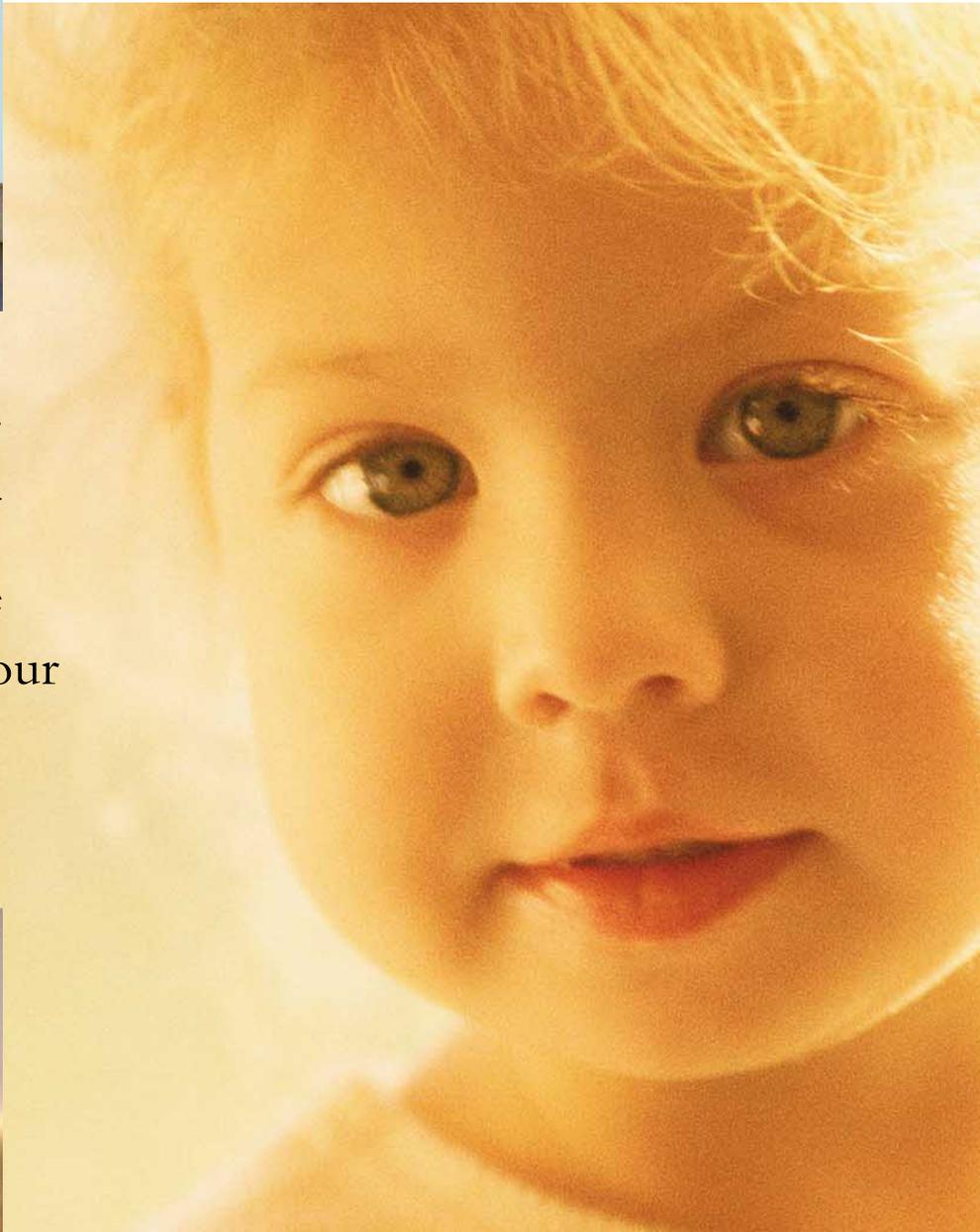


# Consumer and Competition Policy Directorate



## Executive Summary

Research into the mouthing behaviour of children up to 5 years old.



**dti**

Department of Trade and Industry



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# Summary

This report presents the findings of an investigation into children's mouthing behaviour, and particularly how long children mouth on dummies/soothers, fingers, toys and other objects. The work was undertaken to gain a better understanding of the mouthing behaviour of children which could, if appropriate, be taken into account when developing safety standards and policy.

Two hundred and thirty six children aged from 1 month to 5 years were divided into 12 age categories, and information on what children put in their mouths was gathered by parental observation, in the home environment, over a total of 5 hours for each child.

From these observations, estimates were made of how long children in each age group would mouth on different items over a typical day. Data are presented on estimated daily mouthing time according to what was mouthed.

When considering maximum daily mouthing times, dummies/soothers are generally mouthed the most across all age groups, with maximum daily mouthing time between 2 and 5 hours for most age groups. Maximum daily mouthing on dummy/soother shows no real pattern, with several peaks at 9-12 months, 18-21 months, 3 and 4 years, and is at its lowest at age 5. Estimated maximum daily mouthing on fingers generally increases with age, peaking at age 5. This is most probably due to the presence of a few children with thumb sucking habits in the sample.

Maximum estimated mouthing time per day on toys or other objects is generally around 1-1.5 hours each per day. Maximum daily mouthing on toys peaks at 6-9 months and then generally decreases as children get older, while maximum mouthing on other objects peaks at age 2 but generally stays at a more steady level than mouthing on other items.

