5.1 Introduction

Child Resistant Closures (CRC) are applied to packaging in order to prevent young children from gaining access to harmful contents. This is most commonly seen in the storage of medicines which when ingested by a child can be extremely dangerous and cause poisoning. There are two main types of CRC: reclosable and non-reclosable. In the UK, they are regulated by separate British Standards. This article focuses on the design and use of reclosable packaging which relates to ISO 8317:2003 (ISO, 2003).

Regulations on the supply of highly toxic medicines such as aspirin and Paracetamol, were first produced in the early 1970’s (US Government, 1970). These regulations led to the production of child resistant packaging, firstly reclosable bottles and more recently blister packs. Child resistant packaging for products containing aspirin, paracetamol and iron has become mandatory in the UK since 1 October 2003 by means of a Statutory Instrument (2003), the Medicines (Child Safety) Regulations.

The main reclosable CRCs in use today are ‘push and turn’, ‘align and push up’ and ‘squeeze and turn’, and of course, all meet current standards. A typical example of this kind of closure is shown in Figure 5.1.

Figure 5.1. Typical ‘push and turn’ closure for medicine bottles
The current test for CRC reclosable packaging contains an adult test on 50 to 70 year olds and a test on children from 42 months to a five years old. A reclosable design is deemed to fail if a child is able to gain access to sufficient doses to cause severe injury or damage or to remove more than eight units.

Several studies have been undertaken to find out how children access packaging in order to design more foolproof products. An article titled *Childhood poisoning: access and prevention* gathered evidence on how children gained access to six poisoning agents. It was found that the children generally gained access whilst the agent was in use. The article concluded that there was little scope for improved supervision, but that child resistant packaging should be improved. (Ozanne-Smith *et al.*, 2001).

For most, if not all, current reclosable designs when they are in use the CRCs are removed leaving access to all of the package contents. Therefore, if most poisoning happens whilst a product is in use then this highlights a major flaw in current CRC design.

A study in the US into *The effectiveness of child resistant packaging for aspirin* found a 34% reduction in the aspirin-related mortality rate, which equated to the prevention of about 90 child deaths during the 1973 to 1990 post-regulatory period. The study suggested that child resistant packaging has been only partially effective and further poison prevention strategies should be developed (Lemberskyy *et al.*, 1996). This suggests that CRCs are effective but there is still room for improvement.

It can be seen from the literature review that the unintentional ingestion of medications with significant toxicity, particularly by children, could be attributed to a lack of a CRC, inadequate design of CRC’s, attitudes concerning the toxicity of medications, lack of vigilance by parents and carers in storage and administration or a combination of all these problems.

There is therefore, a significant tension between the demand to keep the contents of the bottle away from children and yet allow access to those who need it, particularly older people. This tension leads to the misuse of the CRC and a loss of the perceived benefits that the CRC is designed for.

New measures for child resistance look into the reasons children try to open the bottles and focus more on a complete rethink of child safety than merely improving the closure. Investigation has shown that children are often intrigued by the noise of the tablets inside the bottles which can sound like a rattle.

Research carried out in the US by Bix *et al.* (2004) has highlighted the playful, inquisitive nature of children as traits which could be exploited by medication container designers. She has looked into placing the tablets into a gel which would stop them from rattling, obviously the problems are possible contamination of the medication and how are the tablets removed from the gel. Another fairly recent design exploits an adult’s greater ability to read by turning a cap through a sequence of letters before the cap will open.

Although there is currently a large amount of research being put into the design of new CRCs there have been few changes or developments to the CRCs we use today over the last twenty years. The same designs are being manufactured. The ‘push and turn’ closure is the most widely used design of CRC: it requires the lid to be pushed down onto the body of the bottle before the