The Third Injection Technique Workshop In Athens (TITAN)


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Abstract
The first Injection Technique workshop brought together endocrinologists and injection experts from around the world in Strasbourg in 1997. From its work came groundbreaking recommendations which advanced best practices in areas such as the use of a skin fold when injecting. The second Injection Technique workshop, with an expanded format including nurses and diabetes educators, took place in Barcelona in 2000. The initial stimulus to use shorter injecting needles can be said to date from this meeting. The third Injection Technique workshop was held in Athens in September 2009 and involved 127 experts from across the globe. After a comprehensive review of all publications since 2000 as well as several unpublished studies, the attendees divided into smaller groups to debate and draft new injecting recommendations based on the new data and their collective experience. This paper summarizes all the formal presentations given at this practical consensus workshop.

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Keywords: diabetes mellitus, treatment, insulin, insulin therapy, GLP-1 analogs, injections, needles, subcutaneous tissue, lipohypertrophy, complications, technical aspects, review, recommendations.
1. Introduction

The Third Injection Technique workshop in AthēNs, named TITAN, was held in Athens, Greece from 10-13 September, 2009. During these three days 127 doctors, nurses, educators and psychologists from 27 countries discussed the subject of optimizing injecting practice among people treated with insulin and/or GLP1 agents.

The objectives of the workshop were:
- Updating the state of the art on injection technique by experts working in the field;
- Open discussion on current practice issues and drafting of new injection recommendations;
- Brainstorming on further research in this field and identifying future study needs.

The first Insulin Injection Technique Workshop had been held in June, 1997 in Strasbourg, France. It brought together 40 injection experts from across Europe and the world for two days of presentations and discussions, culminating in the publication of the proceedings [1], the commissioning of a pan-European study of insulin injection technique and the dissemination of the first Insulin Injection Guide.

The Second Injection Technique Event (SITE) was held in Barcelona, Spain in May, 2000 [2]. It expanded the Strasbourg format to include more nurses and educators, eighty persons in all. The results of the European epidemiologic survey were presented [3] and new guidelines discussed and agreed. The summary of this meeting was also published [2] as was the second Insulin Injection Guide.

In this paper, we present summaries of the plenary presentations presented at TITAN. These constitute a summary of the state of the art in the field to the present day.

2. Summaries

■ Injection technique and needle length, how important are they?

Anders Frid, MD (Sweden)

Christian Binder published [4] ground-breaking studies in 1969 using 125I-labelled soluble (‘regular’) human insulin (40U). He found significantly faster disappearance of insulin from muscle tissue compared to fat tissue in the thigh. He also found a faster disappearance from the abdominal area compared to thigh, with the gluteal area in between. The first studies using imaging techniques when evaluating insulin injection appeared in the 1980’s, the first CT studies appearing in 1986 [5]. Paul de Meijer from The Netherlands was the first to use ultrasound to measure fat tissue depth and he showed in 1990 [6] that there seemed to be no difference in insulin absorption from the superficial layer of fat tissue compared to the loose connective tissue between the muscle and fat tissue. Our group showed in the mid and late 1980’s [7, 8] that the absorption of soluble insulin was faster from abdomen compared to thigh and that there was a difference within the abdomen with the fastest absorption above the umbilicus, later also confirmed in elderly patients by Clauson in 1995 [9]. We have also shown no difference in insulin absorption from superficial compared to deep injection in the fat tissue, in type 1 patients [10-12]. Regarding rapid-acting insulin analogues, there are several studies showing that the absorption is similar from injection sites in abdomen and thigh [13-16]. There are also studies showing similar absorption from fat and muscle tissue [17], however these studies were made resting. Blood flow in a working muscle may increase 10-fold which may affect absorption [7]. There are few studies of NPH-insulin but one important study by Henriksen in 1991 [18] showed that the absorption from the abdomen was faster compared to thigh and that abdominal injection in the evening may increase the risk of hypoglycaemia during the night in patients with diabetes. For long-acting insulin analogues it has been shown by Owens in 2000 [19] that insulin glargine has a similar absorption from abdomen, thigh and arm, the abdomen showing the slowest absorption although the difference did not reach statistical significance. Mistakenly injecting a long-acting insulin analogue IM instead of SC with its associated sudden unexpected peak, potentially occurring while the patient slept, could lead to profound hypoglycaemia with possibly lethal consequences. Hence, the importance of correct injection technique.