The results of this study are discussed in relation to potential mechanical hazards, the implications for product safety are considered, and conclusions and recommendations are drawn.

**The Main Report, "Research into the mouthing behaviour of children up to 5 years old", describes the research in detail along with all the results.**

# Chapter 1

## Introduction

This report summarises research carried out into the mouthing behaviour of young children, aged from 1 month to 5 years. The **Main Report** "Research into the mouthing behaviour of children up to 5 years old" describes the research in detail along with all the results.

The aim of the work was to establish the time that children spend during a typical day mouthing on dummies/soothers, fingers (or other body parts), toys, and other objects; other objects being any items mouthed by children that were not considered by the observer to fit into the other categories.

The work was undertaken to gain a better understanding of children's mouthing behaviour and potential associated hazards, for example mechanical hazards such as choking. This research expands on the work carried out in the Netherlands by Groot et al (1998) and in the US by Juberg et al (2001).

# Chapter 2

## Methodology

Pre-pilot and pilot studies were carried out prior to the main study to develop the observation protocol. Observation was carried out by parents in the home, in preference to observation by trained observers or the use of video observation. Observation by parents was the least intrusive method and thereby ensured natural mouthing activity. A validation study carried out at the end of the research, to assess the accuracy of the data collected by parents, showed that the protocol was as reliable as trained observers or video, see the **Main Report**.

The parent/carer observed their child for a total of five hours over a maximum of two weeks, using a diary system to record their child's mouthing behaviours. The five hours were broken down into twenty, fifteen-minute observation sessions spread evenly over the day, and over both weekdays and weekends. In each of these observation sessions the parent was asked to observe their child and to record what they put into their mouth, for how long, and also how they were mouthing each item. Parents were told that they were not to alter their parenting behaviours as the aim was to capture the child's normal behaviour i.e. they were not to encourage or discourage mouthing, or to change their normal policy regarding what they allowed their child to mouth.

236 children in total were observed, broken down into the following age categories:

| Age category | Males | Females | Total |
|--------------|-------|---------|-------|
| 1-3 months   | 3     | 6       | 9     |
| 3-6 months   | 7     | 7       | 14    |
| 6-9 months   | 6     | 9       | 15    |
| 9-12 months  | 6     | 11      | 17    |
| 12-15 months | 5     | 11      | 16    |
| 15-18 months | 5     | 9       | 14    |
| 18-21 months | 11    | 5       | 16    |
| 21-24 months | 6     | 6       | 12    |
| 2 years      | 18    | 21      | 39    |
| 3 years      | 13    | 18      | 31    |
| 4 years      | 17    | 12      | 29    |
| 5 years      | 14    | 10      | 24    |

**Table 1: Sample numbers by age, category and sex**

The sample was representative of UK ethnicity and also included a small number of children with physical disabilities. However, none of the children had any physical or psychological problem which would either impair or exacerbate the natural tendency to mouth.

# Chapter 3

## Results

The data presented in this report are estimates of the time that a child will spend mouthing over the course of a normal day. The results are presented according to age and type of item mouthed. The results of the research and data on how items were mouthed can be found in the **Main Report**.

The estimated daily mouthing time is extrapolated from the mouthing behaviour recorded over the five hours observation time. This is calculated as follows:

$$\frac{\text{Observed mouthing time}}{\text{Total time observed for}} * \text{time available to mouth per day}$$

Where:

- Observed mouthing time** = the amount of mouthing time recorded for each child
- Total time observed for** = the total amount of time that they were observed for (5 hours)
- Time available to mouth per day** = the time available over the whole day for the child to mouth  
i.e. the time during the day when they were awake but not eating

This calculates the average time spent mouthing per hour, multiplied by the total number of hours each day that each child has available to mouth i.e. the number of hours they are awake during the day but not eating. This has been based on the assumption that children are likely to mouth at the same rate throughout the day. A Kruskal-Wallis<sup>1</sup> test showed no significant differences in observed mouthing between the different times of the day that children were observed.

Table 2 presents the maximum estimated daily mouthing time (for males and females combined) for each item mouthed (in hours:minutes:seconds). Data shown for males and females combined as a Mann-Whitney<sup>2</sup> test showed no statistically significant difference in mouthing time between the sexes. Estimates of maximum daily mouthing time on all items are presented in Table 3 to give an indication of the longest period of time that children in each age group are estimated to mouth over a normal day. The average (or mean) time that children mouth on items for each age group is presented in the **Main Report**.

The presented maximum values are the highest estimated daily mouthing times of any child in each age category, for each item. It does not necessarily follow that the maximum values in each age group for each item were exhibited by the same child, that is, one child may have mouthed a lot on a dummy while another child in the same age group may have mouthed a lot on fingers. Also presented is the maximum estimated daily mouthing time for mouthing on all and any items, in each age group, by any single child. Figure 1 graphically shows the data presented in Tables 2 and 3.

<sup>1</sup>The Kruskal-Wallis test is a non-parametric statistical test used to determine whether values of scores for three or more groups are significantly different, in this case we have four groups, i.e. those observed between waking and 11am, between 11am and 2pm, between 2pm and 6pm, and 6pm until bedtime.

