



## ORIGINAL ARTICLE

**Everything is awesome: Don't forget the Lego****Andrew Tagg,<sup>1,2</sup> Damian Roland,<sup>3,4</sup> Grace SY Leo,<sup>5,6</sup> Katie Knight,<sup>7</sup> Henry Goldstein<sup>8,9</sup> and Tessa Davis,<sup>7</sup> on behalf of Don't Forget The Bubbles**

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**Aim:** Children frequently ingest coins (generally with minimal reported side effects); however, the ingestion of other items has been subject to less academic study. Parental concern regarding ingestion applies across a range of materials. In this study, we aimed to determine typical transit times for another commonly swallowed object: a Lego figurine head.

**Methods:** Six paediatric health-care professionals were recruited to swallow a Lego head. Previous gastrointestinal surgery, inability to ingest foreign objects and aversion to searching through faecal matter were all exclusion criteria. Pre-ingestion bowel habit was standardised by the Stool Hardness and Transit (SHAT) score. Participants ingested a Lego head, and the time taken for the object to be found in the participants stool was recorded. The primary outcome was the Found and Retrieved Time (FART) score.

**Results:** The FART score averaged 1.71 days. There was some evidence that females may be more accomplished at searching through their stools than males, but this could not be statistically validated.

**Conclusions:** A toy object quickly passes through adult subjects with no complications. This will reassure parents, and the authors advocate that no parent should be expected to search through their child's faeces to prove object retrieval.

**What is already known on this topic**

- 1 Children frequently ingest foreign objects.
- 2 Parents worry about transit times and complications from ingestion.

**What this paper adds**

- 1 A predefined object passes through adult patients in 1–3 days.
- 2 There were no complications in our subjects.
- 3 Parents should be counselled not to search for the object in stools as it is difficult to find.

During the early oral developmental phase (6 months to 3 years),<sup>1</sup> children learn to explore their environment and may ingest things that offer no nutritional value. Whilst some of these items may be harmful – disc batteries, certain medications – most are inert and offer nothing more than inconvenience. This may explain why, in 2002, there were over 128 000 reported incidents of foreign body ingestion or aspiration in the UK.<sup>2</sup> Whilst coins are the most commonly ingested item, and a swathe of literature has been devoted to their passing, there has been very little text dedicated to the second most commonly ingested item,<sup>3</sup> nominally categorised as 'toy parts'.

Early work by Spitz<sup>4</sup> suggested that most coins pass within 3.1–5.8 days with no adverse effects. The authors wondered if smaller, lighter toy parts might pass more rapidly and with a similar safety profile.

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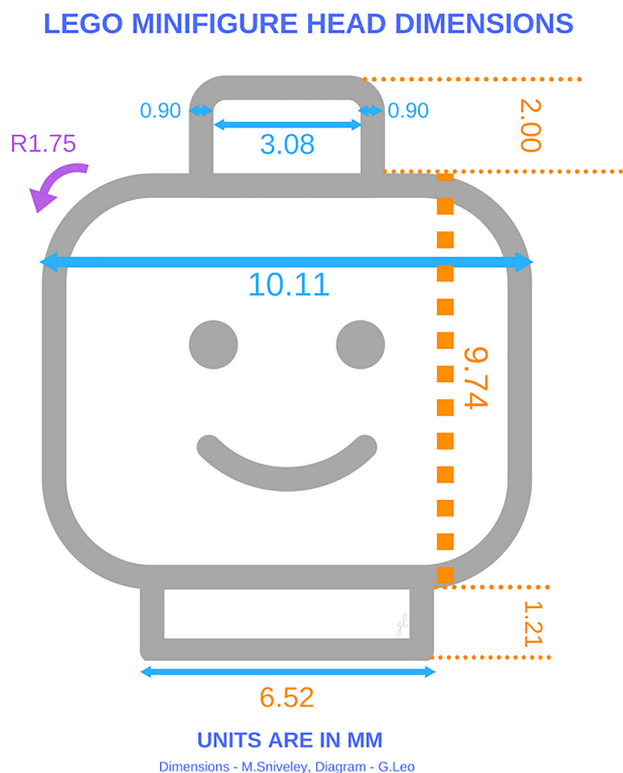
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There has been a noble tradition of self-experimentation in the field of medicine – from Werner Forssmann performing his own cardiac catheterisation<sup>5</sup> to Barry Marshall swallowing a flask of *Helicobacter pylori*.<sup>6</sup> With that in mind, the authors felt that they could not ask anything of their test subjects that they would not undertake themselves.