■ Myths and realities of insulin therapy

Jaime A. Davidson, MD (USA)

Diabetes is a global epidemic. The IDF estimates a 72% increase by 2025 to over 333 million people worldwide with diabetes [20]. New US data is showing an A1c improvement overall, but other populations, such as the Latino/Hispanic had disappointingly higher average A1c [20]. In many diabetes-related papers when discussing minorities, there is always a bias in suggesting that all minorities are poor, underprivileged and uneducated [21-22]. Amongst US Latinos there is a spectrum from very poor to very rich, from politicians and doctors to itinerant agricultural workers. The problem is universal, clinical inertia, where patients requiring insulin are left on oral agents for years with A1c levels well above the recommended targets. From the patient point of view it is challenging. Some believe starting insulin is a sign of failure, some believe it is the end and many still believe insulin causes blindness. In the Optimize Survey [23], a study directed at patients, we learned that many patients will avoid taking insulin, but will accept it when physicians recommended it. Creating a receptive culture and educating patients from day one will eventually allow patients to be treated to the recommended goals. I tell my patients: ‘It is my job to keep you alive so that at some point in the future, you DO go on insulin. Then I know we’ve been successful.’
■ Diabetes trends in Western Europe

Corinne Giely-Eloi* (France)

Diabetes prevalence evolution in Western Europe has now reached 5.01%, compared to 2.76% in 2000 [20]. Thirty per cent of the diabetes population is injecting insulin. The other 70% is mainly on oral agents (55%) and on diet (14%). Among the 30% on insulin, 20% use only insulin and 10% are dual users (insulin + pills). [24]

Insulin pens have become the favorite injection device: reusable pens are still dominant but declining whereas disposable pens are more and more prescribed. Pump use remain a stable, restricted target, and syringe use has now dropped under the 10% level. [24]

The situation is very different from one country to another: whereas Germany and the Netherlands prefer reusable pens, France and Spain are more disposable pens-oriented. Italy and the UK still have a significant number of syringe users. [24]

The 8mm pen needle is used by a majority of patients (66%); use of shorter needles (5-6mm) reaches 25%. Longer needles (>8mm) still represent about 9% of the market. [24]

*Co-author: Corinne Letondeur

■ Federation of European Nurses in Diabetes (FEND): Perspectives of insulin injection equipment

Deirdre Kyne Grzebalski (UK)

FEND is an organisation that provides a unique voice for nurses working in diabetes, research and education in Europe. FEND organises an Annual Conference providing a platform for nurses to discuss new developments in the treatment and management of people with diabetes and share research ideas. The Journal of European Nurses in Diabetes also encourages nurses to publish their research and development ideas. Problems with injections are not new and up to 50% of people with diabetes unintentionally inject insulin into muscle [7,25]. The important question therefore we need to consider is whether education can reduce the number of problems. A study from Denmark demonstrated a reduction in lipohypertrophy after intensive injection education [26]. To ensure that the correct injection technique advice is given and the appropriate needle length chosen, evidence-based guidelines are essential. [27-32]

■ The overall results of the 2008-2009 injection technique survey

Ken Strauss, MD* (Belgium)