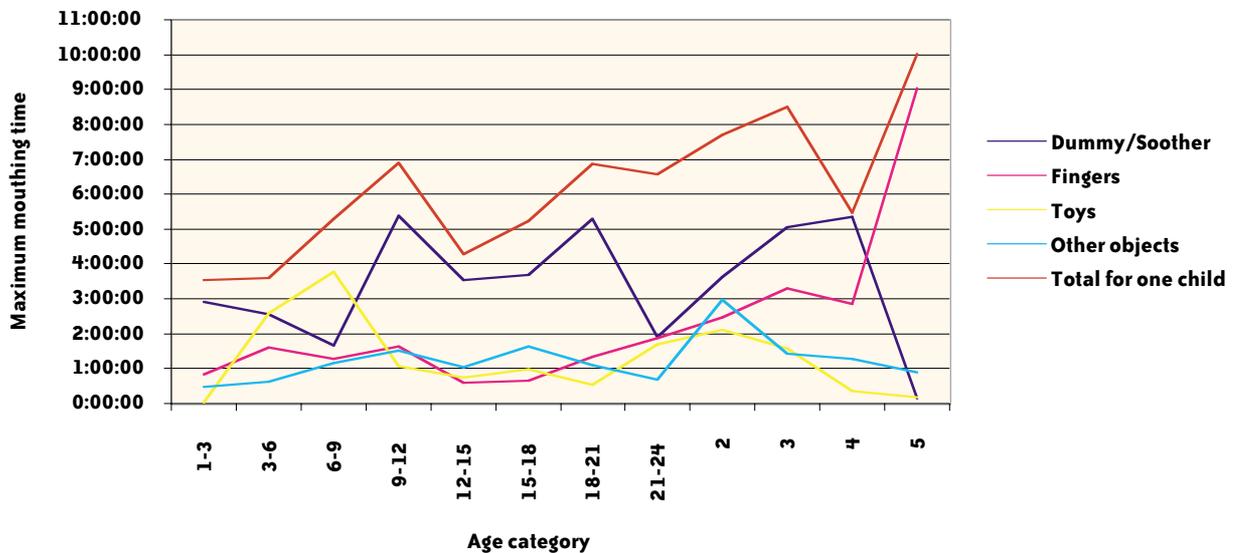
<sup>2</sup>The Mann-Whitney test is a non-parametric statistical test used to determine if there are significant differences between scores or values of two groups with different subjects in each group, i.e. males and females.

| Items mouthed | AGE GROUP  |            |            |             |              |              |              |              |         |         |         |         |
|---------------|------------|------------|------------|-------------|--------------|--------------|--------------|--------------|---------|---------|---------|---------|
|               | 1-3 months | 3-6 months | 6-9 months | 9-12 months | 12-15 months | 15-18 months | 18-21 months | 21-24 months | 2 years | 3 years | 4 years | 5 years |
| Dummy/Soother | 2:54:50    | 2:32:48    | 1:40:02    | 5:23:45     | 3:32:15      | 3:40:21      | 5:17:35      | 1:54:37      | 3:37:00 | 5:04:03 | 5:21:39 | 0:08:08 |
| Fingers       | 0:50:31    | 1:36:02    | 1:17:13    | 1:38:42     | 0:35:53      | 0:39:21      | 1:20:29      | 1:53:10      | 2:27:48 | 3:18:33 | 2:51:01 | 9:02:45 |
| Toys          | 0:00:59    | 2:34:45    | 3:46:46    | 1:04:49     | 0:44:01      | 0:58:28      | 0:32:49      | 1:42:04      | 2:05:48 | 1:34:36 | 0:20:46 | 0:11:20 |
| Other objects | 0:28:11    | 0:36:39    | 1:10:23    | 1:31:00     | 1:03:03      | 1:38:02      | 1:06:21      | 0:40:20      | 2:57:58 | 1:25:29 | 1:16:40 | 0:52:47 |
| Not recorded  | 0:06:42    | 0:03:07    | -          | 0:00:09     | 0:00:26      | 0:01:55      | 0:02:05      | 2:50:37      | 1:35:15 | 0:00:37 | 0:02:24 | 1:05:08 |

Table 2: Estimated maximum daily mouthing time for all items mouthed (hours:minutes:seconds)

| Maximum total estimated mouthing of any child over a day | AGE GROUP  |            |            |             |              |              |              |              |         |         |         |          |
|--|------------|------------|------------|-------------|--------------|--------------|--------------|--------------|---------|---------|---------|----------|
|  | 1-3 months | 3-6 months | 6-9 months | 9-12 months | 12-15 months | 15-18 months | 18-21 months | 21-24 months | 2 years | 3 years | 4 years | 5 years  |
|  | 3:31:50    | 3:36:24    | 5:16:59    | 6:53:01     | 4:17:09      | 5:14:42      | 6:52:18      | 6:35:01      | 7:41:31 | 8:30:12 | 5:28:44 | 10:01:07 |

Table 3: Estimated maximum daily mouthing on all items mouthed (hours:minutes:seconds)



**Figure 1: Estimated maximum daily mouthing on all items (hours, minutes, seconds)**

When considering maximum daily mouthing times, dummies/soothers are generally mouthed the most across all age groups, with maximum daily mouthing time between 2 and 5 hours for most age groups. Maximum daily mouthing on dummy/soother shows no real pattern, with several peaks at ages 9-12 months, 18-21 months, 3 and 4 years, and is at its lowest at age 5. Estimated maximum daily mouthing on fingers generally increases with age, peaking at age 5. This is most probably due to the presence of a few children with thumb sucking habits in the sample.

Maximum estimated daily mouthing time on toys or other objects is generally around 1-1.5 hours each per day. Maximum daily mouthing on toys peaks at age 6-9 months and then generally decreases as children get older, while maximum daily mouthing on other objects peaks at age 2 but generally stays at a more steady level than mouthing on other items.

