‘Get going and stay going’
with pump therapy —
educating adolescents
about pumps

Rebecca Thompson

Introduction
The incidence of Type 1 diabetes in children and young people is increasing with a prediction that prevalent cases in those aged less than 15 years will rise by 70%. With this increase, in the absence of an immediate “cure”, ways of helping children cope with the demands of diabetes and improving outcomes become essential.

Managing diabetes within a full and active life is challenging for young people, with only 16.2% of children in the UK achieving an HbA1c of less than 7.5% (<59 mmols/mol). There is clearly scope for improvement and we need to look at ways of delivering insulin that are more acceptable to the adolescent population.

Many healthcare teams outside the UK have demonstrated with appropriate selection, young people quickly master continuous subcutaneous insulin infusion (CSII) therapy. However a survey by Medical Technology Group confirmed that overall uptake and utilization of CSII was low, with Primary Care Trusts having an average rate of pump provision at 3.9% compared to the 12% benchmarked by NICE.

It is important to recognize that technology alone is insufficient to improve glycaemic control. As education and support influence the success of CSII, this places emphasis on careful preparation and education of young people. Yet there remains uncertainty and lack of guidance as to what skills, abilities, education or motivators might influence success in initiation of CSII.

The UCLH pathway
The team at University College London NHT Trust has now initiated over 150 insulin pump starts in children aged between 13 months and 17 years. Those using CSII represent 48% of the total caseload, with the remainder using multiple daily injections (MDI).

Children and young people using insulin pump therapy have consistently lower HbA1c values than those using MDI (see Table 1), with 48% of those on pumps hitting a target HbA1c value of less than 7.5% (<59 mmols/mol) and 61.6% getting less than 8.0% (<64 mmol/mol). Extrapolating data for 2010 into paediatric and adolescent age groups shows that adolescents on pumps gain better HbA1c levels than adolescents on MDI (median HbA1c 8.4% compared to 8.9%) and children on MDI (median HbA1c 8.5%).

Pre-pump
Adequate pre-pump education is critical to the success of pump therapy with an acknowledgement that successful pump candidates are those who demonstrate frequent blood glucose monitoring, maintain records, count carbohydrates and have good relationships with their healthcare team.

The team at UCLH have incorporated the competences outlined by Kaufman et al. (2001) that are now used routinely in clinic to objectively assess the level of diabetes knowledge and skills of a young person and their carers (Table 2). The diabetes team use these competences to support young people moving to CSII. Adolescents wishing to move to insulin pump therapy need to demonstrate that they are at level 5 prior to initiating a pump. After starting the pump, the competencies are used to identify knowledge and skills that the young person could learn to become more proficient at using the pump once they become confident with the day-to-day basics.

Needle fear
There is little indication as to which factors may impede optimal glycaemic control. It is suggested that as part of CSII assessment and initiation, evaluation of needle fearfulness may be indicated. A pump trial has two useful elements. The first is that the nursing team are able to observe the reaction to the insertion of the cannula, with those adolescents identified as having concerns being offered psychological intervention prior to starting on a pump. The second practical element is that young people can assess their feelings about being attached to a device 24 h a day. This experience enables adolescents to compare the reality of being attached to a pump to their expectations and to see how they feel about a pump being potentially visible to others. For the fashion conscious, young people can purchase appropriate pump pouches before starting the pump for real!

PUMP school
All adolescents who start insulin pump therapy at UCLH undergo 2 days of structured education. This involves a comprehensive explanation of pump functioning, programming, troubleshooting, site care, managing day-to-day experiences such as exercise, hypo and hyperglycaemia and their prevention and emergency actions. This is delivered using power point presentations, button pushing sessions and problem solving. Two age-matched young people are invited to each school which facilitates peer learning and discussion of real life experiences.

The team also think carefully about other individuals who might help support the adolescent and their consequent training requirements. Individuals within schools might not need to be competent to use the pump on a day-to-day basis. However, they do need to have the appropriate knowledge of pump care including what the pump is, treatment of hyperglycaemia and hypoglycaemia including how to stop the pump in an emergency. As a consequence, one or two key individuals from the school are...
invited to attend the pump school with the young person and both parents. This is followed up by the completion of a school medical management plan and the invitation for staff to attend yearly pump workshops in the first week of September each year.

Follow up

The team responds to individual learning needs using telephone, email and clinic appointments. Families are invited to focus on how moving to CSII supports the use of strengths, abilities and resources in self management including how to recognize trends in blood glucose levels and how these relate to management of basal and bolus insulin dosages. Families increasingly demonstrate the ability to independently alter insulin safely with appropriate evaluation following blood glucose monitoring.