From September 2008 to June, 2009, 4352 insulin-injecting Type 1 and 2 diabetic patients from 171 centers in 16 countries participated in the study. Overall 3.6% of patients use the 12.7mm needle; 1.8% the 12 mm; 1.6% the 10mm; 48.6% the 8mm; 15.8% the 6mm; 21.6% the 5mm. Seven percent of patients do not know what length of needle they use. Twenty-one percent of patients admitted injecting into the same site for a whole day or even for a few days, a practice associated with lipohypertrophy. Almost half the patients have or have had symptoms suggestive of lipohypertrophy. Abdominal lipohypertrophy seems to be more frequent in those using the two smaller injection size areas, and less frequent in those using larger areas. Nearly 3% of patients reported always injecting into lipohypertrophic lesions and 26% inject into them sometimes. Of the 65% of patients using cloudy insulins (e.g. NPH), 35% do not remix it before use. It is clear from the latest survey that we have improved in certain areas but in others we have either not moved at all or our efforts have not yielded the results we expected. The results of this survey are available on a country-by-country as well as a question-by-question basis on the website: www.titan-workshop.org.

*Co-author: Carina De Coninck

■ Skin and hypodermis: from basic knowledge to practical questions about hypodermic needle length

Philippe E. Laurent, MD, PhD* (France)

We report on recently published work on epidermal-dermal thickness at injection sites commonly used for intradermal vaccination [33]. This study of non-diabetic adults indicates that the maximal total thickness is 2.4 (±0.4) mm regardless of the subject’s gender, BMI, adult age or ethnic origin. The main variability factor in epidermal-dermal thickness is the body site. This result indicates that hypodermic needle lengths beyond 3 mm deliver drug into the shallow subcutaneous tissue. We studied the impact of the needle length (ranging from 3 to 12.7 mm) on the pharmacokinetic parameters of low molecular weight-heparin (exonaparin) in non-obese (18-25 Kg/m²) and obese (30-40 Kg/m²) volunteers. The injection technique was varied, including skin pinch up (with and without), the injection time (slow [10 sec] versus fast [3 sec]) and different thumb or index pressures on the plunger rod. There were no statistical differences observed in pharmacokinetic parameters analyzed related to the needle length (3 versus 12.7 mm, 4 versus 12.7 mm), the injection speed and the injection technique (pinch, no-pinch). Whatever the needle length used, the impact of variability factors (injection technique, injection speed, weight group and gender) were similar.

In summary, injections using needle lengths longer than 3 mm ensures subcutaneous injections; injection in shallow subcutaneous tissue (3 to 4 mm from skin surface) does not impact the pharmacokinetic profile regardless of the injection technique.

*Co-authors: Laurent A, Mistretta F, Bottigioni D, Dahel K, Goujon C, Nicolas JF, Hennino A
Skin thickness (ST) and subcutaneous thickness (SCT) at injection sites in adults with diabetes (DM)

Laurence Hirsch, MD* (USA)

We used 2D high frequency ultrasound (HFUS) to measure skin and SC tissue thickness at commonly-used insulin injection sites in a varied group of ~ 350 adults with DM. ST (epidermis-dermis) and adipose layer SCT (dermal-SC border to muscle fascia) were measured at 4 body sites (arm, abdomen, thigh, buttocks). At the time of TITAN, the study was about 60% complete. The 95% CIs for ST (epidermis-dermis) varied between 1.6 and 2.7 mm, and for SC adipose tissue depth from 6 to 21 mm. SC thickness increased with BMI, female gender, and at abdomen and buttocks vs other sites; ST varied minimally by common demographic characteristics. The largest within-site differences in SC depth, based on BMI, are in the abdomen, the smallest in the buttocks. When complete, these data should help guide needle length selection to optimize SC insulin injections, and avoid IM or ID injections. This study in persons with diabetes confirms earlier data from non-diabetic populations [33-37]

*Co-authors: Arce C.H., Byron K., McNamara K., Del Rio Y., Gibney M.A.

