Paediatric insulin injection technique: The softer side
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Abstract
This communication highlights the unique features of insulin injection technique in the paediatric age group. It describes the anatomical, neurodevelopmental and psychosocial characteristics of children and adolescents of various age groups. These are correlated to highlight 'best practices' or 'injection manner' which diabetes care providers and care givers should observe, in order to achieve a 'happy' and healthy insulin injection experience for the child.

The softer side of paediatric insulin injection technique adds to existing guidelines on insulin delivery. It encourages research on the special needs and challenges of children and adolescents living with diabetes.

Keywords: FIT, FITTER, injection technique, insulin, paediatric diabetes, type 1 diabetes,

Introduction
This opinion piece aims to encourage collation of evidence, and achievement of consensus, on paediatric insulin technique. We suggest pragmatic recommendation for insulin injection technique in various paediatric age groups. Our suggestions build up upon, and in no way contradict, current guidelines on the topic. These best practices draw upon basic knowledge of developmental stages of childhood, and highlight the softer side of paediatric insulin technique.

Insulin Technique
Injection technique is the first step to optimal insulin usage. The FIT (Forum for Injection Technique) recommendations released in the year 2009, followed by national guidelines from various countries have highlighted this fact.1,2 Newer evidence (Insulin Technique Questionnaire)3,4 has led to the publication of new recommendations for insulin delivery in 2016.5,6

Need for Paediatric Technique Guidelines
These guidelines, though comprehensive, do not share 'best clinical practices' which may enhance the insulin injection experience of children and adolescents. While this population is totally different from those of adults, it is not a homogenous entity in itself, either. Each age group has their unique anatomical and psychological characteristics, needs and challenges, and requires tailored approaches to insulin delivery. Therefore, injection technique needs to be explained for each age group, viz, infants, toddlers, pre-school children, school-going children and adolescents, in separate detail. Age specific 'best clinical' suggestions are listed in Table-1.

Choice of Needle
The shortest needle today is 4 mm long and is available only with pens.5 The shortest needle available with syringes is 6 mm long. While the skin thickness in all children (regardless of age, gender, ethnicity or body mass index) is constant (roughly 2 mm), the subcutaneous tissue thickness may vary. Even with a 4 mm needle, a perpendicular injection has a 20.2% risk of reaching intramuscular tissue in children aged 2-6 years. This risk falls to 4.6% in school going children and 2.4% in adolescents.13

Hence, the 4mm needle is recommended for all children. Children aged ≤ 6 years should use the 4 mm needle by inserting it perpendicularly into a skin fold. Elder children do not need to raise a skin fold. If a 4 mm needle is not available, 5 mm or 6 mm needle may be used with lifted skin fold. Use of 6 mm needles (i.e., syringe vials) must be strongly discouraged in children ≤ 6 years of age.

Choice of Site
The preferred sites are the abdomen, thigh, buttocks and upper arms. Insulin analogues may be injected at any site. Conventional (human) insulin such as regular NPH insulin show site-specific absorption characteristics. These insulins are absorbed fastest from the abdomen and slowest from the buttocks.

Physically active children should preferentially receive
their day time injections on the abdomen, as absorption from this site is not influenced by exercise. On the other hand, insulin absorption will be much faster if the injection is delivered into an exercising thigh. Bed time injections can be safely administered in the thigh, as chances of unexpected physical activity are minimal.

**Care of Site**

Caregivers and children/adolescents should inspect the site prior to injection, and disinfect it if required. Insulin should be administered with clean hands, on clean sites. Injections must not be given in sites of lipohypertrophy, infection, ulceration or inflammation.

Injection site rotation, both intersite and intrasite, must be performed diligently. At each clinical visit, injection sites must be inspected and palpated for evidence of lipo-hypertrophy (LH). Children with LH should be counselled not to inject into LH sites, to rotate injections correctly over larger zones, not to reuse needles, to revise their insulin doses (downwards), and to review their injection site health/glucose control regularly (Table-2).

**Summary**

Insulin technique is not just a matter of administering an injection of a few microliters into a child’s body. It entails an in-depth understanding of the anatomy of the child, as well as her or his psychosocial and neurodevelopmental status. Translation of this knowledge into injection practice helps create a healthy atmosphere for insulin injection. This in turn leads to better acceptance, adherence and outcomes, for both child and family. It also improves satisfaction for the paediatric diabetes care provider.

**References**