td>
</tr>
<tr>
<td>Beecham's Macleans</td>
<td>18.5%</td>
</tr>
<tr>
<td>Rexona's Aim</td>
<td>14.3%</td>
</tr>
<tr>
<td>Others</td>
<td>11.3%</td>
</tr>
</tbody>
</table>

In the competitive spirit, Rexona has launched Aim Minty Gel and the innovative toothpaste "pump" dispenser.

In the words of one Colgate Executive, market observers will have to "stay tuned" for Colgate's reply to the pump toothpaste tube in the protracted toothpaste war.

Promotion for the new Aim gel toothpaste and the Aim toothpaste pump cost Rexona $5.4 million in 1984. Colgate would not reveal their advertising expenses, however, it is believed they are spending a total of $1 million on promotion (Sheahan 1984).

In 1983, there was a large battle between multi-national companies which was known as the great toothpaste war. The skirmish was over the small spot reserved for the humble toothpaste tube. Australians spend $60 million a year on toothpaste making it a lucrative field for manufacturers.

Since World War II, the giant Colgate-Palmolive group has dominated and at times captured 60 percent of sales. Its long time rival, Beecham Australia, manufacturer of Macleans and Aquafresh,
traditionally holds a quarter of the market. But, with the entry of a new brand to the Australian toothpaste trade in 1981, a shiver went through the system. A once stable market was thrown into disarray as rival manufacturers scrambled to hold on to their established buyers.

 Millions of dollars were splurged on advertising and, though none of the main protagonists would care to admit it, it was torrid. As one industry source said "it was very much a cut throat business. The companies kept their profit margins down to a bare minimum, the name of the game was holding your market share".

 The arrival on the toothpaste scene was Aim, manufactured by Rexona Pty Ltd. Rexona, an affiliate of the huge Unilever Group, earmarked $4.5 million to promote the new brand. Rexona was aiming to grab 10-20 percent of the market with Aim. To achieve this someone else had to lose out.

 Colgate-Palmolive, with the lion's share of the toothpaste dollar, had the most at stake. In defence of its three brands - Colgate Fluoriguard, Colgate Dental Cream and Ultra-brite, the household goods heavy weight moved quickly to counter the Aim launch.

 Australian households were swamped with literature offering cash refunds on Colgate purchases and there was full page newspaper advertising. The battle even involved legal action in the Federal Court (Parkinson 1983).
The Court had been told of assertions that independent clinical trials showed that Aim, which contains zinc citrate or citraden, slows the regrowth of plaque and that it gives better protection against plaque than other toothpastes. This result of the formulation that allowed Aim to say it retarded regrowth of plaque between brushing was a very conspicuous difference to assertions by other toothpastes on the market to merely remove plaque.

The earliest commercial which referred to plaque in the toothpaste category appeared in October 1979 for Macleans toothpaste (Sydney Morning Herald, Thursday 24 September 1981).

"The total removal of plaque is, if one includes the pits and fissures in the posterior teeth, nigh on impossible", the Federal Court of Australia was told. Dr Graham Craig, a Senior Lecturer in Child Dental Health at the University of Sydney gave evidence (1981) at a hearing of an application by Colgate-Palmolive Pty Ltd for an interim injunction restraining Rexona Pty Ltd from producing or distributing promotional material or advertising for Aim toothpaste. He said in essence, toothbrushes could reach the outer, inner and biting surfaces of the teeth. When asked if any anti plaque agent must have the potential to reduce decay, Dr Craig said "no, I wish that was true".

A dentist who conducted a trial with his patients on the effects of Aim toothpaste said he told them to stop using it as the presence of plaque on their teeth appeared to increase in some cases. The dentist, Dr Robin Woods of Yass gave evidence in the Federal Court in September 1981 at a hearing of an application by Colgate-Palmolive for
an interim injunction restraining Rexona Pty Ltd from producing or
distributing promotional material or advertising Aim toothpaste.

Dr Woods said he conducted the trial with four of his patients after a
Colgate-Palmolive employee asked him to test the effects of Aim as
some claims of a therapeutic nature had been made about it. Dr Woods
said he gave each of the four patients a tube of Aim but found that
because of the nature of the results it was not in their interests to
continue using it. He said claims for the control of curing of a
disease must be given the most vigorous testing (Illawarra Mercury,
Wednesday 23 September 1981).

Fluoride dentifrices were introduced in the late 1950's and early
1960's but the major impact upon sales did not occur until the 1970's.
The spectacular rise in the market share of fluoride dentifrice during
the 1970's is tabulated by WHO and FDI (1985). Figure 10 shows the
market share held by fluoride dentifrices, 1960-1982 for seven
countries. There is a steady increase in market share of fluoride
dentifrices in Australia.

Recently (1986) Aim and Colgate have introduced new tartar control
formula toothpastes.
Market share held by fluoride dentifrices, 1960-1982

Source: WHO/FDI (1985)
5.4.2 Market Share Analysis

In the toothpaste market, there had been significant growth in all three categories - regular, desensitising products and smoker's toothpaste.

Regular toothpastes had a 67 percent share in pharmacy, desensitising toothpastes 29 percent, and smoker's toothpastes 8 percent, according to the latest market research figures. These segments had increased by 17 percent, 20 percent and 145 percent respectively over the previous year in 1984. The introduction of gel toothpaste into regular toothpastes had increased sales of this category, according to the Marketing Manager for Stafford Miller, Mr Boatwright (1986).

In desensitising toothpastes three new brands had been introduced in the past 12 months, including Sensodyne F, Protect (USV), and Fermadent (mentholatum). Mr Boatwright said the Sensodyne brand held 84 percent of the market, with Sensodyne F holding 24 percent. Floran CSP held 12.3 percent of the market, Protect 4.9 percent, and Fermadent 0.8 percent.

Dramatic growth had been experienced in smoker's toothpastes during the past year. This had been partly due to the introduction of some new products including Hi-white from Stafford Miller, Nicodent from Advil and Pearl Drops for Smokers from Carter Wallace (Dental Products 1985).
5.4.3 Market Research Studies

(a) Market research analysis by Meadowbank Marketing

Meadowbank Marketing (1983)

A market analysis was done by a group of final year students who were engaged in the Marketing Certificate course at Meadowbank College of TAFE in 1983. The analysis included a study of the market situation for toothpastes and interview questionnaire of consumers.

Market situation in 1983

The dental care product market in Australia was valued at approximately $93,160,000 at retail level (IMS Pharmacy Sales & Retail World).

If there is one outstanding feature of the dental care product market, it is the fragmented marketing approach by the corporate heavy weights, Colgate, Rexona, Cooper Laboratories etc. Until 1983, except to a limited extent these marketers have attempted to dominate individual product categories rather than the total consumer market. However, Rexona had launched the Aim toothbrush and Cooper Laboratories a new brand of toothpaste, Zendium.

A number of established trends in the United States are now appearing in Australia. For example, since 1981 toothpaste gels have increased their share of the total toothpaste category from one third to more than half and recently Colgate Fresh Mint Gel was launched onto the Australian market. Competitive analysis of market share for some popular toothpastes in Australia had been summarised by IMS (1983).
**Competitive analysis**

<table>
<thead>
<tr>
<th>Year</th>
<th>Volume (retail)</th>
<th>Retail (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1983</td>
<td>64,000,000</td>
<td>100.0</td>
</tr>
<tr>
<td>Toothpastes</td>
<td>33,175,600</td>
<td>51.8</td>
</tr>
<tr>
<td>Colgate</td>
<td>11,223,100</td>
<td>17.5</td>
</tr>
<tr>
<td>Aim (Rexona)</td>
<td>10,620,900</td>
<td>16.6</td>
</tr>
<tr>
<td>Macleans (Beecham)</td>
<td>8,980,400</td>
<td>14.1</td>
</tr>
</tbody>
</table>

**Study (Meadowbank Marketing 1983)**

The students interviewed 178 people who completed questionnaires to obtain new ideas for an oral hygiene kit. The component relating to toothpastes is given below.

Almost all (99%) of the people interviewed used toothpaste regularly and 0.5 percent used toothpaste only occasionally. Two people used tooth powder.

Regarding the quality of toothpastes of regular purchases, there were 175 responses.

53 out of 175 responses were very happy.

98 out of 175 responses were reasonably happy.

11 out of 175 responses stated that there is room for improvement.

Reasons included in "room for improvement" related to taste and type of tube.
5.5 TOOTHPASTE PRODUCTION

Table 28 shows the toothpaste production in Australia from 1941 to 1985. The production has been decreasing from 0.37kg per person in 1961 to 0.34kg per person in 1983/84.

The average quantity of toothpaste produced per person from 1961 to 1985 is shown in Figure 11.

Toothpaste import/export

Table 29 shows the import/export correction of toothpaste in Australia from 1961 to 1985. There was a gradual increase in the quantity of toothpaste exported from 1965 to 1981/82. From 1982/83 the export of toothpaste is decreasing gradually but the quantity of toothpaste imported is increasing gradually.

In 1984-85 toothpastes and dentifrices were exported to China, Fiji, Hong Kong, Indonesia, New Zealand, Papua New Guinea, Singapore, Thailand and other countries. Out of the 194,000kg exported, 65,000kg (major part) was exported to Singapore.

During 1984-85 toothpaste and other dentifrices were imported from China, Germany, India, Italy, Korea, Netherlands, New Zealand, United Kingdom, United States of America and other countries. Out of the 1,904,362kg imported 1,377,751kg was imported from New Zealand. This was the major import.
## TABLE 28
Toothpaste production in Australia 1941-1985

Source: Barnard (1983) and Karunanathan

<table>
<thead>
<tr>
<th>Year</th>
<th>Population Financial yr</th>
<th>Quantity Tonne</th>
<th>Value $</th>
<th>Mean per person Kg</th>
<th>$</th>
</tr>
</thead>
<tbody>
<tr>
<td>1940/41</td>
<td>7,076,875</td>
<td>NA</td>
<td>$993,144</td>
<td>0.00</td>
<td>$0.14</td>
</tr>
<tr>
<td>1941/42</td>
<td>7,144,140</td>
<td>NA</td>
<td>$1,345,568</td>
<td>0.00</td>
<td>$0.19</td>
</tr>
<tr>
<td>1942/43</td>
<td>7,204,069</td>
<td>NA</td>
<td>$1,320,408</td>
<td>0.00</td>
<td>$0.18</td>
</tr>
<tr>
<td>1943/44</td>
<td>7,271,065</td>
<td>NA</td>
<td>$1,323,728</td>
<td>0.00</td>
<td>$0.18</td>
</tr>
<tr>
<td>1944/45</td>
<td>7,348,170</td>
<td>NA</td>
<td>$1,124,556</td>
<td>0.00</td>
<td>$0.15</td>
</tr>
<tr>
<td>1945/46</td>
<td>7,428,868</td>
<td>NA</td>
<td>$1,599,334</td>
<td>0.00</td>
<td>$0.22</td>
</tr>
<tr>
<td>1946/47</td>
<td>7,518,675</td>
<td>NA</td>
<td>$1,599,334</td>
<td>0.00</td>
<td>$0.21</td>
</tr>
<tr>
<td>1947/48</td>
<td>7,639,519</td>
<td>NA</td>
<td>$1,772,452</td>
<td>0.00</td>
<td>$0.23</td>
</tr>
<tr>
<td>1948/49</td>
<td>7,796,479</td>
<td>NA</td>
<td>$1,966,508</td>
<td>0.00</td>
<td>$0.25</td>
</tr>
<tr>
<td>1949/50</td>
<td>8,044,292</td>
<td>NA</td>
<td>$2,511,686</td>
<td>0.00</td>
<td>$0.31</td>
</tr>
<tr>
<td>1950/51</td>
<td>8,303,043</td>
<td>NA</td>
<td>$2,872,182</td>
<td>0.00</td>
<td>$0.35</td>
</tr>
<tr>
<td>1951/52</td>
<td>8,538,629</td>
<td>NA</td>
<td>$1,051,510</td>
<td>0.00</td>
<td>$0.12</td>
</tr>
<tr>
<td>1952/53</td>
<td>8,734,188</td>
<td>NA</td>
<td>$3,745,700</td>
<td>0.00</td>
<td>$0.43</td>
</tr>
<tr>
<td>1953/54</td>
<td>8,900,344</td>
<td>NA</td>
<td>$4,044,174</td>
<td>0.00</td>
<td>$0.45</td>
</tr>
<tr>
<td>1954/55</td>
<td>9,089,731</td>
<td>NA</td>
<td>$4,376,842</td>
<td>0.00</td>
<td>$0.48</td>
</tr>
<tr>
<td>1955/56</td>
<td>9,314,187</td>
<td>NA</td>
<td>$4,597,918</td>
<td>0.00</td>
<td>$0.49</td>
</tr>
<tr>
<td>1956/57</td>
<td>9,532,514</td>
<td>NA</td>
<td>$4,901,708</td>
<td>0.00</td>
<td>$0.51</td>
</tr>
<tr>
<td>1957/58</td>
<td>9,742,359</td>
<td>NA</td>
<td>$5,523,564</td>
<td>0.00</td>
<td>$0.57</td>
</tr>
<tr>
<td>1958/59</td>
<td>9,948,346</td>
<td>NA</td>
<td>$6,279,428</td>
<td>0.00</td>
<td>$0.63</td>
</tr>
<tr>
<td>1959/60</td>
<td>10,153,863</td>
<td>2,659.0</td>
<td>$5,547,642</td>
<td>0.26</td>
<td>$0.55</td>
</tr>
<tr>
<td>1960/61</td>
<td>10,390,929</td>
<td>3,710.5</td>
<td>$8,291,522</td>
<td>0.36</td>
<td>$0.80</td>
</tr>
<tr>
<td>1961/62</td>
<td>10,644,574</td>
<td>3,940.2</td>
<td>$8,291,522</td>
<td>0.37</td>
<td>$0.78</td>
</tr>
<tr>
<td>1962/63</td>
<td>10,846,574</td>
<td>3,829.5</td>
<td>$7,431,270</td>
<td>0.35</td>
<td>$0.69</td>
</tr>
<tr>
<td>1963/64</td>
<td>11,059,300</td>
<td>3,991.5</td>
<td>$7,759,768</td>
<td>0.36</td>
<td>$0.70</td>
</tr>
<tr>
<td>1964/65</td>
<td>11,278,636</td>
<td>4,444.8</td>
<td>$9,205,000</td>
<td>0.39</td>
<td>$0.82</td>
</tr>
<tr>
<td>1965/66</td>
<td>11,500,617</td>
<td>4,433.4</td>
<td>$8,821,000</td>
<td>0.39</td>
<td>$0.77</td>
</tr>
<tr>
<td>1966/67</td>
<td>11,703,175</td>
<td>4,886.6</td>
<td>$10,363,000</td>
<td>0.42</td>
<td>$0.89</td>
</tr>
<tr>
<td>1967/68</td>
<td>11,909,996</td>
<td>5,181.8</td>
<td>$9,150,000</td>
<td>0.44</td>
<td>$0.77</td>
</tr>
<tr>
<td>1968/69</td>
<td>12,143,969</td>
<td>5,546.1</td>
<td>$9,526,000</td>
<td>0.46</td>
<td>$0.78</td>
</tr>
<tr>
<td>1969/70</td>
<td>12,404,173</td>
<td>5,536.0</td>
<td>$10,692,000</td>
<td>0.45</td>
<td>$0.86</td>
</tr>
<tr>
<td>1970/71</td>
<td>12,728,500</td>
<td>5,266.0</td>
<td>$12,321,000</td>
<td>0.41</td>
<td>$0.97</td>
</tr>
<tr>
<td>1971/72</td>
<td>13,192,200</td>
<td>5,653.0</td>
<td>$12,321,000</td>
<td>0.43</td>
<td>$0.93</td>
</tr>
<tr>
<td>1972/73</td>
<td>13,406,660</td>
<td>6,410.0</td>
<td>$13,659,000</td>
<td>0.48</td>
<td>$1.02</td>
</tr>
<tr>
<td>1973/74</td>
<td>13,612,000</td>
<td>6,704.0</td>
<td>$15,432,000</td>
<td>0.49</td>
<td>$1.13</td>
</tr>
<tr>
<td>1974/75</td>
<td>13,818,200</td>
<td>7,496.0</td>
<td>$17,970,000</td>
<td>0.54</td>
<td>$1.30</td>
</tr>
<tr>
<td>1975/76</td>
<td>13,965,800</td>
<td>7,738.0</td>
<td>$19,079,000</td>
<td>0.55</td>
<td>$1.37</td>
</tr>
<tr>
<td>1976/77</td>
<td>14,110,800</td>
<td>7,333.0</td>
<td>$21,017,000</td>
<td>0.52</td>
<td>$1.49</td>
</tr>
<tr>
<td>1977/78</td>
<td>14,279,500</td>
<td>7,957.0</td>
<td>$18,743,000</td>
<td>0.56</td>
<td>$1.31</td>
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<td>1978/79</td>
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<tr>
<td>1981/82</td>
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<td>$27,950,000</td>
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<td>$1.84</td>
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<tr>
<td>1982/83</td>
<td>15,378,600</td>
<td>6,313.0</td>
<td>$32,740,000</td>
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<td>$2.13</td>
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<td>1983/84</td>
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<td>5,311.0</td>
<td>$34,738,000</td>
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</tr>
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<td>1984/85</td>
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<td>$0</td>
<td>0.00</td>
<td>$0.00</td>
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</table>
Average quantity of toothpaste production per person:
Australia, 1961-1985

Source: Barnard (1983) and Karunanathan

- Toothpaste production
- Correction for import/export (some estimates from $ values)
## TABLE 29

Toothpaste use in Australia 1961-1985
With import/export corrections

Source: Barnard (1983) and Karunanathan

<table>
<thead>
<tr>
<th>Year</th>
<th>Population Financial yr</th>
<th>Quantity Tonne</th>
<th>Value $</th>
<th>Mean per person Kg.</th>
<th>$</th>
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<td>Use</td>
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<td>Use</td>
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<td>$8,291,522</td>
<td>0.36</td>
<td>$0.80</td>
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<td>$8,821,000</td>
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Bristle toothbrushes date back at least 250 years. Indeed the great Fauchard condemned toothbrushes made of horse's hair as being too rough and frequently having a destructive action on the teeth. Sponges and cloths were popular alternatives at that time. However, by the early 19th Century bristle brushes appear to have displaced the other devices and many different designs became available. However, nowadays, the modern nylon brush with standardised characteristics in respect of diameter and length of filament, and rounded filament end, is preferred to the best bristle brush. Toothbrush developments over the past few decades have been concerned with improvements on the basic design and the materials used.