Thickness of subcutaneous fat tissue where
pregnant diabetics inject their insulin
- An ultrasound study

Lars Engström, MD* (Sweden)

Pregnant insulin-treated diabetics coming to ordinary ultrasound examinations of the foetus were examined [38]. They were asked to indicate on their abdomen the point where they usually inject their pre-meal doses of regular insulin. The distance from this point to the umbilicus were measured and the thickness of subcutaneous the fat tissue was measured perpendicularly without pressure using a convex 5 MHz ultrasonic probe. Thirty examinations were performed in pregnancy week 16 to 38. The distance from injection point to the umbilicus varied from 1-20 cm with a mean of 12.7 cm. The thickness of subcutaneous fat tissue where the patients had performed their latest insulin injection varied from 3 to 18 mm with a mean of 8.0 mm. Sixteen out of thirty examinations showed 8.0 mm or less of subcutaneous fat tissue at the injection point. The risk for unintended intramuscular injection of insulin is increased among pregnant women with diabetes. To reduce this risk we recommend examination of injection sites with estimating of subcutaneous fat layer thickness. The ultrasonographic examination offered most pregnant women an excellent possibility to perform this measuring. If SC thickness seems adequate the patients can until next visit use the abdomen as injection site. In that case we recommend using 5 mm injection needles with a two-finder pinch-up. We don’t recommend perpendicular injection. For thin patients we dont’t at all recommend abdominal insulin injections. For these patients we recommend injection in the lateral gluteal region.

*Co-authors: Hans Jinnerot, Elisabeth Jonasson.

Glycaemic variability as the enemy!

Jean-Pierre Sauvanet, MD (France)

Sustained chronic hyperglycaemia (characterized by elevated HbA1c and mean plasma glucose levels) has deleterious vascular consequences as a result of excessive protein glycation, and generation of oxidative stress [39-40]. Glucose swings also appear to specifically activate oxidative stress and amplify the effects of chronic hyperglycaemia. Recent studies, both in type 1 or type 2 diabetic patients, suggest that oscillating glucose is more deleterious to endothelial function and oxidative stress than stable mean glucose [39-40]. Furthermore, glycaemic variability appears to be an HbA1c-independent risk factor for diabetic complications; additionally, wide fluctuation of blood glucose is a strong independent predictor of mortality in elderly type 2 patients as well as in critically ill patients. In insulin-treated patients, well known exogenous factors also contribute to glycaemic variability, including inappropriate diet content and/or repartition, inadequate insulin regimen and/or insulin injection technique. Use of continuous glucose monitoring appears to be a promising tool to both evaluate glucose variability and to optimize insulin treatments and regimen. Therapeutic education should emphasize appropriate dose adaptation and proper insulin injection technique.

Investigation of coincidences between
injection practice, blood glucose excursions
and frequency of lipohypertrophy during
insulin therapy

Gerhard-Walter Schneis, MD *

One major cause of unexplained glycaemic excursions appears to be suboptimal injection practice, as well as the existence of ignored lipohypertrophy [41-45]. We studied injection practice in 500 patients with insulin dependent diabetes mellitus using intensified conventional insulin therapy. Lipohypertrophy within the last 12 months was reported by 35% of the interviewed patients. The validation exam by the diabetes nurse revealed lipohypertrophy in 41.2% of the examined patients. Implausible blood sugar excursions within the last 4 weeks were observed in 45.3% of the patients with type 1 diabetes mellitus and in 38.0% of the patients with type 2 diabetes. Lipohypertrophy correlated with the following factors: Duration of insulin therapy \( (P<0.001) \), multiple use of pen needles \( (P=0.002) \), outflow of insulin from injection site after injection \( (P=0.002) \) and use of relatively small injection sites in the abdomen \( (P<0.029) \). In patients with lipohypertrophy implausible blood sugar excursions were significantly more frequent \( (P<0.001) \). The data support the recommendation regarding regular evaluation of the injection sites and if necessary re-training on injection techniques.

