Who is not familiar with this scenario: a child is ill, but does not want to take his medicine – after all, the drink is bitter and large tablets are difficult to swallow. One way or another, we have all experienced these scenes in families with children, but it is not only children who dislike taking their medicine or have difficulties taking them with the usual aids; this can well be an issue for geriatric patients as well. A device that is accurate, easy to use and clean is not only going to enable the patient to receive the correct dose, but also gives peace of mind.

In addition to the administration of the medicine, another problem is ensuring the right dose is given. Underdosing of drugs potentially reduces the success rate of both the therapy and the duration of the treatment, thus increasing costs. In some cases this may cause bacterial resistance. Conversely, overdosages may result in potential side effects of the medicine, which is equally problematic. Investigations have revealed that it is not all that easy to handle measuring spoons, dosing syringes and the like. In particular, measuring spoons are unreliable and tend to encourage overdosage. After all, liquids of different viscosity and surface tension still need to be dosed correctly. However, syringe-type dosing systems permit errors in use, such as incorrect reading of the scale.

There are alternatives available though, as this article highlights. Currently, various pharmaceutical companies are developing better drug administration systems, which can provide both exact dosing and user friendly handling. Indeed, there are many versatile polymer assemblies and system solutions to facilitate accurate treatment of the patient. It has also been substantiated that the better the patient’s compliance to a therapy, the better its success. Three examples of interesting solutions substantiate this fact impressively:

- Straw systems for the administration of pre-dosed granulated medicine
- Dose sipping syringes which enable individual dosing and administration at the same time
- Bottle cap systems which double as drug reservoirs

All systems demonstrate that the realisation of innovative ideas can also coincide with a high degree of economic efficiency; after all, in times of tight budgets, low manufacturing costs are an important aspect in the specifications for development. For this reason, well thought out manufacturing concepts with fully automatic injection moulding, extrusion and fabrication processes are the basic prerequisite for subsequent success.

The two systems mentioned above are based on the straw principle since, in...
sipping technology. The second example shows the dose sipping syringe that has been developed with a double function. This innovative product stands out for individual dose and easy intake by using the straw and syringe principle. In steps of 1.25ml, the user or the pharmacist can individually adjust the dose prescribed by the doctor, using a dosing ring (see Figure 3). This individual setting permits a precise treatment adapted to the patient, which is demanded by current demands for personalised medicine. Once the system has been fixed it need not be changed for the duration of the administration. During every administration, the patient will suck in the same volume of fluid and thus will not make any errors in dosing. The dose-sipping syringe is docked to the medicine container by means of an adaptor customised to the bottleneck (see Figure 4), and is dosed upside down (see Figure 5). Subsequently there are two ways of orally administering the medicine. Either the patient uses the dose-sipping syringe like a normal dosing syringe or he or she puts it into a glass with a beverage of his or her choice and applies it like a straw (see Figure 6). A special valve on the inside of the piston permits this flexible use. The product is easily disassembled for thorough cleaning between the individual applications – and the device.

Firstly, this method presents a possibility to administer granulated medicine (see Figures 1 and 2). The straw contains the exact dosage, so the patient need not worry about taking the right amount. He or she rips open the safely-sealed single pack and removes the straw, which is then put into a favourite drink. The child removes the cap, and starts sucking. The straw contains a so-called controller which rises in the straw along with the intake of the medicine. When the total amount has been consumed, this controller stops at the top. This is a reassuring signal for parents, for example, because they can be certain that their child has taken the right dose. Furthermore, the experience will generally appeal to the child.

The system is manufactured using an extrusion plant with a fully-automatic length cutting and stacking device to produce the straw with an accuracy to a hundredth of a millimetre. The units are packed for further processing by the pharmaceutical industry. Computer-assisted recording systems record the manufacturing conditions and save them for batch traceability. The appertaining cap drops from a 32-cavity tool, which is subsequently checked thoroughly by means of a camera system, the results of which are documented.

Fluid drugs can also be dosed and administered individually using the
can also be put in a dishwasher. Subsequently, the dose-sipping syringe is ready for use again very quickly.

The manufacturing concept for large scale series includes a fully automatic assembly controlled entirely by vision inspection systems, ensuring that the user receives a consistently high quality product. In this way, it is ensured that the user receives an invariably high quality product. The production is carried out in Class 7 cleanrooms in accordance with ISO 14644 and with a quality management system in conformity with ISO 13485. Naturally, the polymer processor has also obtained CE approval for the device.

Many drugs may only be mixed with water immediately prior to intake. Here it is also important to keep to the precise dose; easy, straightforward handling increases the patient’s compliance. When opening the device a tamper-evident closure indicates clearly that the dose has not been opened yet. After its removal, an easily handled but effective mechanism ensures that fluid and powder can be mixed. In the third step, the medicine is released for administration to the patient. Safety is equally important, especially to avoid breaking off fingernails.

The entire range of polymer processing technologies can be applied in the manufacture of these products. Extrusion of almost all thermoplastic materials as well as silicones is technically possible. Another approach is precision injection moulding, including multi-component or sandwich injection moulding. The latter process is applied, among others, when properties are required which one polymer material alone provide, such as barriers to oxygen and water vapour.

Although the patient’s viewpoint is significant, it is not the only way of looking at the development of these devices. An economically viable filling process is a decisive prerequisite for the pharmacist for subsequent success on the market. Pharmacists need slim linear processes because otherwise the filling plants become complicated and expensive. For this reason, it is becoming more important to discuss the processes with the pharmacist, manufacturer of the highly complex filling techniques and polymer processor at an early point in time. The key to success is to seek solutions right from the beginning that are patient-friendly, ensure a highly economical filling process, and permit pharmacists enough range for differentiation.

CONCLUSION

The three examples above demonstrate that today’s drug administration systems are able to do much more than measuring spoons, dosing syringes and the similar devices in the past. Precise dosage of the medicine and safe, user friendly patient administration, with consideration of the economic demands in the filling process, can be optimised in a perfect manner with polymer materials for the benefit of patients.

About the author

Frank Richter has been Head of the Business Marketing and Sales team within the Moulding/Pharma Solutions strategic business unit at RAUMEDIC AG since 2004. Within this role, he is jointly responsible for the strategic alignment of the company in the pharmaceutical market. His career in the REHAU group, a globally active polymer processor, began almost 20 years ago when he was a product manager for the furniture supply industry. In 2000 he changed division, then still within REHAU, and was responsible for medical technology and pharmaceutical polymer solutions. Frank has undergone vocational training in both plastics technology and business.

Email: info@raumedic.com