There is a multitude of different shapes, textures, sizes and patterns of toothbrushes available on the Australian market. There are brushes with tufted ends, designed particularly for getting to the lingual surfaces of the lower anterior teeth. There are brushes with various shapes and curves designed to improve access to certain particular brushing areas. Finally, there are straight brushes with all bristles of equal length. Most of these brushes have either three or four rows of tufts. Out of all these, only 26 types of toothbrushes meet Australian Standards and are accepted by the Australian Dental Association (ADA 1986). Since few persons will use more than one brush at one toothbrushing session, the straight brush is the one most generally recommended in Australia.
Today, the trend in selection of the toothbrush is towards the use of rather small toothbrushes with straight or flat trimmed heads. The main criterion for selection of brush head size is that it should be small enough to allow access to, and freedom of movement in, all areas requiring brushing. The smallest brush available is the Reach Youth and the largest, Oral B 60.

No one specific type of toothbrush has been found to be consistently more effective than another. Differences in oral hygiene conditions and the manual dexterity of individual patients may lead to varying requirements for toothbrushes. Through standards, attempts are being made to classify and quantify characteristics related to the performance of brushes. The presence of a Standards Mark on toothbrushes is an assurance that the toothbrushes have been produced under a system of supervision, control and testing applied during manufacture which includes periodic inspections at the manufacturer’s works in accordance with the Certification Mark Scheme of the Standards Association of Australia.

While the great majority of toothbrushes sold in Australia are made of a synthetic monofilament there are still a few manufacturers producing the natural bristle variety. Due to their rather poor hygiene qualities and natural variability, natural bristles are not generally recommended.

In two surveys conducted for the Dental Health Education and Research Foundation, by Dr Goodman in 1976 and 1980, 11 manual toothbrushes (soft) were tested by a panel of adults with an interest in preventive
dentistry. There was a positive preference for the quality and durability of the bristles of the imported brushes (Oral B 30 and Pycopay) as compared with locally made brushes since they were found to last longer and cause less trauma to the gingiva. There was a positive preference for small head brushes and brushes with larger handles. Goodman concluded that "an ideal toothbrush should combine a mini sized head with an adult size handle". According to the participants in the trial, small size head brushes provide better cleaning efficiency in areas of the dentition where access is difficult. Larger handles were preferred as they rest most comfortably in the palm of the hand. The toothbrushes that appeared to meet requirements most closely were Oral B 30 and the Jordan short head brush.

In the study by Chong and Beech (1983) of the Australian Dental Standards Laboratory, examination of a wide variety of toothbrushes showed that they are of consistent good quality. Although many manufacturers claimed on packaging and in advertisements that the bristles in their brushes are end rounded, the great majority failed the test in standard which requires that at least 50 percent of the bristles must be rounded.

The most widely used toothbrushes and their comparative costs have been obtained for Sydney (January 1987) by the writer through visiting major retail outlets. There were differences in costs for the same brand and type of toothbrushes within various supermarkets and pharmacies. The cheapest brush found was $0.20 and the most expensive
brush was $2.70.

Most of the dentists and manufacturers recommend the placement of the brush at the gum at an angle of 45 degrees and moving it in tiny circles while brushing. They recommend a brushing time of 5-10 seconds for each group of teeth and not less than 3 minutes for all the teeth. Also they recommend replacement of a brush every 3-4 months. No toothbrush used effectively will last for a year if it is used two or three times daily after meals.

In a study reported by Henning and Fanning in 1967 on toothbrushing habits of a group of Australian dental patients, the results indicated the state of ignorance in oral hygiene which exists among many patients who seek regular dental attention. Only 18 percent of the whole group claimed to brush their teeth more than twice daily. This study showed that the group of adults studied did not follow a consistent routine of oral hygiene.

In a study carried out by Barnard (1985a) in Tamworth, the number of children not brushing their teeth was higher in 1964 than in 1979 for all age groups with the exception of 12 year old children. As well, the number of children brushing their teeth three or more times per day was higher in 1964 than in 1979 for all ages.

In the multi national study carried out by the World Health Organization (1985), importance was given to attitudes and behaviour. In Sydney metropolitan and non metropolitan areas, 95 percent of males brushed their teeth on the day prior to the interview. In Sydney
metropolitan females, 98 percent brushed their teeth on the day prior to the interview. In general, females reported higher frequencies of toothbrushing as did those of higher social position.

In the survey carried out by Powell and McEniery (1985) in Brisbane, the majority of subjects (94.8%) claimed to have brushed their teeth the previous day. Among those who did so the frequency of brushing increased with age. Frequency of brushing was higher in females than in males.

Colgate Palmolive carried out a study on consumer usage and awareness of toothbrushes in 1985. It was found that Tek had the highest levels of awareness both spontaneously and at a prompted level. Oral B was second for all levels. While Nada and Reach follow in third position. Aim does not appear to have generated high awareness of its entry into the toothbrush market. Perhaps this was overshadowed in consumer minds by the manufacturers more predominant involvement with a toothpaste of the same name.

Approximately 82 percent of the toothbrushes sold in Australia are purchased from supermarkets and variety stores, the remainder being divided between pharmacies, small stores, and directly through dentists. The latter represents a very small quantity and is usually in conjunction with the dentists oral hygiene programmes for particular patients.

According to the consumer awareness and usage study by Colgate (1985)
per capita usage of toothbrushes was 1.2 brushes per annum in 1984. According to Media Monitor (1982) per capita toothbrush usage was 1.5 brushes a year in 1982. People expected their toothbrushes to last for eight or nine months before replacement.

According to the Marketing Manager for Stafford Miller, Oral B toothbrushes dominated the $24 million retail toothbrush market and held 58 percent of the pharmacy share of the market (Dental Products 1985). Johnson & Johnson's Reach brand was in number two position and Nada was the third biggest selling toothbrush in the pharmacy market. However, Rexona's Aim was the fastest growing brand in the market during the year May 1984 to May 1985. The brand was heavily promoted during that year and showed rapid increase in market share within a short period.

Oral B is the dominant brand of manual toothbrushes recommended by dentists for adult patients and children (Richard Barnes & Associates 1986). Also Oral B is the brand used by many dentists to clean their own teeth (Yann Campbell-Hoare Wheeler Survey 1986).

Information on toothbrushes available and their comparative costs has been obtained for Sydney (January 1987) by the writer through visiting the major retail outlets. There were 25 brands of toothbrushes available in adult and junior forms. Most brushes were available only in soft textures. Some natural bristle brushes were available at pharmacies. The cost of the toothbrushes at a pharmacy was slightly higher than in supermarkets. There was also variation in costs within the supermarkets. The most expensive brush was Oral B 15 - Ortho
($2.70). The cheapest was No Frills ($0.20 each).

Out of all these only 5 brands (26 types) are recommended by the Australian Dental Association. They are Aim, Oral B, Reach, Tek and Toothmate.

The number of toothbrushes produced varied from 1.18 per person per year in 1941 to 1.39 per person per year in 1981/82 and the use was 1.87 in 1981/82. The export figures for toothbrushes are not published separately. Toothbrushes are imported from Austria, Canada, China, France, Germany, Hong Kong, Italy, Japan, Korea, New Zealand, Norway, Switzerland, United Kingdom, United States of America and some other countries.

Manufacturers estimate the Australian sales for toothbrushes range from 22-25 million brushes per year or between 1.5 to 1.8 brushes per capita. The combined toothpaste/toothbrush expenditure per person for the year was $7.33. A person in the Northern Territory spends $8.58 on toothpaste/toothbrush which is the highest figure by State. The lowest amount spent was $7.20 (Western Australia). In New South Wales a person spends $7.56 on the above items per year. These figures are much higher than the manufacturer's production cost.
In the World Health Organization survey for adults 35-45 years, more than two thirds of the sample were using fluoride in toothpaste, or as an application by their dentist in Sydney. There was consistently more use of fluoride in the metropolitan areas in Sydney. Females used fluoride more frequently than males. A consistent direct association between fluoride use and high social position was found for the adult sample in Sydney.

McNair and Anderson have carried out questionnaire surveys on the use of toothpaste, frequency of use and brands most often used by sex, state, capital cities and country areas. Among both toothpaste users and non users in 1985 there was no big difference between males and females. Some 8 percent of Australians do not use toothpaste and 55 percent of the population brush 8-14 times per week (medium). Only 15 percent of the population brush heavily (15 times or more per week). Females brush more often than males. Colgate is the most popular brand among the users, next comes Macleans and Aim.

According to the study of Richard Barnes and Associates in 1986, the brand most often recommended by dentists for the sensitivity of teeth is Sensodyne F (40%) followed by Floran (15%). Sensodyne F appears to have outstanding attributes relative to the products it was measured against. Its major advantages appear to be in taste, after taste and fluoride content.

By about the 18 Century the toothbrush had become the most popular device for cleaning the teeth. Toothpastes, which also became
increasingly popular about this time, were not as carefully compounded to promote brushing as they were to become in the following Century, but they were by no means all weird or exotic.

Among the various substances which had gone into earlier toothpastes were coral, mother of pearl, pumice, crabs eyes, dragon's blood, calcined alum, chaff, orris root, essential oils, charcoal, precipitated chalk and glucose syrup.

At the beginning of the 20th Century, ways and means were sought to develop better dentifrices. Toothpaste manufacturers throughout the world increased their efforts year after year to find better ways and means for achieving and maintaining good dental health through the use of improved products and techniques. Fluoride has been added to the majority of toothpastes.

There are standards which specify requirements for toothpastes intended for use with a brush for the cleaning of natural teeth. Such toothpastes may contain therapeutic additives. Manufacturers, with some co-operation with the dental profession, are putting forward acceptable products to the market. There is however, no approved list of toothpastes by the Australian Dental Association as none of the manufacturers has approached the Standards Association for approval.

There is a multitude of different types and brands of toothpastes available to the public. There are toothpastes with fluoride, without fluoride, tartar control formulas and with desensitising agents. Today the trend is selection of toothpastes with fluoride. For the
purchaser the most important characteristic of a toothpaste is taste and cost. The manufacturers advertise widely and competitively.

In 1982 McGonigal tested 56 brands of toothpastes for Choice Magazine. The pastes were tested for chloroform, sugars, fluoride, colours, abrasives, shelf life, nozzle contamination, viscosity and delivery. None of the toothpaste was found to have chloroform or sugar in it. A couple of toothpastes tested were too acidic and have been rated as not recommended. All fluoride toothpastes had adequate levels of fluoride but not excessive levels. Every toothpaste made specifically for children had colours added. Amaranth, brilliant blue, erythrosine, sunset yellow and tartrazine are food colours which have all been linked with allergic reactions and hyperactivity. But these have been quite large variations within groups in abrasiveness, tooth powders as a class are more abrasive than toothpastes which in turn are more abrasive than liquid polishes. Only one toothpaste failed the test for abrasiveness.

Use of fluoride toothpastes was noted by WHO (1985) in the Sydney area in 1973. The student sample (13-14 years) in Sydney the use of fluoride toothpaste was predominant and more than 70 percent in all subcategories used it. There was no consistent sex variation or social variation in Sydney's student sample.

In a survey administered by Barnard (1977-1985) to first year dental students of the University of Sydney, it was found that all the students (730 males and 284 females) used fluoride toothpaste
regularly.

Flashy features like blue gels, anti-plaque additives, soft laminated tubes and pumps are attracting consumers of toothpastes and hotting up the sales in the multi-million dollar market of toothpaste. At present, Colgate holds the major market share of toothpastes. According to 1983 research figures (Sheahan 1984), Colgate held 56.2 percent of market share followed by Macleans (18.5%). Aim held the third position (14.3%).

The most widely used toothpastes and their comparative costs have been obtained for Sydney (January 1987) by the writer through visiting the major retail outlets. There were 89 types of toothpastes available to the public. The most expensive toothpaste was Nicodent which is a smoker's toothpaste used to remove stains. The cheapest brand was No Frills which is a product of Franklins Supermarket. The cost was very much higher for some toothpastes in pharmacies than in the supermarkets.

The production of toothpastes increased from 1960/61 (0.36kg/person) to 1975/76 (0.55kg/person). After this the production has decreased and the import has increased. The use of toothpaste was 0.36kg per person in 1960/61 and 0.34kg per person in 1983/84. The highest use was observed in 1975/76 (0.54kg/person). The decrease in use could be due to the high increase in costs (Table 23). Toothpastes and other dentifrices are imported from China, Germany, India, Italy, Korea, Netherlands, New Zealand, United Kingdom, United States of America and some other countries. Out of 1,904,362kg imported most (1,377,751kg)
was imported from New Zealand in 1984-85.

Toothpaste and other dentifrices have been exported to China, Fiji, Hong Kong, Indonesia, New Zealand, Papua New Guinea, Singapore, Thailand and other countries. Out of 194,000 kg exported 165,000 (the major part) was exported to Singapore.
1. No specific toothbrush can be singled out as being superior for routine use for the removal of dental plaque. The requirements for toothbrushes differ greatly among individuals, depending on such factors as the anatomy of dentition, tooth alignment in the arches, periodontal health, and manual dexterity.

2. No scientific evidence has shown that a specific type and design of manual toothbrush is superior to another. However, a brush with soft bristles that have round, polished ends is recommended for general use because of lower tendency for soft and hard oral tissue damage to occur. A soft toothbrush with a smaller head and larger handle is recommended as ideal.

Oral B is the dominant brand of manual toothbrushes recommended by dentists for children and adults. Also Oral B is the dominant brand which dentists use to clean their own teeth.

3. A survey of the dental literature has revealed no clinically meaningful differences among the various toothbrushing techniques in clearing efficacies or reduction in gingival inflammation. The thoroughness of tooth cleaning is more important than the specific method toothbrushing and the frequency. Guided instruction, continual supervision and careful development of manual dexterities of the individual patient by knowledgeable dentists and preventive auxiliaries are highly desirable.
4. No toothbrush used effectively will last for a year if it is used two or three times daily. It is doubtful whether most people now using a toothbrush effectively clean each surface of each tooth and message the gums in the correct manner.

5. A market share analysis for 1986 estimated the dollar retail standing of major brands as follows:

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<th>Brand</th>
<th>Market Share</th>
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<tr>
<td>Tek</td>
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<tr>
<td>Aim</td>
<td>9.2%</td>
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<tr>
<td>Wisdom</td>
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<tr>
<td>Jordon</td>
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<td>Colgate</td>
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</tbody>
</table>

6. Toothbrush usage for 1986 in Australia has been given as 22 million for a population of 15 million. Out of this total the Oral B brushes used are 5.7 million.

7. The number of toothbrushes produced increased dramatically between 1965 and 1971, decreasing very much after that period; however, the use of toothbrushes remains high.

8. There is a multitude of different types and brands of toothpastes available to the public. There are toothpastes with fluoride, without fluoride, tartar control formulas and with desensitising agents. Today, the trend is selection of toothpastes with fluoride.
9. None of the toothpastes used in Australia in 1982 included chloroform or sugar. All fluoride toothpaste had an adequate level of fluoride. Every toothpaste made specifically for children had colours added.

10. Colgate is the most popular brand used in Australia followed by Macleans and Aim. In 1985, 55 percent of toothpaste users used toothpaste 8-14 times per week. Eight percent of the population in Australia did not use toothpaste (McNair & Anderson 1985).

11. Sensodyne is the brand mostly recommended by dentists to relieve dental sensitivity. Next comes Floran.

12. According to 1983 research figures, the market shares of toothpastes were as follows:

<table>
<thead>
<tr>
<th>Brand</th>
<th>Market Share</th>
</tr>
</thead>
<tbody>
<tr>
<td>Colgate</td>
<td>56.2%</td>
</tr>
<tr>
<td>Macleans</td>
<td>18.5%</td>
</tr>
<tr>
<td>Aim</td>
<td>14.3%</td>
</tr>
</tbody>
</table>

and all other brands 11.9%

13. The majority of toothbrushes and toothpastes sold in Australia are purchased from supermarkets. Information on most widely used toothbrushes, toothpastes and their comparative costs have been obtained for Sydney (January 1987) by the writer through visiting major retail supermarkets and pharmacies. The most expensive toothbrush was Oral B 15 - Ortho which was $2.70 and the cheapest toothbrush found was No Frills which was $0.20 each. The most expensive toothpaste found was Nicodent which costs between
$5.23 to $7.65 for 110gm. The highest price increase was observed for Nicodent which was $0.99 in 1982 for 110gms. The cheapest toothpaste found was No Frills at $0.57 for 110gms. The lowest price increase of $0.80 was observed for No Frills toothpaste from 1982 to 1987.

14. In Australia a person spends about $7.20 to $8.58 on toothpaste/toothbrush per year. There are more toothpastes imported into Australia than exported.

15. There were 21,131,000 toothbrushes to the value of $5,629,000 produced in 1981/82. With imports this equalled approximately 1.9 toothbrushes per person per year at $0.48.

16. There were 5,311 tonnes of toothpaste to the value of $34,738,000 produced in Australia in 1983/84. Adjusted for imports and exports this equalled 450gm per person per year to the value of $2.57. Toothpaste production has been decreasing since 1975 although the use has remained high.

17. Only 26 types of 5 brands of toothbrushes were certified by the Australian Dental Association in 1986. They were Aim, Oral B, Reach, Tek and Toothmate. None of the toothpastes have been submitted for certification by the Standards Association or Australian Dental Association.
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Guidelines to oral hygiene: toothbrushes, toothbrushing, dentifrices and abrasivity.
Guidelines to oral hygiene: toothbrushes, toothbrushing, dentifrices and abrasivity*

Fédération Dentaire Internationale
Technical Report No. 23

Members of the Working Group compiling this Report were: Leader: Dr P. Nygaard Ostby (Norway), Dr A. S. Atkinson (UK), Dr D. Beech (Australia), Prof A. Bergenholtz (Sweden), Prof K. Dreyer-Jørgensen (Denmark), Dr G. Franz (FRG), Dr E. Hamburg (Sweden), Dr W. MacDougall (Australia), Dr H. Maddalena (Argentina), Dr P. F. Puech (France), Dr J. C. Rodda (New Zealand), Prof J. Viohl (FRG).

There is little agreement between authorities on oral hygiene on the subjects of mechanical cleaning and abrasivity of dentifrices and their desirable and undesirable effects. This confusion has obvious disadvantages for patients and oral hygiene education.

The purpose of this document is to present a group of guidelines pertaining to toothbrushes, toothbrushing, the function of dentifrices and their abrasivity. From it, conclusions may be drawn which will form the basis of rational patient information and dental education.