# Chapter 4

## Implications for Product Safety

### 4.1 WHY CHILDREN MOUTH

The urge to suck and mouth by young children is a natural developmental phase. Sucking may be divided into two distinct behavioural types: nutritive and non-nutritive sucking (Turgeon-O'Brien et al, 1996). Nutritive sucking is the instinctive need to feed. Non-nutritive sucking (e.g. sucking on a dummy/soother) is thought to be adopted by infants as a response to frustration, as a need for contact, or as a part of the child's psychological development in exploring the world around them through touching and tasting objects with the mouth and tongue.

Research on the mouthing behaviour of children has usually concentrated on the psychological development of the act, being concerned with the cause and motivation behind mouthing. There is, however, a child safety issue concerned with the safety of items being placed into the mouths of young children. Some products, such as dummies/soothers, teething rings and bottle teats, are intended to be placed into the mouth. Unfortunately, products not intended to be mouthed invariably end up in children's mouths, as this is how young children explore their world. Obviously, child safety is of paramount concern, and so products must be as safe as possible for all forms of interaction, whether they are being handled or placed in the mouth.

### 4.2 OVERVIEW OF LEGISLATION AND STANDARDS

All items that are placed into a child's mouth have the potential to be a mechanical hazard. The most obvious hazards are choking or suffocation, although there is a risk of any item becoming stuck in the mouth and the resultant trauma may be serious. There is also the risk of foreign body incidents where a child swallows an item which may then cause harm to internal systems of the body.

The European Standard on the Safety of Toys (EN 71-1, 1998) details the mechanical and physical properties to which toys must conform, with toys being "any product or material designed or clearly intended for use in play by children of less than fourteen years of age" (p4). There are a large number of requirements to which a toy must conform, with additional requirements for toys intended for children of less than 36 months. The main requirement for such toys concerns small parts which could potentially be choking, suffocation or foreign body hazards. The test for small parts is whether or not the toy or any removable part of the toy fits entirely within a specified test cylinder. If the toy or any removable part of the toy fits entirely into the truncated cylinder without compression it does not conform to BS EN 71. The cylinder used for small parts testing is 31.7 mm (1.25") in diameter, with side lengths of 51.7 and 25.5 mm respectively. The standard also describes test procedures for the shape and size of certain toys (such as rattles, teething rings, hand-held activity toys) which are intended for use by children who are too young to sit up unaided.

Certain toys in the EU are required to have a specific safety warning label depending on the type of toy. For example, latex balloons are required to have a label on the packaging stating "Warning! Children under eight years can choke or suffocate on uninflated or broken balloons. Adult supervision required. Keep uninflated balloons from children. Discard broken balloons at once" (BS EN 71-1, p18). Additional warning labelling is required for toys not intended for children under the age of 36 months in the form of "Not suitable for children under 36 months" (BS EN 71-1, p18) together with a description of the hazard, such as "contains small parts".

The Child Safety Protection Act (CSPA) of 1994 in the US details similar requirements, with the same size test cylinder defined for small parts testing, but in 1994 a new section was added which puts labelling requirements on certain balls, balloons, marbles, and certain toys and games intended for use by children three years of age and older. The amendment also bans certain balls intended for use by children younger than 3 years of age. Balls are tested with a cylinder similar to that used for small parts testing, but with a diameter of 44.5 mm (1.75"). A small parts warning label is also required in the US: "Warning: CHOKING HAZARD: Small parts. Not for children under 3". The European Standard, EN71, is being amended to include similar requirements.

According to the guidelines of the Consumer Product Safety Commission (CPSC) and CSPA, toys pose a choking hazard if they have play value for children under three (e.g. they are easy to understand, brightly coloured, etc) and would entirely fit into the small parts cylinder or the small balls cylinder. Toys that may pose a choking risk include those that fit inside the cylinder only when compressed; fit inside with an area sticking out of the cylinder; play food that fits through the ball testing cylinder; latex balloons which are deflated or balloon pieces. It is illegal for a toy manufacturer to make a toy which is obviously intended for use by children under 3 and to label it as intended for use only by children aged over 3.

Unfortunately there are many objects in the home environment other than toys which can pose a choking, suffocation, foreign body or general hazard to young children. Obviously it is impossible and impractical to attempt to control what people have in their homes, and so the emphasis is placed on best practice on limiting access to items of potential danger<sup>3</sup>.

### 4.3 ACCIDENT STATISTICS ON MECHANICAL HAZARDS

The primary mechanical hazards associated with children placing items into their mouths are classified as foreign body accidents, which include choking, suffocation or stuck-in-mouth incidents. A foreign body is basically an object that should not naturally be in the eye, the stomach or any other orifice of the body. Choking is the main focus of this discussion.

DTI research into choking hazards of children (DTI, 1999) found that over the period 1986/7 to 1995/6 the number of choking cases involving foreign bodies was declining, however there were still an average of 2600 non-fatal cases a year between 1987 and 1996, and an average of 24 fatalities a year between 1986 and 1995. Most cases (88%) were classified as being 'trivial' or 'minor'<sup>4</sup>. Children under 3 are most vulnerable (82% of non-fatal choking incidents involved children under 3 years of age), while 56% of choking fatalities involved children under the age of 1 year.