The evaluation of learning requirements led to the development of annual ‘pump expert education days’ for all young people and their parent’s using insulin pumps. The programme is developed by the families and the day facilitated by the diabetes team. Families have the opportunity to get together and share successful solutions that they have found to address common challenges in the day-to-day management of diabetes.

Sensors/CGM

At UCLH most young people start on a pump that has the potential for continuous glucose monitoring (CGM). Through the involvement of the hospital contracts team and a tendering process, we have negotiated a financial package that incorporates the use of part-time sensors. For those using pumps without CGM ability, young people can borrow stand alone continuous glucose monitoring devices. Recent studies have shown that for CGM to be effective, it needs to be worn regularly. However, many young people have expressed reluctance to be attached to an additional piece of technology, however small. The nursing team have developed monthly group sensor training sessions which cover both the practical ‘how to insert a sensor’ followed by how to interpret the uploaded data. Whilst these sessions are still in their infancy, those who have attended and talked to other young people about the potential advantages of sensors appear more enthusiastic. At a minimum, young people are encouraged to wear a sensor prior to each clinic appointment. This allows more effective consultations, identification of problem areas and making the consequent changes to insulin settings.

Changing insulin doses

It is recognized that insulin requirements increase during adolescence, with a mean insulin requirement in pubertal young people of 1.25 units/kg/day. Keeping up with insulin increases can be challenging if adolescents reschedule and cancel out patients appointments, resulting in extended periods of time between reviews. This may result in a low total daily insulin dose compared to their weight. For those young people who are seeing a rise in HbA1c, it can be helpful to start again and recalculate both basal rates and ratios using an anticipated total daily dose for their weight.

History screens can provide valuable information. Reviewing the average total daily dose and basal to bolus proportions can help health care professionals advise on insulin alteration. In addition, pumps that provide data on the average number of bolus’s per day can highlight those young people who are struggling to give insulin with food. This information can help

Table 1

<table>
<thead>
<tr>
<th>Mode of insulin therapy and HbA1C</th>
<th>2004</th>
<th>2005</th>
<th>2006</th>
<th>2007</th>
<th>2008</th>
<th>2009</th>
<th>2010</th>
</tr>
</thead>
<tbody>
<tr>
<td>MDI</td>
<td>9.7 ± 0.2</td>
<td>9.2 ± 0.2</td>
<td>9.2 ± 0.2</td>
<td>9.7 ± 0.2</td>
<td>9.6 ± 0.2</td>
<td>Median 9.5</td>
<td>Median 8.6</td>
</tr>
<tr>
<td>CSII</td>
<td>8.6 ± 0.3</td>
<td>7.6 ± 0.2</td>
<td>7.6 ± 0.2</td>
<td>7.7 ± 0.1</td>
<td>7.9 ± 0.1</td>
<td>Median 7.9</td>
<td>Median 7.9</td>
</tr>
</tbody>
</table>

Table 2

<table>
<thead>
<tr>
<th>Competency</th>
<th>Characteristics</th>
<th>Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>Safety</td>
<td>Initial information, injections, blood testing, treatment for hypoglycaemia</td>
<td>1</td>
</tr>
<tr>
<td>Basics</td>
<td>Blood glucose targets, actions for levels out of target, glucagons, action of</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>different types of insulin, diet and carbohydrates</td>
<td></td>
</tr>
<tr>
<td>Carbohydrate management</td>
<td>Determine quantity of carbohydrates in food, use of plan for carbohydrate intakes</td>
<td>3</td>
</tr>
<tr>
<td>Correction</td>
<td>How to correct blood glucose out of target</td>
<td>4</td>
</tr>
<tr>
<td>Daily changes</td>
<td>Decision making about changes in daily routine adjusting insulin and carbohydrate</td>
<td>5</td>
</tr>
<tr>
<td>Base dose adjustment</td>
<td>Making base dose adjustments, review blood glucose values to observe overall</td>
<td>6</td>
</tr>
<tr>
<td></td>
<td>effects of treatments</td>
<td></td>
</tr>
<tr>
<td>Advanced diabetes management</td>
<td>Understand hormone pathways and food absorption; know about strategies to</td>
<td>7</td>
</tr>
<tr>
<td></td>
<td>reduce complications</td>
<td></td>
</tr>
<tr>
<td>Maximized control, basal and bolus therapy</td>
<td>Independence in MDI/ CSII to maximize control, flexibility and freedom</td>
<td>8</td>
</tr>
</tbody>
</table>
provide an honest starting point for conversations with a young person and their family about improving glucose control.

**Conclusion**

With support and education, adolescents using insulin pump therapy achieve better HbA1c than those on multiple daily injections. Whilst there is consensus within healthcare teams that the ‘ideal’ pump candidate is one who is motivated, there needs to be more thought about the young people who do not necessarily fit the selection criteria. The role of CSII in motivating young people to improve their diabetes control warrants further investigation.

**Further Reading**