Based on these guidelines, it should be possible to build a more uniform patient education programme. Interdental cleaning is not considered within the scope of this document. However, it must be emphasized that it is an absolutely necessary part of complete oral hygiene.

TOOTHBRUSHES AND TOOTHPRESSING

1. The Manual Toothbrush
The toothbrush is an effective aid for cleaning the accessible surfaces of the teeth.

The cleaning ability of the toothbrush is generally insufficient interdentally and in the fissure system. Consequently, it must be supplemented with interdental cleaning. The fissure system has to be dealt with separately.

2. Natural Bristles and Synthetic Filaments
The majority of toothbrushes available are manufactured from synthetic fibres. There are few data available to justify the use of natural bristle.

3. Filament Configuration (Profile)
The positioning and density of the bundles of filaments (straight, multitufted, V-shaped, serrated and others) has no significant influence on the cleaning efficiency of the occlusal, vestibular and lingual surfaces. None of the existing profiles have been found to have a sufficient interproximal plaque removing ability.

4. Stiffness
There is a relationship between the stiffness of the tufts and the cleaning efficiency of the brush on the flat surfaces of the teeth and gingival trauma. Further research is necessary to find out the relationship of stiffness to plaque removal efficiency and the avoidance of gingival trauma.

5. The Useful Life of a Toothbrush
The useful life of a toothbrush varies greatly between individuals. However, it increases with increasing stiffness.

6. Toothbrush Design and Dimensions
Within usual variations, the length and the width of the toothbrush head of manual toothbrushes does not normally influence the cleaning efficiency.

The shape of the handle (straight, spoon shape, contra-angle or others) by itself has limited influence on the cleaning efficiency of the toothbrush.

7. Toothbrushing Technique
The choice of toothbrushing technique, among those usually recommended (Bass, roll, Charters, scrub etc.), is of minor importance in plaque removal compared to the knowledge and attitude of the individual and his/her manual dexterity, which are much more important in achieving efficient cleaning.

8. Frequency of Toothbrushing
The research on frequency (how many times a day) and duration of the brushing procedure is presently sparse and inconclusive with regard to caries incidence.

For the prevention of plaque growth and its maturation and the control of gingivitis, the frequency of toothbrushing should be determined on an individual basis.

Brushing more than twice a day does not appear to confer any added benefit over twice a day brushing. There is little justification for recommending that people should brush more than twice a day.

9. Force of Toothbrushing
The force of toothbrushing varies between individuals. It is nearly equal between sexes (a range between 2-14 N).
10. Powered (electrical) Toothbrushes
Minor differences exist between manual and adequately powered toothbrushes with respect to plaque removal in controlled experiments. However, the less informed the patients are about toothbrushing, the greater is the advantage in using a powered toothbrush. Powered toothbrushes are useful aids to oral hygiene measures for handicapped subjects.

DENTIFRICES AND ABRASIVITY
1. Cleansing dentifrices used with a toothbrush are effective in the removal of stained pellicle and plaque.
2. An acceptable degree of abrasivity is necessary together with a detergent effect if a dentifrice is to be described as an effective cleansing dentifrice.
3. Effective removal of plaque twice a day can result in improved gingival health and reduced dental caries.

4. Most conventional cleansing dentifrices do not damage oral hard and soft tissues and restorations.
5. When excessive wear of oral hard or soft tissues and restorations is observed, the possibility of abnormal dentifrice composition, toothbrushing, dietary habits and combinations thereof should be investigated.
6. The rarely seen allergic responses to dentifrices may be due to the detergent or flavour systems.
7. Cleansing dentifrices with fluoride compatible abrasive systems are excellent delivery agents for daily topical fluoride applications.
8. Fluoride containing cleansing dentifrices have been shown to be an efficient means of reducing dental caries at low cost compared to non-fluoride containing dentifrices.

SUMMARY
This report provides a series of statements on toothbrushes, toothbrushing, dentifrices and their abrasivity. The use of conventional toothbrushes and dentifrices will adequately cleanse the exposed surfaces of the teeth. Neither variations in the design of toothbrushes nor the formulation of dentifrices confer extra cleaning benefit. For efficient cleaning patient knowledge, motivation and dexterity are of overriding importance.

DIRECTIVES POUR L’HYGIÈNE DENTAIRE: LES BROSSES À DENTS, LE BROUSSAGE DES DENTS, LES DENTIFRICES ET L’ABRASIVITÉ
RAPPORT TECHNIQUE No. 23
RÉSUMÉ
Ce rapport fournit une série d’informations relatives aux brosses à dents, au brossage des dents, aux dentifrices et à leur abrasivité. L’emploi des brosses à dents et dentifrices classiques permet un nettoyage approprié des surfaces dentaires exposées. Ni les modifications apportées à la forme des brosses à dents, ni celles concernant la composition des dentifrices ne semblent conférer de qualités nettoyantes supplémentaires. La motivation et la dextérité constituent les facteurs les plus importants pour permettre au patient de bien maîtriser la technique du nettoyage dentaire efficace.

RICHTLINIEN FÜR DIE MUNDHYGIENE: ZAHNBÜRSTEN, ZÄHNEPUTZEN, ZAHNPASTEN UND ABRASIVITÄT
FACHBERICHT Nr. 23
ZUSAMMENFASSUNG

GUIAS EN LA HIGIENE ORAL: CEPILLO, CEPILLADO, DENTÍFRICOS Y ABRASIVIDAD
INFORME TÉCNICO No. 23
RESUMEN
Este informe proporciona una serie de detalles en los cepillos, cepillados, dentífricos y su abrasividad. La utilización de los cepillos convencionales y los dentífricos llevarán a una limpieza adecuada de las superficies expuestas de los dientes. Ninguna de las variaciones en el diseño de los cepillos ni en la formulación de los dentífricos confiere un beneficio suplementario de limpieza. Para el conocimiento eficiente de la limpieza del paciente, la motivación y la destreza son de una gran importancia.
APPENDIX 2

Australian Standard®
1032—1985

DENTAL EQUIPMENT—
TOOTHBRUSHES

The Tariffs, Instruments, Materials and Equipment Committee of the Australian Dental Association has adopted this standard for use in connection with its program for accreditation of certified dental products, lists of which are published periodically. Enquiries regarding this program should be addressed direct to the Australian Dental Association. When used in connection with the program, the standard is known as Australian Dental Standard (ADS) 1032—1985.

[Title allocated by Defence Cataloguing Authority: TOOTHBRUSH ... NSC 8530]
This Australian standard was prepared by Committee DN/13, Oral Hygiene Agents and Devices. It was approved on behalf of the Council of the Standards Association of Australia on 12 March 1985 and published on 7 June 1985.

The following interests are represented on Committee DN/13:
- Australian Chamber of Commerce
- Australian Federation of Consumer Organizations
- Australian Dental Association
- Australian Dental Standards Laboratory
- Australian Dental Trade Association
- Australian Retailers Association
- Confederation of Australian Industry
- Cosmetic, Toiletry and Fragrance Association of Australia
- Dental Health Education and Research Foundation
- Dental Hospitals and Schools
- Department of Defence
- Proprietary Association of Australia
- Royal Australian Chemical Institute
- Universities

This standard is listed in the Index of Australian Defence Specifications and Standards for use by the Department of Defence.

Review of Australian Standards. To keep abreast of progress in industry, Australian standards are subject to periodic review and are kept up-to-date by the issue of amendments or new editions as necessary. It is important therefore that standards users ensure that they are in possession of the latest edition, and any amendments thereto.

Full details of all SAA publications will be found in the Catalogue of SAA Publications; this information is supplemented each month by SAA's journal 'The Australian Standard', which subscribing members receive, and which gives details of new publications, new editions and amendments, and of withdrawn standards.

Suggestions for improvements to Australian standards, addressed to the head office of the Association, are welcomed. Notification of any inaccuracy or ambiguity found in an Australian standard should be made without delay in order that the matter may be investigated and appropriate action taken.

First published ............................................. 1971
Second edition .............................................. 1981
Third edition ................................................ 1985

ISBN 0 7262 3772 8
PREFACE

This edition of this standard was prepared by the Association’s Committee on Oral Hygiene Agents and Devices under the direction of the Dental Materials and Equipment Standards Committee to supersede AS 1032—1981. The standard is one of a series intended for use in assessing the quality of dental goods used in Australia. This standard applies to manually operated toothbrushes in general use in the home.

In this edition account has been taken of requirements in AS 1032—1981.

This edition differs from the 1981 edition in that the requirement for fastening of tufts has been lowered from 25 N to 15 N, the clause relating to depth of tuft holes has been clarified and an additional marking requirement has been included. The lowering of the requirement for tuft anchorage was made as the previous value was considered to be higher than necessary for its intended purpose.

Facilities for testing toothbrushes for compliance with this standard are available at the Australian Dental Standards Laboratory, 240 Langridge Street, Abbotsford, Victoria 3067.

CONTENTS

SPECIFICATION

STANDARDS ASSOCIATION OF AUSTRALIA

Australian Standard

for

DENTAL EQUIPMENT—TOOTHBRUSHES

1 SCOPE. This standard specifies requirements for manually operated toothbrushing devices for general use. It does not apply to special purpose treatment brushes or denture brushes or to those toothbrushes which are power operated.

NOTE: For specific directives regarding the use of this standard by the Department of Defence, see Appendix A.

2 DESCRIPTION OF TOOTHBRUSH. The components of the toothbrush are the brush, the tuft, the handle, the stock and the head.

3 DEFINITIONS. For the purpose of this standard, the following definitions apply:

3.1 Brush—that part of the toothbrush that comprises the tufts.

3.2 Tuft—the aggregate of monofilaments that are fixed in one hole in the stock.

3.3 Stock—the extension of the handle which supports the tufts.

3.4 Handle—that part of the toothbrush which is not defined as the head.

3.5 Head—the stock and brush.

3.6 Monofilaments—single strands of material which are grouped together to form the tuft.

3.7 Contour variation (for serrated tufts and contoured brushes only).

3.7.1 For tufts—the difference in length between the longest and shortest monofilaments in a single tuft.

3.7.2 For brushes—the difference in height between the highest and lowest tufts.

3.8 Tuft configuration—number of rows of tufts and placement of tufts on the brush head.

4 CLASSIFICATION.

4.1 Basis of classification. Toothbrushes shall be classified by handle size and texture of the tufts in accordance with Clauses 4.2 and 4.3.

4.2 By handle size.

(a) Adult.

(b) Junior.

(c) Child.

4.3 By texture of tufts.

(a) Hard.

(b) Medium.

(c) Soft.

(d) Extra soft.

5 MATERIALS.

5.1 Handle and stock. The handle and stock shall be manufactured from materials which are free of objectionable odour or taste, and shall be non-injurious and non-toxic. Any colouring material added shall be fast. The handle shall be made of sufficiently strong and resilient material and moulded in such a manner that it will not break under normal use. The handle style may be varied according to individual manufacturers’ designs, provided that it still complies with the requirements of Clauses 6, 7.1 and 7.2.

5.2 Brush. The brush material shall consist of nontoxic synthetic monofilaments of dimensions specified in Table 1. The monofilaments shall be of—

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<thead>
<tr>
<th>Texture of tufts</th>
<th>Specification</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hard</td>
<td>(a) Brush length</td>
<td>18—31</td>
</tr>
<tr>
<td></td>
<td>(b) Brush width</td>
<td>7—12</td>
</tr>
<tr>
<td></td>
<td>(c) Diameter of monofilaments†</td>
<td>0.29—0.32</td>
</tr>
<tr>
<td></td>
<td>(d) Length of tufts</td>
<td>11—13</td>
</tr>
<tr>
<td>Medium</td>
<td>(a) Brush length</td>
<td>18—31</td>
</tr>
<tr>
<td></td>
<td>(b) Brush width</td>
<td>7—12</td>
</tr>
<tr>
<td></td>
<td>(c) Diameter of monofilaments†</td>
<td>0.24—0.29</td>
</tr>
<tr>
<td></td>
<td>(d) Length of tufts</td>
<td>11—13</td>
</tr>
<tr>
<td>Soft</td>
<td>(a) Brush length</td>
<td>18—31</td>
</tr>
<tr>
<td></td>
<td>(b) Brush width</td>
<td>7—12</td>
</tr>
<tr>
<td></td>
<td>(c) Diameter of monofilaments†</td>
<td>0.19—0.24</td>
</tr>
<tr>
<td></td>
<td>(d) Length of tufts</td>
<td>9—13</td>
</tr>
<tr>
<td>Extra soft</td>
<td>(a) Brush length</td>
<td>18—31</td>
</tr>
<tr>
<td></td>
<td>(b) Brush width</td>
<td>7—12</td>
</tr>
<tr>
<td></td>
<td>(c) Diameter of monofilaments†</td>
<td>0.16—0.19</td>
</tr>
<tr>
<td></td>
<td>(d) Length of tufts</td>
<td>9—13</td>
</tr>
<tr>
<td>All textures</td>
<td>Tuft and brush contour variations</td>
<td>2 max.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1.5 max.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1.0 max.</td>
</tr>
</tbody>
</table>

*1 or number of tufts, see Clause 8.2.
† Can be measured using a micrometer, dial gage or projection toolmaker’s microscope.

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(a) nylon 66, 610, 612; or
(b) other synthetic materials, provided that evidence is produced to the testing authority to show that their relevant physical properties and clinical effectiveness are at least equal to those of nylon 66, 610 or 612.

The brush shall be free from objectionable odour and taste and, if coloured, the dyestuff shall be fast and non-injurious.

5.3 Fastening. The tuft fastening material shall be non-toxic and shall show no visible evidence of corrosion after partial immersion in a 10 percent (m/V) solution of sodium chloride for 48 h in the temperature range 20°C to 25°C.

6 WORKMANSHIP. The toothbrush shall be manufactured in accordance with standard commercial practice. All surfaces of the toothbrush shall be smooth and uniform in finish, clean and free from sharp edges and corners.

With toothbrushes that have collapsible handles, the unit shall be so designed as to provide a firm and stable handle to the brush under normal conditions of use.

7 DIMENSIONS OF HANDLE AND STOCK.

7.1 Overall length. The overall length of the handle and stock shall conform to the following limits:
(a) 150 mm minimum (Adult).
(b) 125 mm minimum (Junior).
(c) 100 mm minimum (Child).

7.2 Width and thickness of handle. The width and thickness of the handle may be varied according to individual manufacturers' designs, provided that the width of the stock conforms to Clause 7.3 and there is sufficient thickness to allow for all tufts to be embedded to a depth of not less than 3.3 mm.

7.3 Width of stock. The width of the stock shall conform to the following limits:
(a) 15 mm maximum (Adult).
(b) 13 mm maximum (Junior).
(c) 11 mm maximum (Child).

7.4 Overhang of stock. The dimensions of the stock shall be such that its free edges in the transverse axis project not more than 2.0 mm, and in the longitudinal axis (i.e. the free end of the stock) not more than 3 mm, beyond a line tangential to the outermost points on the outermost tuft holes in the stock.

8 TUFTS.

8.1 Texture of tufts. Where the claim for more than one texture in a brush head is made by the manufacturer, each texture shall be identified (see Clause 11.2(b)) and shall conform to its appropriate classification as specified in Table 1.

8.2 Number of tufts. For Adult (all textures) and Junior (soft and extra soft textures) toothbrushes, the minimum number of tufts shall be 18; for Child (soft and extra soft textures) toothbrushes, the minimum number of tufts shall be 11 (see Clause 9.4 for tuft configuration).

8.3 Length of tufts. The length of the tuft, as measured from the face of the stock, shall conform to the dimensions specified in Table 1 for the toothbrush as classified in Clause 4. With contoured brushes the length of the longest tuft shall be measured when assessing this requirement.

8.4 Fastening of tufts. Each individual tuft shall be held in place with a corrosion-resistant fastening (see Clause 5.3).

When tested in accordance with Appendix B, each tuft tested shall withstand without displacement a steady direct pull of 15 N on the whole tuft for a period of not less than 15 s.

8.5 Diameter of tuft holes. Tuft hole sizes may be varied according to the individual manufacturers' designs, provided that they are not less than 1.5 mm nor more than 2.5 mm in diameter.

8.6 Depth of tuft holes. The depth of tuft holes shall be such as to allow for all tufts to be fixed in the stock at a depth of not less than 3.3 mm.

9 BRUSH CHARACTERISTICS.

9.1 Brush length. The length of the brush, as measured on the face of the stock, shall conform to the dimensions specified in Table 1 for the toothbrush as classified in Clause 4.

9.2 Brush width. The width of the brush as measured on the face of the stock shall conform to the dimensions specified in Table 1 for the toothbrush as classified in Clause 4.

9.3 Diameter of monofilaments. The diameter of all single monofilaments in each tuft shall conform to the dimensions specified in Table 1 for the toothbrush as classified in Clause 4.

9.4 Tuft configuration. Tuft configuration may be varied according to individual manufacturers' designs, provided that the brush complies with Clauses 7.4, 8.2, 9.1 and 9.2.

9.5 Shape of brush. The profile of the top of the tufts shall be either straight or contoured. All contoured shapes may be varied according to individual manufacturers' designs but shall conform to the contour variation specified in Table 1.

9.6 Trim of brush. The trim of the free ends of the brush shall be either flat or serrated as illustrated in Fig. 1. The profile of each serrated trimmed tuft shall conform to the contour variation specified in Table 1.

9.7 Shape of free ends of monofilaments. If it is claimed by the manufacturer that the free ends of the monofilaments are rounded, the brush shall comply with the criteria specified in Appendix C.

10 PACKAGING. The toothbrushes shall be hygienically packed in sealed paperboard or plastics containers such that either the head of the toothbrush is visible or a full size representation of the toothbrush is on the container.

11 MARKING.

11.1 Handle. The manufacturer's name or trade name or mark shall be permanently and legibly embossed or stamped on the handle.

11.2 Package. The following information shall be clearly visible on or in the package:
(a) Manufacturer's name or registered trade name or mark.
(b) Classification, as follows:
(i) Handle size—if Junior or Child.
(ii) Texture or textures of tufts in the toothbrush.

NOTE: With dual textured or multi-textured brushes, the predominant texture, as defined by the monofilament diameters, should be indicated first, e.g. 'medium/soft' indicates that there are more medium monofilaments than soft. With dual or multi-textured brushes having equal quantities of monofilaments of different diameters, the texture as defined by the largest diameter monofilaments should be indicated first.

That the free ends of the monofilaments are rounded, where claimed as such by the manufacturer.

The word 'Toothbrush'.

NOTE: Manufacturers who place the number of this Australian standard on toothbrushes, on packaging or on literature related hereto should ensure that the products are manufactured to comply with the standard.