Of the choking incidents to children under the age of 4 over that period, toys were responsible for 6% and non-food items (or 'other objects' as classified in this study) were responsible for 32%. Of the incidents involving toys, 85% happened to children under 3 years of age. Of the fatalities to children under 3 years, 8% were caused by non-food objects and 4% by toys or parts of toys. Nearly two thirds of fatalities (60%) at all ages are caused by items of food.

<sup>3</sup>The Department of Trade and Industry's (DTI) Consumer Affairs Directorate publish safety leaflets aimed at educating the general public about common hazards and how to avoid them- <http://www.dti.gov.uk/cacp/ca/safety/safetyleaflets/safepdf.htm> as does the CPSC in the US- <http://www.cpsc.gov/cpsc/pub/pubs/pubcat.html>

<sup>4</sup>trivial - 'patient did not wait' or 'examined but no treatment given'

minor - 'treated; but no more treatment required', 'referred to GP', 'referred to any outpatient (OP) clinic'. 'referred to OP or GP', referred to other hospital' or 'admitted for less than 1 day' (DTI, 1999).

## 4.4 MOUTHING TIMES

The estimates of daily mouthing times from this study show that the highest estimated mean daily mouthing time<sup>5</sup> on toys and other objects is at ages 6-9 months, and that mouthing on these items drops off at 4 and 5 years of age. These data fit the pattern of the accident statistics, as it is logical that the higher the mouthing time on toys and other objects the higher the risk of an injury occurring due to greater exposure to the hazard.

## 4.5 ITEMS MOUTHED

This study has shown that the average number of items mouthed per child peaks at age 6-9 months and so children at this age are putting the widest variety of items into their mouths. Research by the DTI (1999) on choking risks to children lists the foreign bodies that caused choking accidents to young children, by non-food objects (i.e. other objects) and toys or parts of toys. Amongst toys, the most accidents are caused by small round items, such as marbles, ball bearings, beads and building bricks. Estimated data on the number of choking accidents caused by toys or parts of toys between 1986 and 1996 for children under the age of 4 in the UK show there were an average of 167 incidents a year, with the main hazards coming from:

- Parts of toys - 26 cases per year
- Toy (unspecified) - 24 cases per year
- Toy (specified) - 22 cases per year
- Toy (unknown) - 19 cases per year
- Ball bearing - 16 cases per year
- Plastic beads - 16 cases per year
- Piece of plastic toy - 12 cases per year
- Marble - 11 cases per year
- Plastic brick - 8 cases per year
- Coin/disk (plastic) - 7 cases per year.

Most accidents that involve toys or parts of toys are of a trivial or minor nature and all accidents with serious or very serious outcomes involved toys or parts of toys which would fit completely within the small parts cylinder (DTI, 1999).

Of the accidents caused by other objects (i.e. neither food, toys or parts of toys), some 30% are caused by coins, followed by different types of small objects. Most of these accidents are also of a minor or trivial nature. The main hazards came from the following items (estimated data for children under 4 from 1986 to 1996 show there were an average of 846 incidents a year involving other objects):

- Coin - 255 cases per year
- Paper/foil - 93 cases per year
- Piece of plastic/metal - 47 cases per year
- Top of bottle/tube - 31 cases per year
- Piece of glass - 30 cases per year
- Packet/packaging/bag - 24 cases per year.

<sup>5</sup>Mean daily mouthing times are presented in the **Main Report**

#### 4.6 HAZARDS FROM ITEMS MOUTHED IN THIS STUDY

The items that children mouthed in this study were assessed for their potential hazards to young children, for example in terms of choking, suffocation, or foreign body type incidents and for comparison to the items recorded as causing choking incidents.

Presented in Table 4 are the mouthed items considered to be a potential hazard, what they are made out of, and what possible hazard they represent.

| Item   | Made from                  | Potential Hazard                 |
|--|----------------------------|----------------------------------|
| Building block   | Plastic/rubber/wood        | Choking/cut/foreign body         |
| Pen/pencil   | Metal/plastic/wood         | Cut/foreign body/puncture        |
| Spoon and toy spoon  | Metal/plastic/wood         | Cut/foreign body                 |
| Toy figures and accessories                                      | Plastic/rubber/metal       | Choking/foreign body             |
| Play food  | Plastic                    | Choking/foreign body             |
| Ball   | Fabric/foam/plastic/rubber | Choking/foreign body             |
| Remote control (TV, CD player)                                   | Plastic                    | Choking                          |
| Toothbrush   | Nylon/metal/plastic        | Choking/foreign body/puncture    |
| Paper  | Wood pulp                  | Choking                          |
| Baby wipes/tissues   | Fabric/paper               | Choking                          |
| Crayon   | Wax/wood                   | Choking/foreign body             |
| Jigsaw piece   | Wood/cardboard             | Choking                          |
| Stacking cups/rings  | Plastic                    | Choking/foreign body             |
| Balloons   | Foil/rubber                | Choking/foreign body/suffocation |
| Doll accessories   | Fabrics                    | Choking/foreign body             |
| Sponge   | Foam                       | Choking                          |
| Cuddly toy   | Fur                        | Choking                          |
| Key and toy key  | Metal/plastic              | Choking/cut/foreign body         |
| Pen top  | Plastic                    | Choking/foreign body             |
| Coin and toy coin  | Metal/plastic              | Choking/foreign body             |
| Straps/cords   | Canvas/fabric              | Strangulation                    |
| Chocolate wrapper/crisp packet/cake cup/packet                   | Foil/plastic               | Choking/cut                      |
| Cables (electrical, telephone, games controllers)                | Plastic                    | Strangulation                    |
| Bottle lids/tube lids/bottle tops e.g. shampoo, glue, toothpaste | Plastic                    | Choking/foreign body             |
| Cloth  | Fabric                     | Choking                          |
| Ring and toy ring  | Metal/plastic              | Choking/foreign body             |
| Bag  | Plastic/fabric             | Suffocation                      |