*Co-author: Evelyn Drobinski, Verband der Diabetes-Beratungs- und Schulungsberufe in Deutschland e. V. (VDBD)
Factors influencing lipohypertrophy

Sevgi Kızılcı* (Turkey)

While lipohypertrophy (LH) was seen in 76.9% of the individuals with diabetes who changed injection sites at each injection, the condition was seen in only 23.8% of people who rotated the injection site weekly [45]. If people with diabetes use all injection sites (arms, abdomen, legs, buttocks), and use each injection site for one week, it will be 6-8 weeks before returning to the same site. During this time the tissue will be free from the effect of insulin. The development of lipohypertrophy is in this way diminished because of the lessening effect of insulin in the area. Another controllable factor influencing the development of LH is the frequency of changing needles. It has been reported that individuals who reuse needles more frequently are more likely to have LH than those who reuse less frequently. While LH was observed in 20.3% of individuals with diabetes who changed their needle at every injection, this proportion was 51.2% in those who changed needles every two–three injections, 75% in those that changed every four–five injections and 100% in those that changed only when the cartridge was finished. The majority of patients (76%) responded negatively when they were asked if they had a problem. However, well over half of this group was found to have LH on examination. Fifteen per cent of the patients reported that their injection sites had never been checked by a doctor or a nurse.

*Co-author: B. Vardar

How improved technology has affected starting injectable therapy in the United States

Timothy S Bailey, MD, FACE, CPI (USA)

Two major approaches that have been taken to solve the problem of patient resistance to insulin:
- Changing the delivery route (e.g. inhaled insulin)
- Improving the injection process (e.g. pens, less-frequently administered preparations)

Despite the demonstrated advantages of pen therapy, use of insulin pens in the U.S. has trailed in that in other developed countries. This is largely due to the economic disincentives built in to the healthcare system, most importantly those practices which have resulted in a larger out-of-pocket cost to the patient. Newer injectable therapeutic agents (e.g. Byetta®, Forsteo®) have been released only in pen form in the U.S. [46]

The effect of pen therapy on clinical practice efficiency may be to increase patient acceptance of injectable therapy. [47-49]

Glargine basal-bolus insulin regimen vs insulin pump therapy: a comparison of glycaemic control

Harold Starkman MD* (USA)

We studied the glycaemic control in subjects utilizing Glargine Basal-Bolus Insulin Regimens (GBBIR) as compared with subjects using Insulin Pump Therapy (CSII). Of 13 studies available for critical review comparing GBBIR with CSII in type 1 diabetes, 7 investigators reported improved glycaemic control with CSII and 6 reported no significant difference. We evaluated the experience obtained in our practice, by evaluating changes in HbA1c when patients were transitioned from conventional split mixed insulin regimens (CSMIR) to either GBBIR or CSII. While not randomized, our data showed that HbA1c decreased significantly when subjects were transitioned from CSMIR to GBBIR (P<0.001). HbA1c levels at 3 months, 6 months and 1 year were not significantly different for subjects on GBBIR when compared to subjects on a CSII regimen at any time point after regimen initiation. HbA1c trended upward during both CSII (P=0.058) and GBBIR (P=0.036) when 3 month and 1 year values were compared. Thus, our data show no significant difference in glycaemic control, as reflected by HbA1c, in type 1 paediatric subjects treated with GBBIR when compared with CSII for up to 1 year.