Attention is particularly drawn to the scheme for independent assurance provided by the Standards Mark which is a registered certification trademark owned by the Standards Association of Australia and which is available for use with suitable Australian standards.

The presence of the Standards Mark on or in relation to a product is an assurance that the goods have been produced under a system of supervision, control and testing applied during manufacture and including periodical inspections at the manufacturer's works in accordance with the certification mark scheme of the SAA. The Standards Mark can be used only by manufacturers licensed under the certification mark scheme operated by the SAA, and only when accompanied by the number of the relevant Australian standard. It will usually be a requirement that the words 'Manufactured to Australian Standard' accompany the number of the standard and enclose the Mark as shown below; however, this is a matter for negotiation with the Association.

Further particulars of the terms of licence and suitability of this standard for certification purposes may be obtained from the Quality Assurance and Certification Department, Standards Association of Australia, 80 Arthur Street, North Sydney, NSW, 2060.

Fig. 1. DIAGRAMMATIC REPRESENTATION OF TYPICAL SERRATED TRIM PROFILES
APPENDIX A
APPLICATION BY THE DEPARTMENT OF DEFENCE

A1 APPROVED ITEM NAME (AIN). This standard is listed by the Defence Cataloguing Authority (DCA) under the AIN ‘TOOTHBRUSH’.

A2 ENDORSEMENT. This standard dated 1985 has been endorsed by the Department of Defence subject to the provisions set out in the following clauses.

A3 APPLICABLE DOCUMENTS. The requirements of DEF(AUST)5541, General Requirements to Accompany Specifications Produced Outside the Defence Group, shall apply except that the toothbrush need not carry the marking required in Paragraph 4.3.1 of that specification.

A4 VARIATIONS FROM THE AUSTRALIAN STANDARD.
A4.1 Type. The toothbrush shall be of the type categorized as Adult, Soft, Straight, Flat, Close Tuft.

A4.2 Certification. The toothbrush or its immediate container shall be marked to indicate that the manufacturer is licensed under the Certification Scheme operated by the SAA (see Clause 11, Marking).
APPENDIX B
FASTENING OF TUFTS

B1 SCOPE. This Appendix sets out the procedure for testing the retention of the toothbrush tufts in the stock.

B2 PRINCIPLE. Tuft retention is evaluated by applying a force axially to the tuft for a specified period.

B3 APPARATUS. The following apparatus is required:
(a) A pin vice (size 0—1 mm) or similar device for holding the tuft under test.
(b) A stand that supports the brush head during the test but does not grip it under compression.
(c) A dead weight whose mass combined with that of the apparatus in (a) applies a force of 15 ± 0.1 N.

B4 NUMBER OF TEST SPECIMENS. Depending on the length of the brush head, a minimum of two and a maximum of four tufts from each longitudinal row using three separate toothbrushes shall be selected for testing. Tests shall not be carried out on adjacent tufts.

B5 PROCEDURE. The procedure shall be as follows:
(a) The selected tuft shall be isolated by trimming off the adjacent tufts level with the stock as illustrated in Fig. B1. Care should be taken to ensure that the selected tuft is not damaged during this trimming operation.
   NOTE: Do not isolate the selected tuft by pulling the adjacent tufts from tuft holes.
(b) Grip the selected tuft firmly in the pin vice ensuring that the monofilaments are not twisted in the tuft hole.
(c) Support the test specimen on the stand as illustrated in Fig. B2 and carefully apply a force of 15 N for a period of 15 s axially through the tuft by means of the dead weight.
   NOTE: When tufts have been set at an angle by the manufacturer, the test specimen would need to be supported on the stand in such a way that an axial force can still be applied through the tuft.

B6 REPORT. Report whether all tufts tested withstand the loading test for 15 s.
Fig. B1  STOCK SHOWING ISOLATED TUFT.

Fig. B2  APPARATUS FOR DETERMINING TUFT ANCHORAGE.
APPENDIX C

TEST FOR PROFILE OF MONOFILAMENT FREE ENDS

C1 SCOPE. This Appendix sets out the procedure for examining the free ends of the monofilaments of a toothbrush.

C2 PRINCIPLE. End rounding of the monofilament is evaluated by comparing its projected profile with a standard mask.

C3 APPARATUS. The following apparatus is required:
(a) Optical viewing system capable of magnification of 100× or 200×.
(b) Double profile mask, as illustrated in Fig. C1(a).

C4 NUMBER OF TEST SPECIMENS. The monofilaments from three randomly selected toothbrushes shall be used for this test.

C5 PROCEDURE. The procedure shall be as follows:
(a) Cut close to the stock all the monofilaments from each toothbrush. Mix the monofilaments together, ensuring that the cut ends can be differentiated from the manufactured ends.
(b) Select 100 monofilaments at random from the whole population of cut monofilaments and compare the profile of the manufactured end of each monofilament with the double profile mask. Do not rotate the monofilaments on their axis in order to obtain a fit. Record as a 'pass' the number of monofilaments whose manufactured end fits the shaded portion of the mask (see Fig. C1(b)).
An acceptable profile of the free end of the monofilaments could be asymmetric as illustrated in Fig. C1(c).
If the number that pass from the 100 monofilaments examined lies within the limits of Table C1, repeat the test using a further 100 randomly selected monofilaments until the aggregate pass number found is outside the limits given, or for 500 monofilaments, whichever comes first.
(c) Record the number of monofilaments tested and the number passed.

C6 CRITERIA FOR PASSING AND FAILING. If the pass number is less than the lower value in Table C1 for the number of monofilaments tested, the material shall be deemed to have failed.
If the pass number is greater than the upper value in Table C1 for the number of monofilaments tested, the material shall be deemed to have passed.
If, after 500 monofilaments have been tested, the aggregate pass number still lies within the limits of Table C1, then a pass shall be recorded.

TABLE C1
PASS/FAIL LIMITS
(Based on the normal approximation of the binomial distribution at the 90 percent confidence level)

<table>
<thead>
<tr>
<th>Number of monofilaments tested</th>
<th>Limits</th>
</tr>
</thead>
<tbody>
<tr>
<td>100</td>
<td>42—58</td>
</tr>
<tr>
<td>200</td>
<td>88—112</td>
</tr>
<tr>
<td>300</td>
<td>136—164</td>
</tr>
<tr>
<td>400</td>
<td>183—216</td>
</tr>
<tr>
<td>500</td>
<td>232—268</td>
</tr>
</tbody>
</table>
Fig. C1. DOUBLE PROFILE MASK FOR MONOFILAMENT TIP PROFILE

NOTE: R = radius of monofilament under test, as derived from the diameter given in Table 1.
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APPENDIX 3a

Draft International Standard ISO/DIS 8627

APPENDIX 3b

Comment of Australian Member Body on Draft International Standard ISO/DIS 8627.
Source: Australian Member Body - ISO (1986).
Dentistry — Stiffness of the tufted area of tooth-brushes

Art dentaire — Souplesse de la surface garnie des brosses à dents

UDC 687.9 : 646.73

Descriptors: dentistry, tooth-brushes, classification, tests, stiffness tests, test equipment.
Dentistry — Stiffness of tufted area of tooth-brushes

0 Introduction

The stiffness of tooth-brushes, determined in accordance with a compromise method based on the BSI method and the French/ Norwegian methods, was originally classified into five categories. However as a result of collaborative testing between laboratories it was subsequently decided to reduce the number of categories to three.

This International Standard specifies a method for determining the stiffness of the tufted area of tooth-brushes and a means of assigning the stiffness as measured into categories of stiffness, i.e.:

- soft;
- medium;
- hard.

Classification enables the consumer to choose a brush with the appropriate stiffness for his or her needs. It is therefore desirable that all manufacturers use the same test methods and categories in order that the user can select according to the category and obtain the required stiffness irrespective of brand or country of origin of the brush. At present there can be considerable differences between identical stiffness gradings as claimed by different manufacturers. This has been recognized and has been accommodated in the elaboration of this International Standard by allowing for an overlap of stiffness categories for a limited period, the intention being to revise this International Standard in 5 years time and replace the existing categories by those shown in the note to clause 6.

1 Scope and field of application

This International Standard specifies a test method and grading scheme for the stiffness of the tufted area of conventional manual tooth-brushes, together with relevant information concerning definitions and details concerning testing machines.

2 Definitions

For the purpose of this International Standard the following definitions apply.

2.1 filament: A single element of a tuft fixed into a brush.

2.2 tufted area $A$: The total area of the tuft holes i.e. the area of one tuft hole multiplied by the number of tuft holes.

2.3 stiffness grade $G$: The stiffness as measured and calculated according to this International Standard.

2.4 stiffness category: The category, for example soft, medium, or hard, as defined by the range into which the stiffness grade falls.

2.5 stiffness index: A number relating to the stiffness category.

2.6 filament length $X$: The length measured from the tip of the filament's free end to the point at which it enters the tuft hole.

2.7 deflection force: The reaction force caused by the deflection of the filaments from their normal position by one-third of the weighted mean filament length (see 6.3).

2.8 brush stiffness: The reaction force exerted per unit area of the brush during deflection.

3 Sampling

The tooth-brushes used for testing shall be standard model tooth-brushes. They shall not be altered or adjusted in any way that makes them different from the standard model manufactured.

A minimum of five brushes of each design shall be tested.

NOTE — The method of sampling and the means of procurement are not covered by this International Standard and should be a matter for agreement between the interested parties.

4 Testing conditions

The tests shall be carried out under the following conditions:

- dry: $23 \pm 4^\circ C$ and $50 \pm 5\%$ relative humidity;
- wet: immerse the brushes in water at $23 \pm 4^\circ C$ for 90 s. Remove from the water and commence the test as soon as possible and not later than 5 min after removal.
5 Method of test

5.1 Principle

Determination of the length of a filament of a tooth-brush followed by the determination of the tufted area of the brush and measurement of the deflection force. Calculation of the degree of stiffness of the brush from the values obtained.

5.2 Apparatus

NOTE — An example of a suitable apparatus is shown in figure 1. The letters in parenthesis below refer to that figure.

The apparatus comprises the following elements.\(^1\)

5.2.1 Gripping unit, to grip the brush at right angles to the filaments, which consists mainly of

5.2.1.1 Block (a) in which the head of the brush is fixed. (See the footnote).

5.2.1.2 Adjustable screw (c), for adjusting and moving the block (5.2.1.1).

5.2.1.3 Comparator (d), for measuring the movement of the block (5.2.1.1).

NOTE — Micrometer calipers may be used instead of the adjustable screw (5.2.1.2) and comparator.

5.2.2 Unit, for measuring and indicating the deflection force \(F\), comprising

5.2.2.1 Carriage (g), sliding freely along a slide-way (h) at an axis parallel to the brushing surface.

5.2.2.2 Grid (b), supported by the carriage (5.2.2.1) and made up of stainless steel wires mounted in parallel, with the following dimensions:

- diameter of wire: 0.5 mm
- width: 17.0 mm
- pitch: 3.0 mm
- length: 55 mm (min.)
- maximum roughness, \(R_s = 0.4 \mu m\)

NOTE — Pitch is the distance between the centres of the wires.

The wires shall be in the same plane and this plane shall be parallel to the plane of movement of the head of the brush. The wires shall be parallel to each other and at right angles to the direction of movement of the brush head.

There shall be a clearance of approximately 10 mm between the grid and the base plate under the grid.

5.2.2.3 Screw or bolt/nut system (j) and motor (k), to propel the carriage (5.2.2.1) along the axis of the brush and parallel to the brushing surface at a velocity of between 1 and 15 mm/s.

5.2.2.4 Load cell (e), connected to a measuring device fitted with a numerical indicator and a maximum value indicator, or connected to a recording device (f). The load cell shall be capable of measuring forces of up to 20 N to an accuracy of ± 0.05 N.

5.2.3 Unit for measuring the filament length \(X\), consisting mainly of

5.2.3.1 Carriage (g), running freely in a slide-way and operated by hand.

5.2.3.2 Flat plate (m), carried by the carriage (5.2.2.1) whose upper plane corresponds with level "0".

5.2.3.3 Guiding system (n), for the plate (m) (5.2.3.2), along an axis at right angles to its upper plane.

5.3 Procedure

5.3.1 Determination of the filament length

5.3.1.1 For a flat brush surface parallel to the head

Fix the brush head in the block (a) (5.2.1.1) in the top position. Introduce the unit for measuring the filament length (5.2.2.3). Switch on the indicator or recorder (5.2.2.4) then lower the brush using the adjustable screw (c) (5.2.1.2).

As soon as the first readings appear on the recorder, read, on the comparator (5.2.1.3), measurement \(X\) corresponding to the filament length.

Remove the measuring unit.

Take as the result the mean filament length \(\bar{X}\).

5.3.1.2 For non-flat brush surfaces

Calculate the weighted mean of the overall length of the total number of filaments based on length measurements of individual filaments corrected for the proportion each occupies in the brush head.

5.3.2 Determination of the tufted area \(A\)

Remove three tufts to determine the diameter of the holes. Using a pin gauge measure the diameter of each of the three holes and calculate the mean diameter, \(d\).
Calculate the tufted area, \( A \), using the equation:

\[
A = \frac{N \pi d^2}{4}
\]

where \( N \) is the number of tuft holes in the brush.

For brushes having holes which are not circular other appropriate equations are required.

### 5.3.3 Measurement of the deflection force \( F \)

Remove the measurement units from the brushing surface. Lower the brush, using the adjustable screw (5.2.1.2) to a level fixed at two-thirds of \( X \) (i.e. two-thirds above the plane of the grid and one-third below).

Switch on the measuring unit (5.2.2) and the recorder (5.2.2.4), then introduce the grid (5.2.2.2) beneath the brushing surface using the motor (5.2.2.3). When the brush has completed a full forward and backward movement, read the maximum value, \( F \), in both directions and calculate the mean value.

NOTE — In both the forward and backward movement the brush head should clear the grid at the end of the stroke.

### 5.4 Calculation of results

Calculate the mean value of the stiffness grade expressed in centinewtons per square millimetre, in both the dry, \( G_d \), and the wet, \( G_w \), states for all the brushes in the sample, using the equations

\[
G_d = \frac{F_d}{A}
\]

and

\[
G_w = \frac{F_w}{A}
\]

where

\( F \) is the deflection force, in centinewtons, measured as specified in 5.3.3;

\( A \) is the tufted area, in square millimetres, determined as specified in 5.3.2.

### 5.5 Test report

The test report shall include the following particulars:

a) an identification of the sample;

b) the reference of the method used;

c) the results and the method of expression used;

d) any unusual features noted during the determination;

e) any operation not included in this International Standard or in the International Standard to which reference is made, or regarded as optional.

### 6 Stiffness category

The stiffness shall be classified in accordance with the table.

<table>
<thead>
<tr>
<th>Stiffness index</th>
<th>Stiffness category</th>
<th>Calculated stiffness (stiffness grade, ( G ))</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>Soft</td>
<td>( G &lt; 7 )</td>
</tr>
<tr>
<td>5</td>
<td>Medium</td>
<td>( 8 &lt; G &lt; 9 )</td>
</tr>
<tr>
<td>7</td>
<td>Hard</td>
<td>( 8 &lt; G )</td>
</tr>
</tbody>
</table>

NOTE — At the first revision of this International Standard, i.e. within five years, it is intended to amend the stiffness grades as follows:

<table>
<thead>
<tr>
<th>Index</th>
<th>Grade</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>( G &lt; 6 )</td>
</tr>
<tr>
<td>5</td>
<td>( 6 &lt; G &lt; 9 )</td>
</tr>
<tr>
<td>7</td>
<td>( 9 &lt; G )</td>
</tr>
</tbody>
</table>

### 7 Marking

#### 7.1 Handle

The handle shall be legibly marked with the manufacturer's name or a brand name.

#### 7.2 Packaging

The packaging shall be marked with the stiffness category (see clause 6) and the number of this International Standard, i.e. ISO 8627.

NOTE — In addition, the stiffness index may be included at the option of the manufacturer on the handle and/or the package.
Figure — Example of suitable apparatus used for measuring stiffness
APPENDIX 3b

Comment of Australian Member Body on Draft International Standard ISO/DIS 8627.

Source: Australian Member Body - ISO (1986)

DENTISTRY - STIFFNESS OF THE TUFTED AREA OF TOOTHBRUSHES

Comment of Australian Member Body

The Australian Member Body records a vote of disapproval for the above ISO/DIS for the following reasons:

General Comment

Category descriptions currently in use in Australia are well accepted and understood. Introduction of new criteria together with redefinition of classes could confuse consumers already happy with the system we now use.

Our primary objection to this draft proposal is the method of test. While accepting that textural stiffness (G) may be a more meaningful value to measure relative softness or hardness than filament diameter, the method has a number of defects, namely -

(a) Complicated
(b) Non standard and expensive equipment
(c) No document correlation with filament diameter (BS 5757) has graphs of G versus filament diameter for different filament materials.

We have not seen any data which establishes correlation between currently accepted Australian categories and values obtained from the machine. It is difficult for us to do this with the range of toothbrushes we market since, as far as we know, there is no such testing machine available in Australia.

(d) Appears to discriminate against angled filaments.
(e) Does not allow for dual texture brushes.

The categories are not flexible enough for designating deliberately designed dual textured toothbrushes used for a specific purpose eg a toothbrush containing both medium and soft tufts will have only one stiffness calculated number - how would a user requiring a dual textured toothbrush know whether he is in fact buying such a brush?

(f) Measurements are average of a single forward and a single back measurement (BS 5757 averages 5-10 backward and forward measurements).
(g) It uses resistance to lateral distortion as a measurement of stiffness which is lower than "end on" stiffness achieved at the point when the direction of the scrub stroke is reversed.

Stiffness of a brush is the maximum pressure a bristle or group of bristles can deliver to the tissue. This is effected by many things - diameter, length, direction of bristle movement etc.

It is the property of each individual bristle which is simply measured with a gram gauge. This can be averaged out over a selected number of bristles or bristle area, configuration and density.
APPENDIX 4

Design and use of Oral B toothbrushes.
Source: Cooper Laboratories (1986).
ORAL-B BRUSHES

All ORAL-B brushes consist of nylon filament. Each filament is only 0.18mm in diameter (excluding ORAL-B EXTRASOFT which uses 0.17mm nylon). They are amazingly strong, thin and resilient. Every filament is end-rounded and polished to comply with the Australian Dental Association Standard and are tested and accredited by the Dental Standards Laboratory. This allows us to use the Australian Standards Association "kite mark" and the A.D.A. approved logo on our packaging. There are no sharp ragged edges to abrade teeth or injure gum surfaces.

These flexible nylon filaments make up a compact "tuft" containing 20 strands which are folded over to produce 40 filaments.