**Methods**

Participation was open to health-care professionals working in the field of paediatric hospital care, with exclusion criteria being previous gastrointestinal surgery, inability to ingest foreign objects or an aversion to searching through faecal matter. Six participants were recruited from an established discussion forum related to an educational website the authors were involved in or associated with.

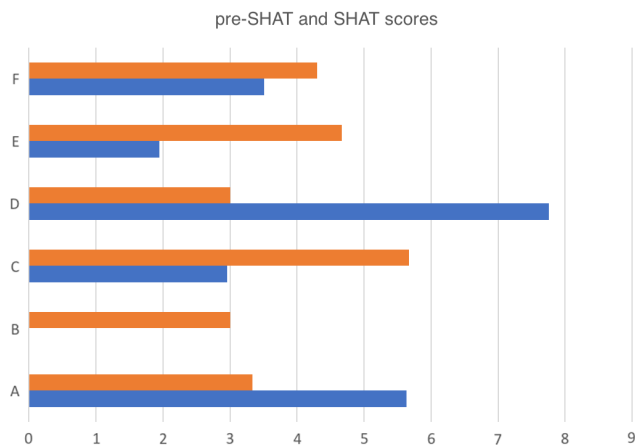
Prior to ingestion of the Lego head, each participant kept a 3-day stool diary noting volume and Bristol Stool Chart score for their bowel movements. This was based on The European Society for Paediatric Gastroenterology Hepatology and Nutrition guidance on monitoring stool output. To standardise bowel habit between participants, we developed a Stool Hardness and Transit (SHAT) score to look at stool consistency over time. The



**Fig. 1** Lego head dimensions. Units are in mm. (Dimensions: M Sniveley; Diagram: G Leo.)

SHAT score is the sum of the Bristol Stool Chart scores over a specific time period divided by that time period in days. A high score indicates more frequent, loose bowel motions (i.e. gastrointestinal upset may be a factor in transit time), whilst a low score indicates less frequent or more firm motions (i.e. more sluggish bowel habit). The pre-SHAT score was the sum of the Bristol Stool Chart scores divided by three (the number of days of logging prior to ingestion). The SHAT score quotient was the time taken to pass the stool containing the object.

The foreign object (Fig. 1) was chosen as it is a standard toy found in most households. It allowed for each participant to ingest an object of the same size and shape. Foreign objects were ingested at the same time of day (between 0700 and 0900 h) to



**Fig. 2** Pre-Stool Hardness and Transit (SHAT) versus post-SHAT scores. (■, Pre-SHAT; ■, SHAT).

minimise diurnal variation in bowel habits. No participant was working night shifts during the time of the study.

Post-ingestion, stools were monitored and examined in search of the excreted item. The search was conducted on an individual basis, and search technique was decided by the participant. The primary outcome was the Found and Retrieved Time (FART) score.

## Results

Six participants were included in the study (Table 1). Half were female. Age of participants ranged from 27 to 45 years, with a mean age of 36.2 years. Five of six participants were able to locate the Lego head in their stools. The male participant who had not located the Lego head searched stools for a total of 2 weeks after ingestion.