*Co-Author: Emily Frydman MD, Rami Bustami PhD

The influence of needle length on glycaemic control and patient preference in obese patients with diabetes (INOBESI)

Gillian Kreugel*

We performed a randomized, prospective, multicenter, open-label, cross-over study in 130 patients with either type 1 or type 2 DM, injecting insulin with a pen, and with BMI ≥ 30 kg/m2 [50]. Patients were randomized into 2 groups. Group A used a 5 mm needle in the first period and an 8 mm needle in the second period, group B used the reverse order; each period was 3 months. The effects of needle length on HbA1c levels, patient-reported bleeding, bruising, backflow of insulin, pain and hypoglycaemic events were compared. There was no significant change in HbA1c while using either needle length, in either group. For all patients, mean HbA1c decreased from 7.6 to 7.5 (P=0.03) when using the 5 mm needle, and stayed 7.6% with the 8mm needle. There were no differences in hypoglycaemic events, bruising and pain in either group during both periods. Patients reported slightly less bleeding (P=0.04) with the 5mm needle, and less insulin leakage with the 8mm needle (P =0.01). The 5mm needle was preferred by 46% of patients, and the 8mm needle by 41%; 13% had no preference. We conclude that 5mm needles can be safely used in obese DM patients without negative effects on HbA1c and without differences in local injection-related complaints.

*Co-authors: Joost C. Keers, Aled Jongbloed, Anneke H. Verweij-Gijzelmaa, Bruce H.R. Wolfenbuttel
Evidence-based clinical guidelines for injection of insulin for adults with diabetes mellitus

Grete Kirketerp* (Denmark)

The Danish guidelines were first published in 2002 and then updated in 2006 by the Danish Nurses Organization under the title, Evidence-based Clinical Guidelines for Injection of Insulin for Adults with Diabetes Mellitus [28]. A literature review searched the following terms: Injections sites; Adherence; The insulin injection process; Choosing needle length; Swapping skin prior to injection; Re-use of needles for pen systems; Disposal of needles and insulin pens; Risk of infection; General guidelines for insulin injection. The document is available in both Danish and English.

*co-authors: Hansen Birtha, RN, MScN, Aarhus University Hospital, Kirketerp Grete, RN, MScN, MPM, Odense University Hospital, Ehlers Gitte, RN, Kalundborg Hospital, Nordentoft Elisabeth, RN, Slagelse Hospital, Hansen Grethe, RN, Stene Hospital

Dutch guidelines ‘The administration of insulin with the insulin pen’

Jolanda Hensbergen, MD (Netherlands)

This mono-disciplinary-developed guideline [27] aims to provide all diabetes care providers with scientifically-supported recommendations regarding the manner of insulin administration with an insulin pen in patients with diabetes mellitus. In this specific regard attention is given to 1) the preparation of an insulin injection; 2) the critical characteristics of pen needles (including matters such as the needle length and needle re-use); 3) determining the best injection site (i.e. location on the body, type of tissue) and 4) the manner of injecting and insulin administration (for example skin fold, speed of injection and massaging). Of 143 articles selected on the basis of title and summary, 105 met the inclusion criteria and were used in the recommendations. Recommendations at level 2 (strong evidence) are made regarding the disinfection of skin and material, maximum dosage per injection, needle length, needle re-use, depth of injection and tissue type, injection site in relation to the time-action profile, rotation, injecting into damaged skin, manner of inserting the needle, speed of the injection, length of time the pen needle is in the skin after insulin administration and massaging. Recommendations at level 3 (moderate evidence) are made regarding the mixing of the insulin, the insulin temperature at the time of injection and the length of time the pen needle is on the pen. Recommendations at level 4 (weaker evidence or expert opinion) concern the removal of air from the pen and removing the pen needle from the tissue.

Patient and health care professionals’ perspectives on insulin therapy

Marjorie Cypress, PhD, C-ANP, CDE (USA)