Support for these tufts is derived from the combined strength of the 40 filaments rather than from fewer thicker bristles. Each tuft is secured in position in the handle by a nickel-silver anchor.

Each soft textured ORAL-B brush has a flat brushing surface to facilitate maximum filament contact with the teeth and gums.
ORAL-B brushes have handles made from high quality polypropionate and offer a variety of head sizes to fit any dental arch.

Most of the ORAL-B range of brushes are made at our manufacturing plant in Goulburn, New South Wales. We are the largest manufacturer of toothbrushes in Australia and supply to most of the Asian countries.
Sulcus brushes are designed:

1. Smaller than normal brushes in order to reach the buccal surfaces of the posterior teeth.

2. Narrower and with fewer filaments in order to facilitate plaque removal in and around the gingival sulcus.

3. As an adjunct to, and not a replacement for, ordinary toothbrushing.

4. As a key part of the preventive dentistry "self care" technique, along with dental floss, disclosing tablets and dental mirror.

**PRODUCT DESIGN**

* End-rounded and polished filaments .18mm diameter.

* Brush head is 7.9mm wide.

* Ten rows long by two rows wide - 800 filaments.

This ensures that the two rows will flatten more easily when pressed against the tooth, and reach into the sulcus. Ideal for use with braces and other orthodontic appliances.
ORAL-B 10 (SULCUS)
ORAL-B 15 (ORTHODONTIC)

This brush has been designed to allow plaque removal from between wires of orthodontic appliances.

The head is a 4 row 35 with a longitudinal V-cut through the bristles. The softer outer bristles gently massage the sulcus while the shorter inner bristles can be applied directly over the fixed appliance and used with a short horizontal stroke.

The ORAL-B 15 is available in the alternative style of a travel brush.
ORAL-B 20 (CHILD)

ORAL-B 20 brushes are designed for use as a children's brush.

The filaments are .18mm in diameter, and are arranged in three rows of 10 equalling 1200 filaments.

Each filament is end-rounded and polished.

It has a small narrow handle, designed for children's use.

ORAL-B "DOGGIE"

Packaging has been designed especially to encourage children by enclosing the toothbrush in a plastic cylinder with a dog's head at one end and tail at the other.

Price is slightly higher than for the standard ORAL-B 20 toothbrush.
ORAL-B 30 (YOUTH)

ORAL-B 30 is designed for use by patients with small dental arches.

Filaments are .18mm in diameter, and are placed in three rows of 10 equalling 1200 filaments.

The head size is identical to that of the ORAL-B 20 but with a slightly longer handle.
ORAL-B 32 (ADULT COMPACT HEAD)

The ORAL-B 32 has concentrated filaments mounted in a small head to allow access to difficult to reach areas. It is also ideal for those with small dental arches such as teenagers and older children.

The 32 head size is also used on the "character" toothbrushes in order to bridge a wider age group.

The filaments are .18mm in diameter and are arranged in 4 rows of 8 -- equalling 1280 filaments.
ORAL-B 35 (ADULT REGULAR)

The ORAL-B 35 is designed for adults who prefer a large number of filaments in a compact area. It allows entry to difficult to reach, smallish dental arches, and is the most popular of the ORAL-B range.

Filaments are .10mm diameter arranged in 4 rows of 10 -- equalling 1600 filaments.
ORAL-B 40 (ADULT MEDIUM)

Is designed for adults with normal size dental arches.

Filaments are .18mm in diameter and are arranged in 4 rows by 12 rows -- equalling 1920 filaments.

Offers a large number of filaments to give optimum cleaning power.
ORAL-B 60 (ADULT LARGE)

ORAL-B 60 is designed for adults with large dental arches.

This brush is popular with middle Europeans or people with a mildew problem in their bathroom tiles.

Filaments are .18mm in diameter, arranged in 4 rows by 15 rows -- equalling 2400 filaments.
ORAL-B EXTRASOFT

Developed for use by those with sensitive gums, easily traumatised by normal brushing. The EXTRA-SOFT is patterned on the popular ORAL-B 35.

Bristles are finer than those used in commercial soft toothbrushes, at 0.17mm diameter arranged in 4 rows by 10 -- equalling 1760 filaments.

ORAL-B POCKET TRAVEL

This brush has been designed to encourage regular oral hygiene habits while away from home.

The bristles are hygienically covered during transport and the container converts to a full length handle to facilitate use.

Available in two head types - ORAL-B 35 (adult regular) - ORAL-B 15 (orthodontic)
ORAL-B RIGHT ANGLE TOOTHBRUSH

This toothbrush has been designed for those who prefer to use an angled brush.

RIGHT ANGLE is superior to most competitors because of its head design.

* multi-tufted compact head
* flat trim brushing surface
* end-rounded and polished bristles

The ORAL-B RIGHT ANGLE is available in the following sizes:

* Adult – 4 row 35 head
* Youth – 3 row x 9 row (shorter head than ORAL-B 30)
* Child – 3 row x 7 row
ORAL-B DENTURE BRUSH

Consists of nylon filaments in a "wing" arrangement, i.e. the filaments protrude on either side of the head.

Tapered bristles to clean the arch of the plate.

Straight bristle to clean denture.
APPENDIX 5

Australian Standard for Toothpastes -
Source: Standards Association of
Australia (1985).
Australian Standard®
2827—1985

TOOTHPASTES

[Title allocated by Defence Cataloguing
Authority: TOOTH PASTE]
This Australian standard was prepared by Committee DN/13, Oral Hygiene Agents and Devices. It was approved on behalf of the Council of the Standards Association of Australia on 11 July 1985 and published on 4 November 1985.

The following interests are represented on Committee DN/13:

Australian Chamber of Commerce
Australian Consumers Association
Australian Federation of Consumer Organizations
Australian Dental Association
Australian Dental Standards Laboratory
Australian Dental Trade Association
Australian Retailers Association
Confederation of Australian Industry
Cosmetic, Toiletry and Fragrance Association of Australia
Dental Health Education and Research Foundation
Dental Hospital and Schools
Department of Defence
Proprietary Association of Australia
Royal Australian Chemical Institute
Universities

Review of Australian Standards. To keep abreast of progress in industry, Australian standards are subject to periodic review and are kept up-to-date by the issue of amendments or new editions as necessary. It is important therefore that standards users ensure that they are in possession of the latest edition, and any amendments thereto.

Full details of all SAA publications will be found in the Catalogue of SAA Publications; this information is supplemented each month by SAA’s journal "The Australian Standard", which subscribing members receive, and which gives details of new publications, new editions and amendments, and of withdrawn standards.

Suggestions for improvements to Australian standards, addressed to the head office of the Association, are welcomed. Notification of any inaccuracy or ambiguity found in an Australian standard should be made without delay in order that the matter may be investigated and appropriate action taken.

This standard was issued in draft form for comment as DR 80009.
TOOTHPASTES

AS 2827—1985

First published ....................... 1985

PUBLISHED BY THE STANDARDS ASSOCIATION OF AUSTRALIA
STANDARDS HOUSE, 80 ARTHUR ST, NORTH SYDNEY, N.S.W.

ISBN 0 7262 3935 6
PREFACE

This standard was prepared by the Association's Committee on Oral Hygiene Agents and Devices under the direction of the Dental Materials and Equipment Standards Committee, and is one of a series intended for use in assessing the quality of dental goods used in Australia.

In the preparation of this standard, account was taken of BS 5136:1981, Toothpastes, and the Council of the European Communities Directive relating to cosmetic products.

Chemical and other test methods that are required for this standard but not specified in Appendices should be recognized techniques which are subject to agreement between the manufacturer and the testing authority.

Some facilities required for the testing of materials for compliance with this standard are available at the Australian Dental Standards Laboratory, 240 Langridge Street, Abbotsford, Victoria, 3067.

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STANDARDS ASSOCIATION OF AUSTRALIA

Australian Standard
for
TOOTHPASTES

1 SCOPE. This standard specifies requirements for toothpastes intended for use with a brush for the cleaning of natural teeth. Such toothpastes may contain therapeutic additives.

NOTES:
1. Dentifrices presented in powder or liquid form may be the subject of separate Australian standards.
2. Advisory information on sampling and assessing compliance with this standard is given in Appendix F.

2 REFERENCED DOCUMENTS. The following documents are referred to in this standard:

AS 1032 Toothbrushes
AS 1152 Test Sieves
BS 2006 Metal Collapsible Tubes
BS 2625 Chemically Pure Glycerol
BS 2942 Formaldehyde Solution
BS 3984 Sodium Silicates
Proposed Australian Approved Names and Other Names for Therapeutic Substances
British Pharmacopoeia
European Pharmacopoeia
United States Pharmacopoeia—National Formulary
Approved Food Standards and Approved Food Additives
Standard for Cosmetics
British Pharmaceutical Codex
Food Chemicals Codex
World Health Organization Food Additive Series
Food and Agriculture Organization Nutrition Reports
United States Code of Federal Regulations

3 DEFINITIONS. For the purpose of this standard, the following definitions apply:

3.1 Unit pack—pack (generally a carton) containing a complete primary container.
3.2 Primary container—the container (generally a collapsible tube) which is actually in contact with the toothpaste.

4 COMPOSITION

4.1 Basic requirements. The composition of the toothpaste shall be such that—
(a) no toxic or irritant reaction is caused in the mouth;
(b) allowing that amounts may be inadvertently ingested, no harmful effects will result from normal use; and
(c) the toothpaste will comply with relevant Commonwealth and State legislation governing health, safety and therapeutic claims.

NOTE: Appendix A gives an interim list of substances which are used, or may be used, in the manufacture of toothpastes. These, and other substances which may be added to the list, must comply with the relevant Commonwealth and State legislation governing health and safety, and the other requirements set out in Clause 4.1.

Substances not on the list may also be used provided that their chemical identity is disclosed to the Commonwealth Department of Health and in confidence to the inspecting authority. The proposed National Health and Medical Research Council Cosmetics Standard will provide further guidance to manufacturers.

4.2 Therapeutic additives.

4.2.1 Additives other than fluorine derivatives. Toothpastes having additives claimed to impart clinical effectiveness to the toothpaste shall maintain their clinical effectiveness during the normal life of the product (see Clauses 7.2 (d) and 7.3 (d)). At the time of manufacture, the amount of such additives shall be not more than 115 percent or less than 85 percent of the amount stated on the label.

4.2.2 Fluorine derivatives as additives. When determined in accordance with one of the two methods described in Appendix D, the total fluorine content shall not exceed 1000 μg/g (tolerance limits 90 percent to 110 percent). The water soluble fluorine derivative determined as fluoride ion shall be not less than 600 μg/g within one year of manufacture (see Clause 7.1(d)).

4.3 Heavy metals. Toxic or heavy metals shall not be present in quantities greater than those shown in Table 1.

<table>
<thead>
<tr>
<th>Toxic or heavy metals</th>
<th>Content μg/g max</th>
</tr>
</thead>
<tbody>
<tr>
<td>Antimony</td>
<td>1.5</td>
</tr>
<tr>
<td>Arsenic</td>
<td>2</td>
</tr>
<tr>
<td>Cadmium</td>
<td>1</td>
</tr>
<tr>
<td>Copper</td>
<td>10</td>
</tr>
<tr>
<td>Lead</td>
<td>5</td>
</tr>
<tr>
<td>Mercury</td>
<td>0.5</td>
</tr>
<tr>
<td>Selenium</td>
<td>1</td>
</tr>
<tr>
<td>Tin</td>
<td>50</td>
</tr>
<tr>
<td>Zinc</td>
<td>150</td>
</tr>
</tbody>
</table>

NOTE: For the purpose of this standard, antimony, arsenic and selenium are deemed to be metals. The restrictions for metals, added for a specific purpose do not apply if a value higher than that shown in Table 1 can be demonstrated to comply with the requirements of Clause 4.1.

5 PHYSICOCHEMICAL PROPERTIES.

5.1 pH value. When determined in accordance with Appendix B, the pH value of the toothpaste shall be within the range 4.2 to 10.5.

5.2 Abrasive properties. When the toothpaste is tested in accordance with Appendix C, its abrasivity calculated by the statistical treatment provided shall not exceed the following limits when measured by either the radio-tracer or the surface profile method:
(a) For dentine, 2 times the reference paste.
(b) For enamel, 4 times the reference paste.
However, the radio-tracer method shall be obligatory if a dispute arises or if the results obtained using the surface profile method exceed the following limits:
(i) For dentine, 1.5 times the reference paste.
(ii) For enamel, 3 times the reference paste.

5.3 General texture. The toothpaste shall readily disperse during oral use and be free of foreign particles or agglomerated lumps.

5.4 Consistency (for tubed products). Within a temperature range of 5°C to 35°C the toothpaste shall not readily flow out of a tub if the tube is left on its side with the cap off, and when applied to a toothbrush, complying with AS 1032, the bulk of it shall not immediately sink between the bristles, neither shall the toothpaste, after application, roll off the brush during normal handling.

5.5 Dispensing from container. The toothpaste shall nearly completely dispense in a smooth manner within a temperature range of 5°C to 35°C.

5.6 Physical stability. During normal conditions of storage or when heated to a temperature of 45 ± 2°C for a period of 28 days, the toothpaste shall not undergo phase separation, gassing, fermentation or otherwise deteriorate aesthetically.

6 PACKAGING.

6.1 Material. The toothpaste shall be contained in primary containers which shall not show defects to an extent which adversely affects the quality of the product during normal conditions of storage, or when heated to a temperature of 45 ± 2°C for a period of 28 days.

Metal collapsible tubes, when used as primary containers for toothpaste, shall comply with BS 206. The primary container may be supplied in a unit pack.

6.2 External surface finish

6.2.1 Composition. The external surface finish used in decorating and marking the primary containers of toothpastes shall not contain more than 250 μg/g of combined lead, antimony and cadmium, nor more than 20 μg/g arsenic, when determined by recognized analytical techniques.

6.2.2 Durability of external surface finish (for metal collapsible tubes). When tested in accordance with Appendix E, the external surface finish of the primary container shall not allow any appreciable defects as listed therein.

7 MARKING OF UNIT PACK AND PRIMARY CONTAINER. Notwithstanding the following requirements for marking, there shall be conformance with any relevant statutory requirements.

7.1 Primary container (when it is supplied in a unit pack). The following information shall be clearly marked on the primary container when it is supplied in a unit pack:
(a) Identity of product.
(b) Manufacturer’s name or registered trade name or mark.
(c) The approved chemical name and the concentration of any ingredient which is claimed to be therapeutic. (Where applicable, the name shall be as listed in Proposed Australian Approved Names and Other Names for Therapeutic Substances.)
(d) An indication of the date of manufacture.

7.2 Primary container (when it is supplied without a unit pack). The following information shall be clearly marked on the primary container when it is supplied without a unit pack:
(a) Identity of product and the amount expressed as net mass in grams.
(b) Manufacturer’s name or registered trade name or mark.
(c) The approved chemical name and the concentration of any ingredient which is claimed to be therapeutic. (Where applicable, the name shall be as listed in Proposed Australian Approved Names and Other Names for Therapeutic Substances.)
(d) Toothpaste that may deteriorate in physical or chemical properties within 1 year to such an extent that they will no longer comply with this standard shall have an expiry date as a clearly recognizable item.
(e) An indication of the date of manufacture.

7.3 Unit pack. The following information shall be clearly marked on the unit pack where present:
(a) Identity of product and the amount expressed as net mass in grams.
(b) Manufacturer’s name or registered trade name or mark.
(c) The approved chemical name and the concentration of any ingredient which is claimed to be therapeutic. (Where applicable, the name shall be as listed in Proposed Australian Approved Names and Other Names for Therapeutic Substances.)
(d) Toothpastes that may deteriorate in physical or chemical properties within 1 year to such an extent that they will no longer comply with this standard shall have an expiry date as a clearly recognizable item marked on the unit pack.

NOTE: Manufacturers who place the number of this Australian standard on toothpaste packaging or literature related thereto should ensure that the toothpaste is manufactured to comply with the standard.

Attention is particularly drawn to the scheme for independent assurance provided by the Standards Mark which is a registered certification trademark owned by the Standards Association of Australia and which is available for use with suitable Australian standards.

The presence of the Standards Mark on or in relation to a product is an assurance that the goods have been produced under a system of supervision, control and testing applied during manufacture and including periodical inspections at the manufacturer’s works in accordance with the certification mark scheme of the SAA. The Standards Mark can be used only by manufacturers licensed under the certification mark scheme operated by the SAA, and only when accompanied by the number of the relevant Australian standard. It will usually be a requirement that the words ‘Manufactured to Australian Standard’ accompany the number of the standard and enclose the Mark as shown below; however, this is a matter for negotiation with the Association.

Further particulars of the terms of licence and suitability of this standard for certification purposes may be obtained from the Quality Assurance and Certification Department, Standards Association of Australia, 80 Arthur Street, North Sydney, N.S.W. 2060.

* Published by the Commonwealth Government
APPENDIX A
INTERIM LIST OF ALLOWABLE SUBSTANCES
IN TOOTHPASTES

A1 SCOPE. This Appendix provides an interim list of substances which are used, or may be used, in the manufacture of toothpastes.

A2 QUALITY OF SUBSTANCES.
(a) The quality of the substances listed in this Appendix shall be in accordance with recognized authority cited in the Standard for the Specifications of Identity and Purity of Food Additives.* The following are nominated:

British Pharmacopoeia  
British Pharmaceutical Codex  
Food Chemicals Codex  
World Health Organization Food Additive Series  
Food and Agriculture Organization Nutrition Reports  
British Standards Institution  
United States Code of Federal Regulations  
Pharmaceutical Codex

(b) If the above authorities are inapplicable to any substance listed in this Appendix, the United States Pharmacopoeia—National Formulary, the European Pharmacopoeia, or standards for cosmetics, toiletry and fragrant substances, the merit of which are acknowledged by industry, shall be acceptable.

A3 LIST OF SUBSTANCES.