| Item                                 | Made from            | Potential Hazard              |
|--------------------------------------|----------------------|-------------------------------|
| Hair band/clip/scrunchie             | Fabric/plastic/metal | Choking/foreign body          |
| Fork and toy fork                    | Metal/plastic        | Cut/foreign body/puncture     |
| Modelling clay                       | Dough                | Choking                       |
| Necklace and toy necklace            | Metal/plastic        | Choking/strangulation         |
| Straws                               | Plastic              | Choking/foreign body/puncture |
| Clothes peg                          | Wood/plastic         | Choking                       |
| Fridge magnet                        | Plastic/metal        | Choking/foreign body          |
| Fur                                  | Natural              | Choking                       |
| Bamboo cane/stick/<br>lollipop stick | Wood/plastic         | Cut/foreign body/puncture     |
| Cassette tape, reel of tape          | Plastic              | Choking/strangulation         |
| Toy screwdriver/ screw               | Plastic              | Cut/puncture                  |
| Comb                                 | Plastic              | Choking/puncture              |
| Dressing gown belt                   | Fabric               | Choking/strangulation         |
| Emery board/nail<br>file/sandpaper   | Wood                 | Cut                           |
| Knife and toy knife                  | Metal/plastic        | Cut/foreign body              |
| Lip salve/lipstick/ make-up          | Plastic              | Choking/foreign body          |
| Pebble                               | Stone                | Choking/foreign body          |
| Scissors                             | Plastic              | Cut/puncture                  |
| String                               | Nylon                | Choking /strangulation        |
| Zip                                  | Metal                | Cut/choking/pinch             |
| Ball bearings/ marbles               | Glass/plastic/rubber | Choking/foreign body          |
| Coat hanger                          | Plastic              | Foreign body                  |
| Eraser                               | Rubber               | Choking                       |
| Magnet                               | Metal/plastic        | Choking                       |
| Badges                               | Cardboard/metal      | Choking/foreign body/puncture |
| Beads                                | Plastic              | Choking/foreign body          |
| Cotton thread/wool                   | Cotton               | Choking/strangulation         |
| Laces                                | Fabric               | Choking/strangulation         |
| Whistle                              | Plastic              | Choking                       |
| Bath toy                             | Foam                 | Choking/foreign body          |
| Brush/hairbrush                      | Plastic/fibres       | Choking                       |
| Buttons                              | Plastic/metal        | Choking/foreign body          |
| Toy car wheel                        | Rubber               | Choking/foreign body          |
| Dice/domino                          | Plastic              | Choking                       |
| Hat bobbles                          | Fabric/plastic       | Choking                       |
| Pencil sharpener                     | Metal                | Choking/cut                   |

| Item                   | Made from | Potential Hazard                   |
|------------------------|-----------|------------------------------------|
| Toy pliers             | Plastic   | Cut/pinch                          |
| Rope                   | Nylon     | Choking/strangulation              |
| Seashell               | Natural   | Choking/foreign body               |
| Soap                   |           | Choking/foreign body               |
| Soil                   | Natural   | Choking/foreign body               |
| Tape measure           | Plastic   | Choking/strangulation              |
| Cable tie              | Plastic   | Choking/foreign body               |
| Cafetiere plunger      | Metal     | Choking/cut                        |
| Can                    | Metal     | Cut                                |
| Candle                 | Wax       | Choking/foreign body               |
| Chalk                  | Natural   | Choking/foreign body               |
| Toy drill bit          | Plastic   | Foreign body/puncture              |
| Toy fire engine ladder | Plastic   | Choking/foreign body               |
| Toy fishing rod        | Plastic   | Choking/foreign body               |
| Gasket                 | Rubber    | Choking/foreign body               |
| Pastry cutter          | Plastic   | Cut                                |
| Radiator cap           | Plastic   | Choking                            |
| Rubber band            | Rubber    | Choking/strangulation/foreign body |
| Shredded paper         | Wood pulp | Choking                            |
| Syringe                | Plastic   | Cut/foreign body/puncture          |
| Toy bolt               | Plastic   | Choking/foreign body               |
| Toy fire extinguisher  | Plastic   | Choking/foreign body               |
| Toy traffic lights     | Plastic   | Choking/foreign body               |

**Table 4: Mouthed items that present a mechanical hazard to children**

Without examining individual items it is difficult to assess potential hazards, but there are categories of items which could be seen as potentially hazardous. When the list of objects mouthed in this study is compared to information on choking accidents, of the toys or parts of toys which were cited as involved in choking accidents by the DTI (1999) report (13 items or categories), all but 2 were recorded as being mouthed by children in this research. Of the other objects involved in choking accidents (52 items of categories, not including unknown items) 31 were recorded as mouthed by children in this research. This is evidence that the items causing choking are commonly mouthed and are not isolated incidents.

The findings of this study reinforce the fact that the high risk age for choking incidents is up to 1 year as having the greatest exposure to choking hazards both in terms of mouthing time and the number of objects mouthed. The study also shows that children up to 3 years of age are at risk from the items they mouth.