When people with diabetes are told they need insulin, many may be fearful of pain, getting sicker, having hypoglycemia, gaining weight, and getting complications. Health care professionals may also fear acute complications, but additionally may worry about alienating their patients, poor compliance, the burden of teaching and dealing with crises. The Insulin Impact Survey asked 500 people with insulin treated diabetes >18 years old (PWD) about the impact on insulin injections, and asked 300 health care professionals (HCP) what they perceived their patients to feel [51]. While 33% of PWD said they dreaded their injections and 29% said that injecting insulin was the hardest part of managing diabetes, 76% of HCP thought their patients had adapted to insulin injections and 61% felt that insulin was just an inconvenience. When asked if they discussed problems with insulin injections with their patients, 98% of HCP said they did. But when the PWD were asked if their HCP ever talked to them about problems with insulin injections, 79% said never or rarely, and 77% with problems said they never discussed the problem with their HCP. Recommendations for overcoming barriers to insulin therapy include: Asking patients about problems with insulin injections. Identifying and correcting misconceptions, and explaining the disease process emphasizing that insulin therapy is not a personal failure or punishment. Self management education should focus on minimizing complications (hypoglycaemia, weight gain etc.), integrating the treatment regimen into an individual’s lifestyle, good communication, and stressing the benefits of good glycaemic control.

Patient and physician resistance to initiating insulin therapy

Dr. Susan Jung Guzman, PhD (USA)

Delaying the initiation of insulin therapy (IT) may lead to long periods of chronically high blood glucose levels [52-55]. Patients may drop out of treatment to avoid IT. Patients on insulin may come to believe that less insulin = less disease - so they may omit insulin until they begin feeling “bad”. Obstacles to insulin initiation include the feeling that once started, I can never stop; insulin will restrict key aspects of my life; starting IT means I have failed; the stigma (now I really have a serious disease); shots will be too painful; insulin may cause blindness.

Influence of physicians may take the form of threatening patients with insulin: “If you can’t make some positive changes in how you eat and exercise, then we’ll have no choice but to start insulin.” Underlying messages may be: Insulin should be avoided at all costs; or you have failed; or you are to be punished. Solutions include:

- Speak about the natural course of diabetes, and be positive
about insulin therapy
- Encourage an immediate injection
- Provide a sense of control regarding IT
- Consider insulin pens
- Address patient’s concerns

■ Number of injections, therapeutic regimen
  and glycaemic control in children and adolescents

Jean-Jacques Robert, MD (France)*

The data base of the national association which organizes diabetes camps allowed evaluating 8 176 children and adolescents (age 12.8±2.7 yrs, diabetes duration 5.2±3.4 yrs) at admission in summer camps between 1998 and 2007 (707-896/yr). Over 10 yr, the main changes were: shift from human insulin to analogues; decrease of 2 injections from 42 to 19%; drop of premixed from 21 to 4%; decrease of unclassified from 30 to 15%; increase of basal-bolus from 13 to 48%, and of pump from <1 to 13%; changes related to age and diabetes duration. Mean yearly HbA1c varied from 8.24 to 8.53%. HbA1c was significantly higher with regimens using exclusively premixed insulin, but there were no differences between the other regimens (multivariate analysis). HbA1c showed a significant but minor decrease, by 0.02% per year, but the decrease was similar with premixed and other regimens. A major trend in intensifying insulin treatment in children and adolescents with type 1 diabetes has been accompanied by a modest improvement in HbA1c. No insulin regimen has shown any better results, except over premixed insulin.

*Co-authors: Isabelle Redon, Pierre Taupin, Delphine Martin, Cécile Aubert, Michel Cahane

■ Psychological preparation for delivering injections to children

Ms. Angela Cocoman & Ms. Carol Barron (Ireland)

Injections do not occur in a vacuum. They occur within individual cultures and societies. Major influences on the delivery of injections to children include; the child, family, and health care profession at the micro level and the societal beliefs and cultural influences at the macro level [56]. Both need to be addressed in the preparation of children for injections. For example at the macro level in western English-speaking societies the language we use to describe injections such as “shot” and “jab” is that of violence and pain (see Fig. 1 and 2). At the micro level the psychological preparation of the child we argue also includes the psychological preparation of the health care professional as well as that of the child and family member. For the purpose of this paper we are concentrating on the psychological preparation of the health care professional as well as that of the child and parent focusing on education and a questioning of distraction techniques efficiency and ethical use with children and young people.