Abrasives
alumina  
alumina fumed  
alumina hydrated  
aluminium hydroxide  
aluminium silicate  
calcium carbonate  
calcium phosphate  
calcium phosphate high beta phase  
calcium pyrophosphate  
dicalcium phosphate  
dicalcium phosphate dihydrate  
insoluble sodium metaphosphate  
kaolin  
lithium magnesium silicate  
magnesium carbonate

Humectants
glycerol  
lactitol  
maltitol  
mannitol

Detergents
coconut monoglyceride sulphonates  
diotetyl sodium sulphosuccinate  
magnesium laurel sulphate  
polyoxyethylene—polyoxypropylene block polymer  
soap  
sodium alkyl benzene sulphonate  
sodium alkyl sulphate  
sodium laurel ether sulphate

Thickeners
acrylic acid allyl sucrose copolymer  
bentonite  
carboxymethyl cellulose

magnesium silicate  
polymethyl methacrylate  
polyvinyl chloride  
potassium metaphosphate  
pumice  
silica  
silica fumed  
silica hydrated  
sodium aluminium silicate  
sodium bicarbonate  
sodium hexametaphosphate  
sodium metaphosphate  
sodium polymethaphosphate  
titanium dioxide  
zirconium silicate

polyethylene glycol  
propylene glycol  
sorbitol  
xylitol

sodium cocoyl taurate  
sodium lauryl sulphocacetate  
sodium N-lauroyl sarcosinate  
sodium sulpholaurate  
sodium sulphoricinoleate  
sorbitan monolaurate  
sorbitan monooleate  
sorbitan polyethoxy monolaurate

carboxy polymethyleneg  
carrageenan  
calcium carrageenate

* See Approved Food Standards and Approved Food Additives, Section 5, pages 1–7, published by the NH & MRC, Commonwealth Department of Health.
Thickeners (Continued)
diatomaceous earth  
ethylene oxide polymers  
guar gum  
hydroxy ethyl cellulose  
hydroxy propyl cellulose  
kara ya gum  
magnesium aluminium silicate  
polyvinyl pyrrolidone  
sodium alginate  
sodium carboxymethyl cellulose  
sodium lithium magnesium silicate  
starch  
tragacanth gum  
xanthan gum  

Sweeteners
aspartame  
calcium cyclamate  
3-4 dihydro-6-methyl, 1-2, 3-oxathiazine-4-one-2, 2 dioxide potassium salt  
hydrogenated corn syrup  
6-methyl-1, 2, 3-oxathiazine-4-(3H)-one-2, 2 dioxide potassium salt  
monoammonium glycyrhrizinate  
saccharin  
sodium cyclamate  
sodium saccharin  

Other substances
acetic acid  
alkyl and aryl esters of p-hydroxy benzoic acid  
allantoin  
aluminium sulphate  
amine fluoride  
5-amino-1, 3-di (2 ethylhexyl) hexahydro-5-methyl pyrimidine  
ammonium fluoride  
ammonium monofluorophosphate  
ammonium phosphate dibasic  
benzyl alcohol  
benzyldimethyl-2-(2-[ p-(1, 1, 3, 3-tetramethyl butyl phenoxyl) ethoxy) ethyl  
ammonium chloride monohydrate (benzethonium chloride)  
β-methyl umbelliferone  
butylated hydroxy anisole (BHA)  
bromochlorophene  
2-bromo-2-nitropropane-1, 3-diol  
calcium glycerophosphate  
calcium metasilicate  
calcium sucrose phosphate  
cetyl pyridinium chloride  
chlorhexidine salts  
5-chloro-2-(2, 4 dichlorophenoxy) phenol  
citric acid  
colouring agents (see Note 2)  
2-(2, 4-dichlorophenoxy phenol)  
essential oils  
ethanol  
ethylene diamine tetraacetic acid  
ferric fluoride  
flavouring agents  
formaldehyde (see Note 3)  
gluconic acid  
herbal extracts  
isopropanol  
magnesium hydroxide  
magnesium peroxide  
malic acid  
menthol  
2, 2-methylenbis (4-chloro phenol)  
methyl polysiloxane  
petroleum jelly  
potassium fluoride  
potassium hydrogen tartrate  
potassium monofluorophosphate  
polyvinyl pyrrolidone vinyl acetate copolymer  
potassium hydroxide  
potassium nitrate  
quarternary ammonium salts  
sodium benzoate
Other substances (continued)
sodium carbonate
sodium chloride
sodium citrate
sodium fluoride
sodium hydrogen phosphate monohydrate
sodium hydroxide
sodium monofluorophosphate
sodium phosphate
sodium silicate
sodium tripolyphosphate
stannous fluoride
stannous pyrophosphate
strontium chloride
tetrasodium pyrophosphate
thymol
titanium tetrafluoride
tribasic calcium phosphate
trisodium phosphate
urea
urea peroxide
5-ureidohydantoin
water
white mineral oil
zinc chloride
zinc citrate
zinc oxide
zinc sulphate
zirconium fluoride

NOTES:
1. Attention is directed to Clause 4:1.
2. Prescribed colouring as currently listed in 'Approved Food Standards and Approved Food Additives' published by the NH & MRC, and in the proposed standard for cosmetics, with reference to cosmetics intended for use on mucous membranes, to be published by the NH & MRC.
3. Formaldehyde must not exceed 0.1 percent m/m unless specifically used as a therapeutic agent and in conformity with the requirements of Clause 4:1.
4. Certain of the substances listed above, or combinations thereof, may be the subject of patent protection and due enquiry should be made to the appropriate authorities to ascertain the existence or extent of patent cover so as to avoid a breach of any such patent.
APPENDIX B

METHOD FOR DETERMINING pH VALUE

B1 SCOPE. This Appendix sets out a method for determining the pH value of toothpaste.

B2 PRINCIPLE. The toothpaste is dispersed in water and the pH value of the slurry is determined electrometrically.

B3 APPARATUS. The following apparatus is required:
(a) Appropriate pH meter and glass/calomel electrode assembly.
(b) Balance.
(c) Stirrer.

B4 PROCEDURE. Weigh $5.2 \pm 0.1$ g of toothpaste from a primary container into a 100 mL beaker. Slurry with $20 \pm 0.1$ mL of distilled water. Determine electrometrically the pH of the slurry at a temperature of 23 ± 2°C using the glass/calomel electrode assembly, about 3 min after the commencement of slurring. If required, stirring by mechanical means may be used.

B5 REPORT. Report the pH value of the toothpaste to the nearest 0.1 pH unit.
APPENDIX C
METHODS FOR DETERMINING ABRASIVITY

C1 SCOPE. This Appendix sets out two methods for the determination of the abrasivity of the toothpaste. One method (surface profile method) is, under certain conditions, an alternative to the other method (radio-tracer method).

C2 RADIO-TRACER METHOD.
C2.1 Principle. The method involves a technique of wear resistance in which extracted human teeth are irradiated, subjected to simulated brushing, and the abrasivity value is calculated on the basis of the measurement of radioactivity transferred to the toothpaste.

C2.2 Apparatus and materials.
C2.2.1 Reference paste.
(a) Composition. The reference paste shall be formulated as follows:

<table>
<thead>
<tr>
<th>Constituent</th>
<th>Percent by mass</th>
</tr>
</thead>
<tbody>
<tr>
<td>Precipitated calcium carbonate*</td>
<td>40.00</td>
</tr>
<tr>
<td>Glycerol (see BS 2625)</td>
<td>23.00</td>
</tr>
<tr>
<td>Sodium carboxymethylcellulose (CMC)†</td>
<td>1.40</td>
</tr>
<tr>
<td>Dodecyl sodium sulphate‡</td>
<td>1.00</td>
</tr>
<tr>
<td>Sodium silicate (80% TW of approximately pH7) (see BS 3984)</td>
<td>0.50</td>
</tr>
<tr>
<td>Saccharin sodium</td>
<td>0.15</td>
</tr>
<tr>
<td>Formalin (40 percent (m/m) formaldehyde) (see BS 2942)</td>
<td>0.10</td>
</tr>
<tr>
<td>Peppermint flavouring</td>
<td>0.80</td>
</tr>
<tr>
<td>Water</td>
<td>33.05</td>
</tr>
</tbody>
</table>

The constituents shall comply with the requirements of the British standards given in parentheses above. For details of mixing and further requirements concerning the constituents, see (b) below and Paragraph C2.2.2.

(b) Details of the reference paste.
(i) Abrasive. Dense precipitated calcium carbonate (see Paragraph C2.2.2) which has been calibrated against the primary reference material‡.

Physical and chemical characteristics of the calcium carbonate are as follows:

- Percentage purity as CaCO₃: 98 percent min. (dry)
- Acid insoluble matter: 0.2 percent max.
- pH (20 percent (m/m) aqueous slurry measured after 10 min): 9.7 max.
- Total calcium as Ca: 38.5 percent to 40 percent
- Loss on heating at 105°C: 2.0 percent max.
- Apparent density (fluffed): 0.78 g/cm³ to 0.89 g/cm³
- Flow point: 13 ± 1
- Fineness through a 75 μm aperture §AS 1152 test sieve: 99.7 percent min.
- Mean particle size (Coulter): 12.5 ± 2.0 μm

NOTE: Because of the extreme sensitivity of the methods of abrasivity measurement, it is most important that the reference abrasive material be calibrated against a primary standard. For the purpose of this standard it is recommended that the calcium carbonate (which has been thoroughly investigated and is listed in Paragraph C2.2.2) be used.

(ii) A recommended method of manufacture. The constituents and the order in which they are used in the mixing procedure are listed on the top of the next page (see Paragraph C2.2.1(a) for further details of constituents):

---

* See Paragraph C2.2.1(b) and C2.2.2.
† See Paragraph C2.2.2.
‡ Available at the Laboratory of the Government Chemist, Cornwall House, Stamford Street, London SE1, United Kingdom.
§ This corresponds to 200 mesh.
Glycerol
Sodium CMC
Saccharin sodium
Sodium silicate
Water
Water
Calcium carbonate
Water
Dodecyl sodium sulphate
Formalin
Peppermint flavouring

Constituent | Percent by mass | Procedure |
--- | --- | --- |
Glycerol | 23.00 | A |
Sodium CMC | 1.40 | |
Saccharin sodium | 0.15 | B |
Sodium silicate | 0.50 | C |
Water | 5.00 | |
Water | 20.55 | D |
Calcium carbonate | 40.00 | E |
Water | 7.50 | F |
Dodecyl sodium sulphate | 1.00 | |
Formalin | 0.10 | G |
Peppermint flavouring | 0.80 | |

(iii) **Procedure.** The procedure shall be as follows:

A. Use a vertical bowl mixer with an anchor-shaped blade. Weigh the glycerol into the mixing bowl and, with slow stirring, add the weighed amount of sodium CMC.

B. Add the saccharin sodium.

C. Weigh the 5 percent quantity of water into a beaker, add the sodium silicate and stir until dissolved.

D. Add this to the dispersion in the mixing bowl followed by the 20.55 percent quantity of water. Transfer to a vacuum mixing vessel and stir for 15 min at the slowest speed until the gel is smooth.

E. Weigh the calcium carbonate and add it slowly to the gel. When all the powder is mixed, stop the stirrer and scrape the blade and side of the mixing bowl. Restart the stirrer and mix, under vacuum, for 10 min at the slowest speed, until smooth.

F. Weigh the dodecyl sodium sulphate into a beaker, add the remaining 7.5 percent water (warmed to approximately 45°C), and stir until dissolved.

Add this to the mix in the mixing bowl with slow stirring for 3 min under vacuum.

G. Add the formalin, followed by the peppermint flavouring and stir for a further 2 min under vacuum.

NOTE: No heating is necessary other than for step F., where the use of warm water water assists in dissolving the dodecyl sodium sulphate.

**C2.2.2 Reagents.**

NOTE: Experience has shown that any sensitive method of abrasivity measurement, such as that specified in this standard, can be significantly affected by undetectable characteristics in the reagents used. It is for this reason that reference is made to the particular commercial products listed below, all of which have been used in the investigations associated with development of the specified test, and not by way of any implication as regards quality. Each product is listed under the paragraph number where it is mentioned.

<table>
<thead>
<tr>
<th>Appendix paragraph reference</th>
<th>Reagent</th>
<th>Commercial product and manufacture</th>
</tr>
</thead>
</table>
| C2.2.1 | Precipitated calcium carbonate
Sodium carboxymethylcellulose (CMC) | Sturcal L (J. and E. Sturge Ltd)
7 MF (Hercules Powder Co. Ltd) |
| C2.3 | Dodecyl sodium sulphate
Epoxy resin
Impression compound | Dental grade (Cyto Chemicals Ltd)
Araldite MY 753 (Ciba Geigy Ltd)
Green or brown stick impression compound (Dental Fillings Ltd) |
| C2.4 & C2.5 | Chlorhexidine gluconate | Hibitane (Imperial Chemical Industries Ltd) |
| C2.6 | Polymethyl methacrylate
Sodium carboxymethylcellulose (CMC) | Perspex (Imperial Chemical Industries Ltd)
7 MF (Hercules Powder Co. Ltd) |

**C2.2.3 Apparatus.** The following apparatus is required:

(a) **Brushing machine**, generally conforming to the design given in Fig. C1 and so constructed that the tooth specimen can be withdrawn for neutron irradiation.

* Information on the availability of a suitable machine and of brush head design may be obtained on application to the British Standards Institution, 2 Park Street, London W1A 2BS.
The brushing movement shall be a 38 mm reciprocating stroke derived from a drive of 150 r/min.

NOTE: It is important that the brushing machine be constructed on sound engineering principles, especially with regard to the brush movement. It is essential that the reciprocating movement of the brush is parallel both with the floor of the brushing box in a horizontal plane and with the walls of the box in a vertical plane and that the specimen (see Paragraph C2.3) is mounted so that the brushing movement is at right angles to its long axis. (See also Paragraph C2.2.3(b) regarding brush head angulation.)

(b) Brush, complying with the following relevant details. The mass of the brush and associated parts shall be such that a force of 2 N is exerted on the tooth specimens:

(i) Mounting. The brush head shall be attached to the driving arm of the brushing machine, with the long axis of the brush head at an angle of between 4 degrees and 5 degrees (in the horizontal plane) to the direction of the reciprocating movement.

(ii) Conditioning. The brush head shall be immersed in water for a minimum of 3 h before commencing the test procedure.

(iii) Replacement. Replace the brush head after it has been used for approximately 50 000 brush strokes.

(iv) Design. Although the design of brush head* does not appear to affect the results of the abrasion test, it is advisable, in the interests of sensitivity, to use a brush of low compliance. (The term ‘compliance’ may be defined as the property of a brush to conform to a given surface.) This may be achieved in practice by selecting a brush with nylon 6.10 filaments of approximately 0.30 mm diameter†, set out with minimum tuft spacing to give a high density of filaments. A flat or serrated trim is recommended and the filaments should be between 11 mm and 12 mm in length. A three or four row brush is desirable with a width of between 7.5 mm and 10 mm. A brush length of 31 mm to 38 mm fits in well with the stroke displacement of the brushing machine.

(c) Source of neutron flux, of $10^{12}$ neutrons/(cm²s).

(d) Counting equipment, suitable for a source of $\beta$ radiation.

C2.3 Preparation of tooth specimens.

C2.3.1 Enamel. Prepare a specimen using human permanent teeth which have been stored, since extraction, in water with a suitable bacteriostatic agent such as chlorhexidine gluconate‡ (1 percent concentration). Cut off the root and mount the crown or slice of the crown, in a mounting medium such as epoxy resin§ with the labial or buccal surface uppermost and in an orientation to give crosswise brushing in the machine (see Figs. C2(a) and C2(b)). The specimen shall stand proud of the surface by about 2 mm and shall have an area of about 50 mm² exposed, which shall be intact and undamaged.

NOTE: Take particular care to ensure that no dentine or cementum is exposed. Such tissues wear many times faster than enamel and even a 1 percent exposure could double the effective wear rate of the specimen.

C2.3.2 Dentine. Prepare a specimen using single rooted human permanent teeth which have been stored, since extraction, in water with a suitable bacteriostatic agent such as chlorhexidine gluconate‡ (1 percent concentration). Cut off the crown, remove enamel, and mount in a suitable medium such as epoxy resin as shown in Figs. C3(a) and C3(b)). A small amount of exposed enamel will not seriously affect the overall wear rate of the specimen. The specimen shall stand proud of the surface by 1 mm to 2 mm and have an area of at least 50 mm² exposed, which shall be intact and undamaged.

An alternative source of dentine tissue is the root of a large maxillary incisor (see Figs. C3(c) and C3(d)).

C2.3.3 Mounting technique. Thoroughly clean the teeth selected for test purposes using a dental polishing paste on a rotating brush held in a straight dental handpiece, and then carefully wash to remove any abrasive matter. Cut the specimen under a jet of water using a diamond disc rotating in a straight dental handpiece. The specimen may be held in a stick of impression compound‖, the end of which is softened by heating in a flame.

Carefully dry the surface of the specimen without heating, prior to mounting in epoxy resin. The casting of the tapered holder and mounting of the tissue may be performed in one operation using the moulding block shown in Fig. C4. Use polyvinyl alcohol as the release agent. Do not use any mounting medium that might lead to a level

* Information on the availability of a suitable machine and of brush head design may be obtained on application to the British Standards Institution, 2 Park Street, London W1A 2BS.
† This diameter filament is usually found in ‘hard’ grade brushes.
‡ See Paragraph C2.2.2

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of radioactivity after neutron irradiation, which would interfere with the test. After about 12 h, remove the mounted specimen from the mould and transfer it to a vessel containing water and a suitable bacteriostatic agent such as chlorhexidine gluconate* (1 percent concentration). Immediately prior to irradiation, thoroughly brush the tooth using the reference paste, wash in water and place in a sealed polyethylene capsule filled with fresh water and a bacteriostat. At no time shall the specimens be allowed to dry out except for the short period required for mounting.

Avoid handling the specimens or using detergents for cleaning to limit formation of $^{24}$Na during irradiation.

C2.4 Irradiation of tooth specimen. Irradiate the polyethylene capsule containing the specimen, water and bacteriostat to an integrated thermal neutron flux of $10^{16}$ neutrons/cm$^2$ (dentine) or $3 \times 10^{16}$ neutrons/cm$^2$ (enamel). (For instance, 3 h for dentine and 10 h for enamel in a thermal neutron flux of $10^{12}$ neutrons/cm$^2$) would be suitable. Avoid using flux levels in excess of $10^{12}$ neutrons/cm$^2$.

Place the specimens at a position in the thermal column where the cadmium ratio (gold) is 7 or higher and the temperature less than 65°C. The irradiation should be carried out with 20 cm of lead shielding to reduce the gamma ray dose received by the specimens.

The total absorbed dose received by the tissues from all sources of radiation should not exceed $3 \times 10^5$ grays (dentine) and $10^5$ grays (enamel). The final specific activity will be of the order of 1 MBq.

Carry out the irradiation using a low temperature reactor designed to keep the temperature of the specimen as low as possible, but in no case above 65°C.

After removing the capsule from the reactor, wait 4 days before carrying out the test procedure to allow any highly radioactive elements, such as $^{24}$Na, to decay.