## 4.7 REDUCING ACCIDENT LEVELS

The types of items that are recorded as causing choking incidents were commonly and frequently mouthed in this study. In fact the toy category 'building blocks/bricks/shapes' which is cited as one of the major toy types involved in choking incidents was fifth in the list of most commonly mouthed toys in this study.

Most strikingly, the results of this study illustrate the huge variety of items that are mouthed by children, and that most items in the home are likely to be mouthed, particularly once the child becomes mobile. This means that it is not possible to identify specific design features of an item that makes it more likely to be mouthed. If the complete list of toys and other objects mouthed is examined in the **Main Report** the vast range of characteristics of each item can be seen.

This study highlights that the majority of items mouthed were made of plastic. However, given that many items in the home are made of plastic the exposure level of children to the material is much higher than (for example), exposure to items made of glass or metal. Also, there are different types of plastic, such as soft and hard plastic, which were not distinguished between in this study.

### 4.7.1 TOYS

Accident statistics show that toys which cause serious or very serious choking accidents always involve toys or parts of toys that fit within the small parts cylinder, such as marbles, ball bearings, beads and building blocks. Additionally, some toys have small part components, such as pieces of a toy which would then fit through the small parts cylinder if separated from the main toy body. Although toys that fail the small parts cylinder test should not be given to children under the age of 3, children who have older siblings may well have access to such products.

This leaves few options with which to try and reduce the number of choking accidents caused by such items. One route would be to remove all small parts from toys intended for children, although this would have obvious ramifications for industry. For small items such as marbles and building blocks, legislation could be introduced to require a new minimum size for them to ensure that small children would not be able to swallow them if they had access to them, or to ban all such items altogether. By effectively banning small toys or parts of toys consideration needs to be given to the effect this would have on older children who play with small toys to develop motor and cognitive skills, for example using building blocks to construct objects. By banning small toys or toys with small parts "the benefit would be to eliminate a maximum of 100, mostly minor, accidents. The cost would be to deprive children of an opportunity to learn valuable skills" (p3,DTI, 1999).

Extending or changing the legislation on the small parts cylinder has been assessed for its potential impact on accident numbers by previous DTI research (DTI, 1999). By extending the current regulations to cover 4 year olds it has been estimated that some 19 accidents a year involving small toys or parts of toys could be prevented (of which one would be serious or very serious). If children under the age of 3 could be prevented from coming into contact with small toys or parts of toys (i.e. if they were banned) then a further 109 accidents a year could be prevented, with a further 19 for three to four year olds.

#### 4.7.2 OTHER OBJECTS

It is logical that by "banning" small toys and small parts of toys we will reduce the potential hazards to children, but there are many problems with this approach. Also, banning small toys will have no effect on the hazards posed by the many small objects that children may have access to in their homes.

Obviously it is impossible to use legislation to restrict children's access to objects other than toys which may be a hazard, although it may be possible to alter a design to reduce the potential hazard. Of the six items listed in Section 4.5, which cause most choking accidents, two are not whole items (i.e. pieces of glass or of plastic/metal), two are packaging (i.e. bags or packets, and paper or foil) and the others are coins and bottle or tube tops. Of these items only bottle and tube tops offer any potential for re-design to reduce the choking hazard they offer, if the shape could be altered in some way. Further design research and evaluation would be required to examine the feasibility of such a move and its potential in reducing the numbers of choking incidents.

#### 4.8 USING PRODUCT FEATURES TO DETER MOUTHING

An alternative to removing the possibility of children coming into contact with toys and non-toy items through banning them, is discouraging children from mouthing these items by altering the product characteristics. Product characteristics have been separated into the following categories, with potential ways of discouraging mouthing attached to each. These are initial ideas only, and should be fully researched before being implemented to ensure that natural child development is not impeded and that the desired effect is produced.

**Colour** - young children may be attracted to brightly coloured toys. Toys intended for use by older children, i.e. over 3 years of age, could be less brightly coloured so as not to catch the eye of younger children.

**Taste and smell** - if toys or products taste and/or smell bad then children may be less likely to mouth them. For instance, bitter tasting agents have been used in some household products to limit children from swallowing a large amount. A similar taste or an off-putting smell could perhaps be applied to toys and other objects commonly mouthed (but not intended to be mouthed) to discourage children from doing so. However, this study shows that children mouth on metal and other bad tasting items and also on items with an unpleasant smell, which indicates that in younger children, at least, taste and smell are not strong deterrents to mouthing.

**Texture** - children do not appear to be put off mouthing by the texture of an item (i.e. whether it is rough or smooth), but future research could assess if any particular texture would discourage children from mouthing.

**Size and shape** - children mouth items of any size, but obviously only the smaller items will fit into their mouths and become a choking hazard. The shape of an item does not appear to be a factor in children's tendency to mouth an item.