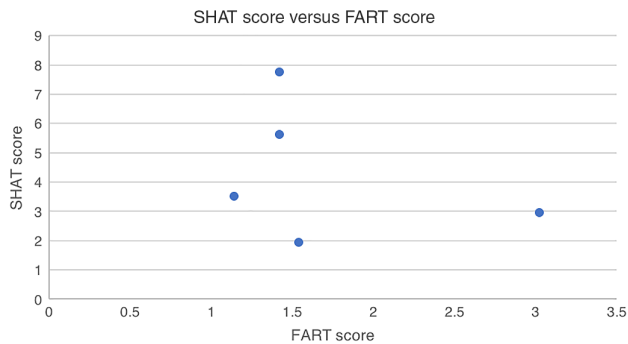
Of the successfully retrieved Lego heads, the number of bowel motions searched ranged from one to three, with an average of two bowel motions. The females appeared to have faster passage of the foreign body, retrieving the Lego head within two bowel motions, whereas the two males who retrieved their Lego heads both did so on their third bowel motion. The principal finding of this study, the FART score ( $n = 5$ ), ranged from 1.14 days (27 h 20 min) to 3.04 days (72 h 35 min), with an average retrieval time of 1.71 days.

Comparing the stool diaries pre- and post-ingestion, there was no significant difference in consistency of stool over time (Fig. 2).

**Table 1** Patient characteristics and data

Patient	A	B	C	D	E	F
Age	38	41	45	34	27	32
Gender	F	M	M	M	F	F
Number of stools to retrieval	2	NA†	3	3	1	1
FART score	1.42	NA	3.02	1.42	1.54	1.14
Pre-SHAT score	3.33	3	5.67	3	4.67	4.3
SHAT score	5.63	NA	2.96	7.76	1.95	3.51

†Patient B searched through 13 stools over the 2-week period. FART, Found and Retrieved Time; NA, not applicable; SHAT, Stool Hardness and Transit.



**Fig. 3** Stool Hardness and Transit versus Found and Retrieved Time scores.

The pre-SHAT score ( $n = 6$ ) ranged from 3 to 5.67 prior to ingestion, and the SHAT score ( $n = 5$ ) ranged from 2.96 to 7.76. Comparing these two markers using a Wilcoxon signed rank test demonstrates no significance ( $\alpha_{\text{two-tailed}} \leq 0.1$ ) between Bristol Stool Scores over time before and after ingestion. This suggests that the ingestion of the Lego heads did not appear to have a significant impact on the consistency of bowel motions in participants.

The SHAT score post-ingestion was compared with the FART scores to see if a higher SHAT score (looser stools with greater frequency time) reduced the time of retrieval (Fig. 3). There was no significant correlation found ( $r(3) = -0.33$ ,  $P = 0.58$ ).

## Discussion

In this novel study, it was determined that a predefined toy object passed through adult subjects, on average, in 1–3 days with no complications. It is possible that childhood bowel transit time is fundamentally different from adult, but there is little evidence to support this, and if anything, it is likely that objects would pass faster in a more immature gut. This will be of use to anxious parents who may worry that transit times may be prolonged and potentially painful for their children. Our *in vivo* study has also provided some interesting insights for further research. First, females (in this study) were more likely to retrieve the foreign body earlier, or indeed at all, compared to males. Sadly, this study was not powered to confirm whether this is a true difference. If an experienced clinician with a PhD is unable to adequately find objects in their own stool, it seems clear that we

should not be expecting parents to do so – the authors feel that national guidance could include this advice.

Second, the FART score is shorter than the estimated time for passage of coins by Spitz (reference). The reasons for this are not clear and may only be answered by a factorial design study in which both coins and Lego heads are swallowed (ideally with one study arm including swallowing a Lego figurine holding a coin). We acknowledge different objects may have shorter or longer transit times, and it would perhaps be useful to repeat this study with a body or leg part to see if sharp or irregular surfaces of the plastic structure slow gut passage. We would surmise, in the absence of anecdotal evidence to the contrary, that material that can pass through the pyloric sphincter will pass through the anal sphincter.

There are some limitations to our study. The population studied could not be blinded to the study outcomes as we felt it was unfair on the authors' partners or colleagues to search through their waste products. We also recognise that the Stool Hardness and Transit score is not a perfect surrogate for underlying bowel pattern, but the fact that participants can SHAT themselves without specialist knowledge makes it an inexpensive tool.

## Conclusions

This international, multicentre trial identified that small objects, such as those swallowed by children, are likely to pass in 1–3 days without complication. This should offer reassurance for parents.

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