Handle the mounted, irradiated specimen in accordance with normal practice for a source of the above strength and type. 10 mm of polymethyl methacrylate* or water provides sufficient shielding from the β particles. Under no circumstances handle the specimen without tongs (length greater than 0.25 m) or view directly without suitable goggles. Detailed advice on the handling of radioactive tracer elements should be sought before carrying out the experiments.

C2.5 Conditioning of tooth specimen. Transfer a radioactive specimen of dentine or enamel to the trough of the brushing machine and condition the surface, at room temperature, by brushing for 1000 and 10 000 double brush strokes respectively in a slurry of the standard reference paste (20 g of standard reference paste plus 70 g of diluent, 0.5 percent of aqueous solution of sodium carboxymethylcellulose*). Determine the volume of this slurry before adding it to the trough as its magnitude is required for correction purposes later. At the end of the conditioning period, pour away the slurry into a suitable container and thoroughly wash the brush and specimen in water.

C2.6 Procedure. Dry the trough containing the specimen with a paper tissue, add 30 g of the standard reference paste slurry, made up to a concentration of 67 percent (20 g of standard reference paste plus 10 g of diluent, 0.5 percent of aqueous solution of sodium carboxymethylcellulose*). After ensuring that it is adequately covered, brush the specimen for 250 or 1000 double strokes, depending upon whether the specimen is dentine or enamel. At the end of this run, add 15 mL of diluent to the trough and after thorough mixing with a glass rod fitted with a rubber cap, brush for a further 250 or 1000 double strokes. Repeat this procedure for a further three additions of 15 mL of diluent.

Pour the active slurry from the trough and break the foam, if present, with a drop of diethyl ether. After gentle stirring withdraw two 1 mL samples of the slurry with a pipette and transfer to aluminium planchets of 25 mm diameter. Dry the planchets under an infrared lamp or in an oven.

An alternative gravimetric method of sampling may be used, as follows:

Pour the active slurry from the trough into a 250 mL beaker and break the foam, if present, with a drop of diethyl ether or acetone. After gentle stirring, weigh out two 1 g samples onto aluminium planchets of 25 mm diameter, using a top-loading balance accurate to 10 mg. Dry the planchets under an infrared lamp or in an oven. When using this method, do not correct the activities for the different densities of the slurries as stated in Paragraph C2.7.

Carry out the above conditioning and test procedure at room temperature, first with the standard reference paste, and then with the test paste followed by a repeat run with the standard reference paste. No dentine specimen shall be used for more than 50 000 brush strokes, but this may be extended for enamel so long as there is no evidence of dentine exposure.

* See Paragraph C2.2.2.
C2.7 Calculation and expression of results. Determine the radioactivity of the slurry samples with a 50 mm diameter end-window Geiger Müller counter suitable for β rays of 1.7 meV. Place the planchets close to the window. Correct the count rate for 'dead time' and background errors for a total of 5000 counts. Calculate the mean. If their individual values differ by more than 5 percent from the mean, the test shall be discarded.

Determine the levels of radioactivity of the planchets within a short period of one another so that corrections for decay in activity are reduced to low values. Make any corrections that are necessary on the basis of a half-life of 14.3 days (32P). Corrections for β absorption and backscatter can be neglected when the above counter geometry is used. If other counter geometries are used, activities have to be corrected using appropriate radio-tracer techniques.

As a constant mass of dentifrice and diluent is added to the trough, while a constant volume is withdrawn for sampling, it is necessary to make a small correction for the slightly different ratios of sample to total volumes of paste slurry used in the different tests. This correction factor can be ascertained from the measured volumes of dentifrice slurry employed for the conditioning runs, since these are also performed at the same concentration, viz 22 percent (m/m).

The ratio of the abrasivity of the test paste to the reference paste is given by the corrected ratio of the count rates. For details of the recommended statistical procedure, see Paragraph C4.

C2.8 Alternative procedure for measurement of radioactivity of slurry. Immediately after the brushing program has been completed, pour the active slurry from the trough into a beaker and break the foam, if present, with a drop of diethyl ether. After gentle stirring, transfer a proportion of the slurry to a suitable β particle counter having a nominal capacity of 10 mL.

Carefully wipe away any surplus slurry emerging from the overflow and immediately determine the β activity of the sample by counting for a maximum period of 3 min, in the case of dentine specimens, and 5 min for enamel specimens. Within these periods record at least 1000 counts with the reference paste slurry. If the number of counts is less than this, then it is advisable to use the dry counting procedure. Count both the standard reference paste slurry and the test paste slurry for the same period of time (the tests again following the sequence: standard; test; standard). The ratio of the number of counts recorded is a measure of the relative abrasivity after corrections for counter dead time and background radiation have been applied. No corrections are necessary for absorption, or, if the measurements are made within a short period of one another, for normal activity decay. Small corrections may have to be applied to allow for the fact that the sampling volumes from the two paste slurries will not always be the same fraction of the total final volume of slurry used for the test. This correction is similar to that applied with the dry counting procedure.

C3 SURFACE PROFILE METHOD.

C3.1 Principle. The method uses an identical brushing program to the radio-tracer method but relies for its measurement of abrasivity on a highly accurate measurement of the depth of the abraded groove.

C3.2 Apparatus. The following apparatus is required:

(a) A surface profile measurement instrument* fitted with a stylus of tip radius of approximately 0.25 μm and capable of measuring the cross-sectional areas of grooves 0.5 mm to 2.5 mm wide and 0.1 μm to 20 μm deep.

(b) A planimeter. An instrument for measuring the cross-sectional area of the abraded groove. Alternatively, an integrator attachment may be used to measure the area automatically.

(c) Waterproof silicon carbide papers; grades 220, 320, 400 and 600.

(d) A lapping machine with an unslotted cast iron wheel. The abrading surface is impregnated with 3 μm powdered diamond for the final polishing operation on enamel samples.

(e) A brushing machine, generally conforming to the design given in Paragraph C2.2.3(a).

(f) A brush, complying with the relevant details given in Paragraph C2.2.3(b).

C3.3 Reference paste. See Paragraph C2.2.1.

* Talysurf 10, manufactured by Rank Taylor Hobson, is known to be suitable for this purpose.
C3.4 Preparation of enamel and dentine specimens. Prepare specimens from human permanent teeth which have been stored, since extraction, in water with a suitable bacteriostatic agent, e.g. chlorhexidine gluconate* (1 percent concentration). The specimens should be cut as shown in Figs. C2 and C3.

C3.5 Mounting technique. Thoroughly clean the teeth selected for test purposes with a dental polishing paste on a rotating brush held in a straight dental handpiece, and then carefully wash to remove any abrasive matter. Cut the specimen under a jet of water using a diamond disc rotating in a straight dental handpiece. The specimen may be held in a stick of impression compound*, the end of which is softened by heating in a flame. Carefully dry the surface of the specimen without heating, prior to mounting in epoxy resin. The casting of the tapered holder and mounting of the specimen may be performed in one operation using the moulding block shown in Fig. C4. Use polyvinyl alcohol as the release agent.

Mount the specimen horizontally in the epoxy resin in such a way that it is just below the surface as shown in Fig. C5(a). The orientation of the specimen shall be perpendicular to the direction of brushing.

After about 12 h, remove the mounted specimen from the mould and transfer it to a vessel containing water and a suitable bacteriostatic agent, e.g. chlorhexidine gluconate* (1 percent concentration). At no time shall the specimens be allowed to dry out except for the short period required for mounting.

C3.6 Conditioning. Grind the upper face using the grades of waterproof silicon carbide paper as appropriate, water lubricated, to expose an area of the specimen 2 mm by 6 mm. Continue the grinding operation using progressively finer silicon carbide papers, water lubricated, finishing with 600 grade paper. Grind the upper face so that it is parallel to the lower face. To assist in achieving the degree of parallelism, a tilted, water-lubricated grinding table† may be used. Finish the grinding process for enamel specimens using a lapping machine (C3.2(d)).

The tolerance of flatness of the upper face, as measured by the surface profile measuring instrument, shall be as follows:

(a) For dentine: the surface shall not deviate by more than 1.0 \( \mu m \) from absolute flatness measured across the test area, perpendicular to the direction of brushing.

(b) For enamel: the surface shall not deviate by more than 0.1 \( \mu m \) from absolute flatness measured across the test area, perpendicular to the direction of brushing.

Prior to each test run, repeat the final polishing operation (using 600 grade silicon carbide paper for dentine and the lapping machine for enamel) to remove the minimum amount of tissue to achieve flatness within the tolerances defined above.

C3.7 Procedure. Mask the boundaries of the test area with two strips of unplasticized PVC self-adhesive tape (maximum thickness of 50 \( \mu m \)) to expose a 2 mm wide tract parallel with the direction of brushing. The object of the masking operation is to create an unabraded reference tape on either side of the test area. The position of the masking tape with respect to the specimen is illustrated in Fig. C5(b).

The specimen is set in the trough with the exposed face standing approximately 2 mm proud of the surface of the trough. The brushing operation shall be carried out in accordance with Paragraph C2.6 with respect to the sequential dilution, but the number of strokes per dilution is 200 for dentine and 2000 for enamel.

The testing sequence shall be as follows:

Reference paste; test paste; reference paste.

The reference paste shall be formulated in accordance with Paragraph C2.2.1. After the brushing has been completed, the mounted specimen is removed, washed clean and dried using paper tissue. The contour of the abraded groove is measured using the surface profile measuring instrument, and the area between the base line and the magnified trace is measured with the planimeter. Divide the cross-sectional area of the abraded groove by the width of the groove in order to obtain the average groove depth.

C3.8 Calculation and expression of results. The results obtained are treated as described in Paragraph C4.

C4 RECOMMENDED STATISTICAL ANALYSIS. The procedure shall be as follows:

(a) Test the toothpaste in the sequence: standard; test; standard.

(b) Calculate the arithmetic mean (\( R \)) of the two standard reference readings. (If they differ by more than 40 percent of this mean value, the complete test should be repeated.)

* See Paragraph C2.1.2.
† The table manufactured by Metaserve Ltd has been found suitable.
(c) Take logarithms of the test paste values \((T)\) and the mean \((R)\) of the standard reference paste values.

(d) Subtract \(\log T\) from \(\log R\) for each pair of variates and calculate the standard error \(s/\sqrt{n}\) of their mean difference, \(D_m\), where \(s\) is the standard deviation.

(e) Compare the ratio—

(i) for the radio-tracer method

\[
\frac{D_m + \log 2 \ (or \ log 4)}{s/\sqrt{n}}
\]

where

\(\log 2\) (or \(\log 4\)) is the abrasivity limit (see Clause 6.2 for radio-tracer method)

\(n\) is the number of test sequences performed (see (a))

(ii) for the surface profile method

\[
\frac{D_m + \log 1.5 \ (or \ log 3)}{s/\sqrt{n}}
\]

where

\(\log 1.5\) (or \(\log 3\)) is the abrasivity limit (see Clause 6.2 for surface profile method)

\(n\) is the number of test sequences performed (see (a)) with the value of the random variate of Students’ \(t\) distribution for \(n-1\) degrees of freedom and at a significance level of 10 percent (corresponding to 5 percent level single sided test).

(f) The required number of test sequences, \(n\), will depend upon the expected level of abrasivity of the test sample relative to that of the reference paste. If the ratio is small, there will be no need to carry out a large number of repeat measurements to determine compliance with the standard. Alternatively, if the ratio of the \(t\) test: reference paste abrasivity is close to the relevant limit, then more measurements may be necessary in order to establish a satisfactory comparison. In general, a minimum value of \(n = 4\) should be aimed at and the tests should be carried out on at least two dental tissue specimens of the same type.

**C5 REPORT.** Report the method used and the abrasivity of the toothpaste in terms of that of the reference paste for both dentine and enamel.
(b) Brushing head with stirring vanes

Fig. C1. (continued)

4 vanes at 45° to line of travel.
Side and lower profile to give small clearance with trough.
Each vane to contain 4 holes of appropriate size.

Internal dimensions of trough

Brush head inclined at 5°
to line of reciprocating action

PTFE tape

5°
Fig. C2. PREPARATION OF ENAMEL SPECIMEN

Fig. C3. PREPARATION OF DENTINE SPECIMEN (RADIO-TRACER METHOD)
Fig. C4. GENERAL ARRANGEMENT OF MOULD FOR TOOTH MOUNT
(a) Prior to conditioning

(b) After conditioning and masking

Fig. C5. MOUNTED TOOTH SPECIMEN MASKING
APPENDIX D

METHODS FOR DETERMINING SOLUBLE FLUORINE DERIVATIVES AND TOTAL FLUORINE DERIVATIVES IN TOOTHPASTE

D1 SCOPE. This Appendix sets out two methods that may be used to determine soluble fluorine derivatives and total fluorine derivatives in toothpastes.

D2 BY GAS CHROMATOGRAPHY.

NOTE: Some manufacturers may consider this method unsatisfactory for their toothpastes, in which case the fluoride ion specific electrode method should be used (see Paragraph D3). The manufacturer should stipulate the method(s) to be used.

D2.1 Principle.* The fluorine derivative species in a sample of toothpaste (for total fluorine derivative analysis) or in the aqueous extract of the toothpaste (for soluble fluorine derivative analysis) is allowed to react with trimethylchlorosilane under acidic conditions to produce trimethylfluorosilane. This derivative is extracted into toluene containing n-pentane as internal standard, and the organic phase is analysed by gas chromatography. The GC peak height ratio of trimethylfluorosilane to n-pentane is measured and the fluorine derivative content in the sample is calculated by reference to a calibration curve as fluoride ion.

D2.2 Reagents. The following reagents are required:
- Sodium fluoride, AR, dried at 105°C
- Concentrated hydrochloric acid, AR (1180 kg/m³ at 20°C)
- n-Pentane (AR)
- Trimethylchlorosilane (TMCS), LR
- Toluene, LR
- Distilled water

Fluoride standard solutions
1000 µg/mL—weigh 2.210 g sodium fluoride, dissolve in water and dilute to 1 L.
100 µg/mL—pipette 10 mL of the 1000 µg/mL fluoride standard into a 100 mL volumetric flask and dilute to volume.

n-Pentane internal standard in toluene
Weigh 0.50 ± 0.1 g of n-pentane into a flask containing approximately 10 g of toluene, mix well and quantitatively transfer to a 500 mL standard flask. Dilute to volume with toluene and mix. A 5 mL aliquot of this solution contains approximately 5 mg of n-pentane.

D2.3 Apparatus. The following apparatus is required:
- Screw-cap plastics centrifuge tubes (20 mL to 50 mL capacity)
- Glass beads
- Vortex mixer
- Centrifuge (capable of 50 000 m/s²)
- Gas chromatograph with flame ionization detector
- Glass column (1.5 m × 3 mm ID) packed with 10 percent silicone OV-101 on 80–100 mesh Chromosorb W or Celite AW DMCS

The recommended GC instrument conditions are as follows:
- Temperatures: Column 60°C, Detector 220°C, Injector 150°C
- Flow rates: Nitrogen carrier 30 mL/min, Hydrogen 30 mL/min, Air 300 mL/min
- Sample size: 0.6 µL

Under these conditions, samples can be injected every 5 min.
- X-T Chart recorder with maximum sensitivity of 1 mV FSD
- Micro syringe (1 µL capacity)
- Pipettes 2 mL, 5 mL, 10 mL (graduated)
- Analytical balance


For low fluorine derivative concentrations as may be found in the soluble fluorine derivative test, it may be necessary to increase the trimethylfluorosilane/n-pentane GC peak ratios by using a proportionately lower concentration of n-pentane in toluene.

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D2.4 Preparation of the working standards and the calibration data. Separately pipette 2 mL and 5 mL of 100 µg/mL fluoride standard and 2 mL and 5 mL of 1000 µg/mL fluoride standard into four plastics centrifuge tubes containing 2 or 3 glass beads. To each add approximately 3 mL of concentrated hydrochloric acid, and 2 mL of TMCS. Screw on the cap and mix thoroughly on the vortex mixer for 2 min. Set aside for 30 min. Uncap the tubes and accurately add to each 5 mL of n-pentane internal standard. Cap the tubes and mix for 2 min on the vortex mixer.

Allow the tubes to stand for several minutes. After the two layers are well separated, inject onto the GC column 0.5 µL of the top layer from the 200 µg fluoride working standard. Allow the chromatogram to develop, adjusting the attenuation controls of the GC instrument or the recorder so that the peak heights of trimethylfluorosilane (first major peak) and n-pentane (second major peak) are 60 percent to 90 percent of full scale deflection. After steady baselines are obtained, repeat the chromatography procedure with the 500 µg, 2000 µg and 5000 µg fluoride working standards.

Draw tangent baselines and calculate the peak height ratio of trimethylfluorosilane to n-pentane and plot versus the amount of fluoride (in micrograms) in the working standards on log-log graph paper.

D2.5 Procedure.

D2.5.1 For total fluorine derivative in toothpaste. Extrude a few centimetres of toothpaste from a primary container and reject. Accurately weigh about 2 g of toothpaste into a plastics centrifuge tube, add 2 or 3 glass beads and 2 mL of distilled water. Add, in small portions, 3 mL of concentrated hydrochloric acid, agitating on the vortex mixer after each addition.

Allow any effervescence from carbonates to subside. Then add 2 mL of TMCS, cap the tube and thoroughly mix on the vortex mixer for 2 min. Set aside for 30 min, then uncap the tube and accurately add 5 mL of n-pentane internal standard. Recap the tube and mix for 2 min on the vortex mixer. After the two layers are well separated (this may be aided by centrifugation), inject 0.6 µL of the organic phase on to the GC column. Allow the chromatogram to develop, adjusting the attenuation controls so that the peaks of interest are 60 percent to 90 percent of full scale deflection.

Calculate the peak height ratio of trimethylfluorosilane to n-pentane. By reference to the calibration curve, establish the amount of fluoride (in micrograms) in the sample. The concentration of total fluorine derivatives in the toothpaste is calculated from the following equation:

\[ F_l = \frac{B}{A} \]

where

- \( F_l \) = concentration of total fluorine derivatives in the toothpaste, expressed as micrograms of fluoride ion per gram.
- \( B \) = amount of fluorine derivatives in the test solution expressed as micrograms of fluoride.
- \( A \) = mass of toothpaste, in grams.

D2.5.2 For soluble fluorine derivative in toothpaste. Extrude a few centimetres of toothpaste from a primary container and reject. Further extrude and weigh 6.5 ± 0.1 g of toothpaste into a 50 mL plastics centrifuge tube. Calculate the mass of the toothpaste to within ±0.005 g. Pipette 20 mL of distilled water into the centrifuge tube and immediately slurry using mechanical agitation for 4 min ±10 s, assisting the dispersion with a plastics spatula if necessary. Centrifuge for 10 min at a speed sufficient to form a clear supernatant.