*Co-authors: Lourdes Saez de Ibarra

■ Spanish setting: sharing our experience

Ruth Gaspar-Lafuente* (Spain)

We published earlier research on the incidence and risk factors related to lipodystrophy. [57] Our latest research shows that 78.7% of patients know the need to rotate injection sites regularly but only 22.7% follow an organized rotation system. We have established the following training process:

1. We give instructions about organized rotation: Each week one quadrant is used; Monday is the day to change quadrants; Clock wise rotation is used.

2. We examine injection sites regularly (preferably every visit; but at least once a year).

3. We train patients to recognize lipohypertrophy. We touch the lipodystrophy first and then ask the patient to palpate it. We ask them to compare it with their own healthy tissue. We take photos of lipodystrophies in order for us to have an objective image and for the patient to appreciate the improvement with rotation and to reinforce the behaviours.

4. We try to make patients aware of the metabolic implications of not rotating injection sites. Only when the patient “experiences” their own results will the behaviour last long term. Group training is a great opportunity to meet patients with real cases of “lipodystrophies” it allows patients without them to understand how important it is to prevent and to share experiencing the improvement of the metabolic control after adopting correct injection behaviours.

*Co-author: Lourdes Saez de Ibarra

The UK Experience

Debbie Hicks MSc, BA, RGN, NMP, DN Cert, PWT Cert. (UK)

To audit the potential changes in practice 10 years after the first pan-European survey [3] but also to account for the impact of new therapeutic approaches to the treatment of diabetes (insulin analogues, GLP-1 analogues, intensive therapy), since the 1st injection technique survey, a 2nd pan-European Injection Technique survey was performed earlier this year. 999 participants from the UK were included in this study giving a wealth of information as to current practice today. The results from the UK show that for a given injection, approximately 75% of the participants use the same site and 25% use multiple sites. Whatever time of the day, the abdomen and the thigh are the preferred injection sites for both adults and children. There is a slight preference for the abdomen in adults with 59%, and a slight preference for the thighs in children and adolescents with 43%. The exception is in the evening where the thigh and the buttocks are used slightly more. Fifty-four percent of the participants reported having lipohypertrophy at sometime in their life: 47% in the adult group and 71% in the children and adolescent group, with 2.6% always injecting into lipodystrophies and 25.7% injecting into them sometimes, both clearly wrong practice. Only 46% of participants have their sites checked every visit. In the UK and Ireland we have initiatives to address:
- Areas of concern in current observed practice;
- Effectiveness of current teaching approaches;
- Generate recommendations for change in injection technique practice;
- Identify opportunities for more innovative education programmes.

3. Conclusions

During TITAN time was spent in small break-out groups discussing the specific injection needs of adults and children; the psychological challenges of injecting; lipohypertrophy; safety needles; and used needle/sharps disposal. A set of New Injecting Recommendations was drafted, discussed and agreed and is published separately in this supplement. A Fourth Injection Technique Workshop is now planned for between two and three years hence.

4. Attendee List (in alphabetical order)

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5. Duality of interest:

All authors are members of the Scientific Advisory Board (SAB) for the Third Injection Technique Workshop in Athens (TITAN). TITAN and this Injection Technique Survey were sponsored by BD, a manufacturer of injecting devices, and SAB members received an honorarium from BD for their participation on the SAB; KS, LH and CL are employees of BD.

References


[41] Schneiul GW. Investigation of coincidences between injection practice, blood glucose excursions and frequency of lipohypertrophy during insulin therapy. (Published in German) Diabetes, Metabolism and the Heart 2009;18:251-8.


Klonoff DC The pen is mightier than the needle (and syringe). Diabetes Technol Ther 2001;3:631-5.


Reach G. Patient non-adherence and healthcare-provider inertia are clinical myopia. Diabetes Metab 2008;34: 382-385.