# Chapter 5

## Conclusions

This study has produced reliable data on the mouthing behaviour of children up to 5 years of age, as shown by the investigation of the validity of the observation protocol used in the study. It gives quantitative evidence of mouthing behaviour which can be used to guide the design and regulation of items intended to be given to children to be mouthed, intended to be given to children but not mouthed, and those items that are not expected to be given to children but even so are likely to end up being mouthed. The main findings of the study were:

- i) no general trend of increase or decrease over ages 1 month to 5 years was found for mouthing on all items, although there are differences between age groups within that range
- ii) mouthing on toys and other objects (which are most likely to be a hazard) shows a trend with age. For maximum estimated daily mouthing 2 year olds mouth for as long as 6-9 month olds (approximately five hours a day)
- iii) sucking was the most commonly observed mouthing behaviour, accounting for approximately two thirds of all observed mouthing behaviours
- iv) approximately half of all toys and other objects mouthed were made of plastic
- v) only around 25% of all toys and other objects mouthed in this study were considered as intended to be mouthed, and around 30% (after age 3 months) of those were made of plastic
- vi) no significant differences were found between the sexes in mouthing times, and no significant difference was found for mouthing times at different times of the day
- vii) a wide array of items were mouthed by the children in this study.

Further information on mean daily mouthing times on items and the types of items mouthed may be found in the **Main Report**.

In terms of mechanical hazards, the results of this study support the accident statistics on choking, in that the highest mean mouthing time is by children under 3 (the high risk age for choking) and particularly children under 1 year, who mouth the most and put the widest variety and number of items into their mouth. The high risk age is when children become mobile and can access items around them rather than being restricted to items that are given to them. The items being mouthed in this study are similar to those most commonly involved in choking accidents.

Mouthing is a natural, developmental behaviour which is impossible to stop in young children. This study has shown that a huge variety of items are mouthed, particularly by children under 1 year, due to teething and using mouthing as a method of exploring their environment. Instruction to children of this age as to what can and can't be placed in the mouth is not feasible. It is also not feasible to physically, or legislatively, restrict the access of young children to their environment. The main route to the prevention of hazards associated with mouthing, particularly such as choking, is through parental/carer observation. Continued education of parents and carers is necessary to ensure the awareness of hazards associated with mouthing, and particularly of those items that accident statistics have shown can cause choking, e.g. food, balloons, coins and marbles.

However, this study has shown that nearly all items a child comes into contact with will be mouthed. This is evidence to suggest that those items which are intended to be used by or with children, particularly toys and child use and care items, should be designed with this hazard in mind. This would include obvious items such as dummies/soothers, feeding equipment and rattles, but also items such as restraints, nursery furniture, bathing items and stair gates. Standards and guidance for these products should include requirements to prevent any hazards associated with mouthing.

Anecdotal evidence from many parents taking part in this study indicated surprise at how much their child actually mouthed (both in terms of the number of times items are mouthed and the number of items mouthed), and that they would have usually missed the short duration mouthing behaviours exhibited by their child. This evidence lends support to keeping the most potentially hazardous items out of the reach of children, as parents cannot always be watching their child and controlling what they put into their mouths, and as far as possible using design standards and legislation to ensure those items which young children are likely to come into contact with, and therefore mouth, do not present any mouthing hazards.

# Chapter 6

## Recommendations

The results of this study illustrates the huge variety of items that are placed in the mouth by children, and that most items in the home are likely to be mouthed, particularly once the child becomes mobile.

Unlike controlled environments such as nurseries and crèches, the home environment is virtually impossible to make entirely free from potentially hazardous items. This leaves the following paths to reducing choking accidents in children.

### 6.1 TOYS

If we accept that children under the age of 3 may have access to toys intended for children over 3 (i.e. that would fail the small parts test) because they have older siblings, then the only way to reduce their potential hazard is by the parents taking care about storage and use of such toys or removing them from the environment altogether (i.e. banning all small parts in toys).

A total ban on small parts is unfeasible. Also, given that choking accidents involving toys only account for 6% of cases for children under 4 years of age and only 4% of choking fatalities (children under 3 between 1986 - 1995, DTI 1999) were caused by toys or parts of toys the impact of such sweeping legislation on choking hazards would be small. This leaves the best way to reduce accidents caused by toys or parts of toys to be through educating parents and carers about the dangers posed by certain products, and best practice to reduce potential hazards in the home.

### 6.2 OTHER OBJECTS

Obviously it is not possible to remove all objects which represent a potential hazard from the home, and so again the best policy is to educate parents and carers about which items are commonly mouthed and commonly cause choking accidents.

If there are certain objects that children mouth on which are considered to be especially hazardous, perhaps consideration should be given to design features to discourage mouthing. However, this would require a degree of initial research followed by trials of re-designed items and then post design assessment to ensure that there is no unintended impact on child development and safety.

This research has demonstrated that children mouth on such a large range of items, both toys and other objects, that it is impossible to stop them doing so through legislation. The most productive way forward is to continue to educate parents and carers, ensuring they understand that:

- all young children mouth naturally as a way of exploring their environment
- they will mouth on virtually any item they have access to
- if they have older siblings then they may have access to toys with small parts
- marbles, building bricks and beads are the main causes of choking hazards from toys
- the main choking hazards from other objects mouthed involved coins, pieces of paper/foil/plastic/metal, bottle and tube tops, pieces of glass and packaging/packets
- the best way to prevent choking accidents is by restricting access to hazardous items. For example, putting away toys after use.

However, it is also important that the risk of children choking on toys and other objects is not overstated. The accident statistics (DTI, 1999) show that the number of choking cases for children under 4 on all items is declining, and that 51% of cases are caused by food, 32% by other objects and only 6% by toys or parts of toys. The vast majority of cases (88%) are also classed as minor or trivial. There are still a small number of choking fatalities, but over the period 1986 to 1995 only 4% (or nine cases) were caused by toys or parts of toys, and 8% by other objects. The vast majority of fatalities (69%) were food related.

# Chapter 7

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