Pipette 10 mL of supernatant liquid into a plastics centrifuge tube, containing 2 or 3 glass beads, and add 10 mL of concentrated hydrochloric acid. Then add 2 mL of TMCS, cap the tube and mix on a vortex mixer for 2 min. After a period of 30 min, uncap the tube and accurately add 5 mL of the n-pentane standard. Recap the tube and mix on a vortex mixer for 2 min. When the two layers are sufficiently separated, inject 0.6 µL of the organic phase on to the GC column. Allow the chromatogram to develop, adjusting the attenuation controls as required.

Calculate the peak height ratio of trimethylfluorosilane to n-pentane. By reference to the calibration curve, establish the amount of fluoride (in micrograms) in the sample. The concentration of soluble fluorine derivatives in the toothpaste is calculated from the following equation:

\[ F_s = \frac{E}{10} \left( \frac{20}{D} + 1 - \frac{C}{100} \right) \]
where

\[ F = \text{concentration of soluble fluorine derivatives in the toothpaste, expressed as micrograms of fluoride per gram.} \]

\[ E = \text{amount of fluorine derivatives in the test solution, expressed as micrograms of fluoride.} \]

\[ D = \text{mass of toothpaste extracted, in grams.} \]

\[ C = \text{insoluble material in toothpaste (see Paragraph D3.5.1) expressed as a percentage (m/m).} \]

**D3 BY FLUORIDE SPECIFIC ION ELECTRODE.**

**D3.1 Principle.** Water soluble fluorine derivatives are extracted from the toothpaste by dilution and centrifugation. After acid treatment of the supernatants, the liberated fluoride ions are measured by the fluoride ion electrode. A correction is applied for the effect of the water soluble component in the toothpaste. Total fluorine derivatives are determined by ashing a sample of the toothpaste in the presence of excess calcium oxide to remove organic matter and convert the fluorine derivatives to calcium fluoride. The fluoride ions in the residue are allowed to react with silica in a sulphuric acid-water medium and are co-distilled as fluosilicic acid with water. After hydrolysis of the fluosilicic acid, the released fluoride ions are determined using the fluoride specific ion electrode.

**D3.2 Apparatus.** The following apparatus is required:

* Plastics beakers, with lids, 25 mL and 50 mL
* Plastics centrifuge tubes, capacity 30 mL
* Centrifuge
* Volumetric flasks, 25, 100, 500, 1000 mL
* Pipettes, 5, 10, 20 mL, also Pasteur type
* Graduated pipette (in 0.1 mL or better)
* Fluoride ion specific electrode
* Ag/Ag Cl reference electrode
* Ion analyser meter with digital readout to ±0.1 mV
* Vortex mixer and/or magnetic stirrer and follower
* Stop watch
* 500 mL three-necked flask with ground-glass sockets
* Splash-head with ground-glass joints
* 200°C thermometer with ground-glass joint
* 500 mL separatory funnel with ground-glass joint
* Water-jacketed distillation condenser with ground-glass joint and socket
* Receiver adaptor
* Platinum or nickel crucible (10 mL to 20 mL capacity) with lid
* Drying oven
* Muffle furnace
* Measuring cylinder, 50 mL
* Glass beads (2 mm to 4 mm dia.)
* Analytical balance
* Appropriate pH meter

**D3.3 Reagents.** The following reagents of recognized analytical quality are required:

* Distilled water
* Sodium acetate, anhydrous
* Citric acid monohydrate
* Sodium fluoride
* 0.1 percent phenolphthalein solution in ethanol
* Sodium hydroxide, 0.5 mol/L, 4.0 mol/L
* Calcium oxide, low fluoride
* Sulphuric acid, approx. 10 mol/L; slowly add with stirring concentrated sulphuric acid (approx. 1840 kg/m² at 20°C) to an equal volume of distilled water.
* Hydrochloric acid (approx. 1180 kg/m² at 20°C)
* TISAB solution—dissolve 150.0 g anhydrous sodium acetate and 2.0 g citric acid monohydrate in about 900 mL of water, transfer to a 1 L volumetric flask and dilute to volume with water.

Fluoride standards in water:

- 500 μg/mL—weigh 1.105 g sodium fluoride, dissolve in water and dilute to 1 L
- 100 μg/mL—pipette 20 mL of the 500 μg/mL fluoride standard into a 100 mL volumetric flask and dilute to volume

* Polypropylene or other suitable material.
20 μg/mL—pipette 20 mL of the 100 μg/mL fluoride standard into a 100 mL volumetric flask and dilute to volume
10 μg/mL—pipette to 10 mL of the 100 μg/mL fluoride standard into a 100 mL volumetric flask and dilute to volume
2 μg/mL—pipette to 20 mL of the 10 μg/mL fluoride standard into a 100 mL volumetric flask and dilute to volume
1 μg/mL—pipette 10 mL of the 10 μg/mL fluoride standard into a 100 mL standard flask and dilute to volume
0.1 μg/mL—pipette 10 mL of the 1 μg/mL fluoride standard into a 100 mL standard flask and dilute to volume

Fluoride standards in TISAB:

Total soluble fluoride derivative—to prepare the 0.1, 0.2, 1, 2, 10 and 50 μg/mL fluoride working standards in TISAB, pipette 2 mL of the 1, 2, 10, 20, 100 and 500 μg/mL fluoride standards in water respectively into plastic beakers and add 18 mL of TISAB.

Total fluoride derivative—to prepare the 0.1, 1, 2, 10, 20 and 100 μg/mL fluoride working standards in TISAB, pipette 10 mL of the 0.1, 1, 2, 10, 20 and 100 μg/mL fluoride standards in water respectively and add equal volumes of TISAB.

Frequently prepare fresh standards.

D3.4 Calibration of the fluoride electrode. Follow the manufacturer's instructions concerning the use of the specific ion electrode and meter. Measure the temperatures of the fluoride standards in TISAB and ensure that they agree within 1 °C. Immerse the fluoride ion and reference electrodes in the 0.1 μg/mL working standard, stir magnetically and measure the e.m.f. (to ±0.2 mV) after equilibrium. Repeat with 1, 2, 10, 50 and 100 μg/mL working standards.

Construct a linear calibration curve of e.m.f. versus the logarithm of the fluoride ion concentration in TISAB. The calibration curve may show evidence of curvature at low fluoride concentrations (less than 1 μg/mL). If the fluoride concentration in sample solutions falls on this portion, additional standards may be required to define the curve more accurately.

D3.5 Procedure.

D3.5.1 For insoluble material in the toothpaste. Extrude a few centimetres of toothpaste from a primary container and reject. Weigh 2.0 ±0.2 g of the toothpaste into a preweighed centrifuge tube. Determine the mass of paste to within ±0.005 g. Add 10 mL of distilled water, slurry with the aid of a glass rod and wash the rod with not more than 5 mL of water. Centrifuge until a clear supernatant is obtained, remove with the aid of a Pasteur pipette and reject. Repeat the washing, centrifuging and removal of the supernatant twice. Dry the tube and insoluble matter at 60 °C for 24 h. Cool and reweigh the centrifuge tube to within ±0.005 g and calculate the mass of insoluble material in the toothpaste from the following equation:

\[ C = \frac{100B}{A} \]

where

- \( C \) = insoluble material, expressed as percent (m/m)
- \( B \) = mass of dried insoluble material, in grams
- \( A \) = mass of toothpaste sample, in grams

D3.5.2 For total soluble fluoride derivatives in the toothpaste. Extrude a few centimetres of toothpaste from the primary container and reject. Weigh 1.67 ±0.1 g into a 25 mL plastic beaker. Calculate the mass of the toothpaste to within ±0.005 g. Pipette 5 mL of distilled water into the beaker and disperse the paste into a homogeneous slurry as rapidly as possible for a total period of 4 min ±10 s.

Immediately transfer a sample of the dispersion into a dry centrifuge tube and centrifuge for 5 min at an appropriate speed to form a clear supernatant. Accurately pipette 1 mL of the supernatant liquid into a 25 mL plastic beaker followed by 1 mL of concentrated hydrochloric acid. Seal the beaker, mix thoroughly and set aside for 1 h at 20 °C to 25 °C. Accurately add 8 mL of distilled water and mix. Pipette 1 mL of this solution into a 50 mL plastics beaker, add 0.2 mL of 4 mol/L sodium hydroxide, mix and add 8.8 mL of TISAB.

Measure the temperature and ensure that it is within ±1 °C of the average temperature measured previously for the fluoride standards in TISAB. Immerse the fluoride ion and reference electrodes in the solution, stir with a magnetic stirrer and measure the e.m.f. of the solution when equilibrium is attained (not more than 5 min. should
be required). By reference to the calibration curve, determine the fluoride concentration in the test solution. Calculate the soluble fluorine derivative in the toothpaste from the following equation:

$$F_s = 100 \frac{E}{D} \left(1 + \frac{5}{C} \right) \left( \frac{D}{100} \right)$$

where

- $F_s = $ concentration of soluble fluoride, or soluble fluorine derivative respectively in the toothpaste, expressed as micrograms of fluoride ion per gram of paste
- $E = $ concentration of fluoride ions in the test solution, expressed as micrograms per millilitre
- $C = $ insoluble material in toothpaste, expressed as percentage m/m
- $D = $ mass of toothpaste sample, in grams

NOTE: The calculation assumes that the specific gravity of the water-soluble material in the toothpaste is equal to that of water, and that the total volume change on mixing with water is zero. All water-soluble fluorine species are assumed to be converted to fluoride by the acid treatment.

D3.5.3 For total fluorine derivative in the toothpaste. Extrude a few centimetres of toothpaste from a primary container and reject. Accurately weigh 2.0 ± 0.1 g (to within ± 0.001 g) into a platinum or nickel crucible. Add 1.0 ± 0.1 g of calcium oxide into the crucible and thoroughly mix with the toothpaste using a spatula. (The addition of several drops of water will aid the mixing.) Carefully wipe off any material clinging to the spatula with a small piece of filter paper and add it to the crucible. Sprinkle 1.0 ± 0.1 g of calcium oxide over the sample, and cover the crucible. Dry the sample in an oven at 105°C for 1 h, then ash the sample at 550 ± 20°C for another hour.

NOTE: Do not allow the sample to ignite.

With the aid of 20 mL to 60 mL of distilled water, quantitatively transfer the residue to the 500 mL three-necked flask containing 250 mL of 10 mol/L sulphuric acid and 50 to 60 glass beads. Insert the thermometer into one of the side necks of the flask so that the bulb is below the reaction mixture and insert the separatory funnel containing distilled water into the other side neck. Attach the splash head to the middle neck of the flask and connect the outlet of the splash head to a condenser which is held in a vertical position.

To the end of the condenser, attach a receiver-adaptor which extends into a 500 mL volumetric flask containing 6 mL of 0.5 mol/L aqueous sodium hydroxide, 50 mL of distilled water and a few drops of phenolphthalein solution.

Heat the 500 mL three-necked flask, collecting the distillate in the 500 mL volumetric flask. When the temperature of the reaction mixture approaches 150°C, add water dropwise from the separatory funnel at a rate so that the reaction mixture is held at 150 ± 2°C. During the distillation, ensure that the distillate in the volumetric flask remains pink, adding small volumes of aqueous sodium hydroxide 0.5 mol/L if necessary. When approximately 495 mL of distillate has been collected, discontinue the distillation and dilute to volume with water.

Repeat the above procedure (with the exception of the ashing) on 2.0 ± 0.1 g of calcium oxide, for the purpose of a blank determination*.

 Pipette 5 mL of each distillate into two 25 mL plastics beakers, accurately add equal volumes of TISAB and mix. (The pink colouration of the solutions should disappear at this stage.) Measure the temperature of each solution and ensure that it is within ±1°C of the average temperature measured previously for the fluoride standards in TISAB. By reference to the calibration curve, determine the fluoride ion concentration in the blank and test solutions.

Calculate the total fluorine derivative concentration in the toothpaste from the following equation:

$$F_t = \frac{500}{H} (G_1 - G_2)$$

where

- $F_t = $ concentration of total fluorine derivative in the toothpaste, expressed as micrograms of fluoride ion per gram
- $G_1$ and $G_2 = $ concentration of fluoride ions in the test solution and blank solution respectively, in micrograms per millilitre
- $H = $ mass of toothpaste, in grams.

D4 REPORT. Report the method used and the total soluble fluorine derivative and total fluorine derivative of the sample tested as micrograms of fluoride ion per gram of toothpaste.

* If the calcium oxide is found to contain more than 100 μg/g of fluoride ions, it is unsatisfactory for use in the above procedure.
APPENDIX E

METHOD FOR DETERMINING THE DURABILITY OF THE EXTERNAL SURFACE FINISH ON THE PRIMARY CONTAINER WHEN IT IS A METAL COLLAPSIBLE TUBE

E1 SCOPE. This Appendix sets out a method for ascertaining the durability of the external surface finish of a primary container for toothpaste when it is a metal collapsible tube.

E2 PRINCIPLE. The resistance of the external surface finish of the primary container to damage and deterioration is determined by examining the effects of crushing the container and subjecting it to contact with an aqueous dispersion of the toothpaste.

E3 APPARATUS AND MATERIALS. The following apparatus and materials are required:
(a) Crushing device as specified in BS 2006.
(b) A dispersion (10 percent m/V) of the toothpaste in distilled water.

E4 PROCEDURE. The procedure shall be as follows:
(a) Carefully empty the contents of a primary container through the opened crimp end as completely as possible.
(b) Rinse the primary container clean with water ensuring that no damage is caused to the primary container or its surface finish.
(c) Examine the primary container and observe any defects.
(d) Crush the primary container using the crushing device (E3(a)) and re-examine.
(e) Examine another primary container, prepared as in steps (a) and (b).
(f) Immerse this primary container completely in the toothpaste dispersion (E3(b)) in a covered beaker for 24 h at 23 ± 2°C. Then remove the primary container, rinse clean with water and examine.
(g) Repeat step (f) using the same (second) primary container.
(h) Crush the primary container referred to in step (g) above using the crushing device (E3(a)) and re-examine.

E5 REPORT. Report with respect to the following:
(a) Cracking, flaking and lifting of the surface finish of the primary container.
(b) Bleeding and discolouration of colourants in the external surface finish of the primary container to such an extent that any printing is illegible.
APPENDIX F

ASSESSMENT OF COMPLIANCE

F1 SCOPE. This Appendix provides advisory information on sampling and assessing compliance with this standard.

F2 CERTIFICATION MARKING. This standard has been presented in a form suitable for use in conjunction with the certification marking scheme of the Standards Association of Australia (the 'Standards Mark' scheme). The scheme relies on the application of an approved quality control system at the point of manufacture to provide assurance of compliance with the standard.

The manufacturer’s quality control system is the subject of external audit and, in addition, random inspections and tests may be carried out from time to time by officers of the Association’s Quality Assurance and Certification Section in accordance with the terms of the licence to use the Standards Mark.

F3 ASSESSMENT OF COMPLIANCE ON THE BASIS OF A SINGLE SAMPLE.

Where assessment of compliance on the basis of statistical sampling is considered impracticable due to size or homogeneity of a group of primary containers, then consideration may be given to the results of tests on a single sample in the assessment of compliance.

Such a sample should be chosen appropriately with regard to its size and the nature of the group and consist of not less than 25 specimens, selected in a manner to be representative of the group under consideration. The sample should be subdivided for testing in accordance with the provisions of Table F1.

### TABLE F1

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NOTES:
1. Certain approved authorities may exercise their own right to inspect and test in magnitudes chosen as they see fit on evidence or on suspicion of non-compliance.
2. Any toothpaste containing a fluorine derivative should not be allowed to remain in contact with glass for prolonged periods before total and soluble fluorine derivative analyses are conducted.
3. Undiluted and otherwise unaffected toothpaste obtained during removal from the tubes can be added to the plastics container to augment the toothpaste available for the tests.
4. The toothpaste available after testing in accordance with this Clause is collected in a sealable plastics container from which it may be used to carry out other tests as appropriate.
PUBLICATIONS OF THE ASSOCIATION

A list of Australian Standards may be purchased or inspected at any office of the Association.

OFFICES OF THE ASSOCIATION

Those interested in the work of the Association are invited to call at the Head Office or any Branch Office, or write for literature.

NEW SOUTH WALES:
Head Office. Standards House, 80 Arthur Street, North Sydney.
J.R. Paton, Director General.
Mail: P.O. Box 458, North Sydney, 2060.
Telegrams: Ausstandard North Sydney.
Telex 26514.
Newcastle Branch Office: 51 King Street, Newcastle, 2300.
(G.A. Jeffries, Manager.)

VICTORIA: Clinches Ross House, 191 Royal Parade, Parkville, 3052.
(P.G. Scanlan, General Manager.)
Telex 33877.

QUEENSLAND: 447 Upper Edward Street, Brisbane, 4000.
(G.E. Lock, Manager.)
Mail: P.O. Box 290, Spring Hill, 4000.

SOUTH AUSTRALIA: 11 Bagot Street, North Adelaide, 5006.
(R. Thompson, Manager.)

WESTERN AUSTRALIA: 11-13 Lucknow Place, West Perth, 6005.
(P.J. Oliver, Manager.)

TASMANIA: 4th Floor, 18 Elizabeth Street, Hobart, 7000.
(Mrs G.M. Lower, Manager.)

NORTHERN TERRITORY: 191 Stuart Highway, Darwin, 5790.
(Agency: Master Builders Association)

AUSTRALIAN CAPITAL TERRITORY: (Cash sales only) 2A Mugga Way, Red Hill, 2603. (Agency: Royal Australian Institute of Architects.)

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NOTE: The following and all other overseas standards are obtainable at or may be ordered through all offices of the Association:

- International Organization for Standardization
- International Electrotechnical Commission
- American National Standards Institute
- British Standards Institution
- Indian Standards Institution
- Japanese Industrial Standards Committee
- Pakistan Standards Institution
- Singapore Institute of Standards and Industrial Research
- South African Bureau of Standards
- Standards Association of New Zealand
- Standards Council of Canada
- Standards Institution of Malaysia
Source: McNair Anderson (1986).
### Appendix 6

**Prime Prospect Profiles. Report on Toothpastes 1986**

*Source: McNair Anderson (1986)*

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APPENDIX 6

PRIME PROSPECT PROFILES. REPORT ON TOOTHPASTES 1986
Source: McIlwain Anderson (1986)

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APPENDIX 6

PRIME PROSPECT PROFILES. REPORT ON TOOTHPASTES 1986
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