

Insulin In Primary Care
Welsh PCDS
Master Class –
Presenter Sian Bodman
Senior Nurse Diabetes

- Pearls and pitfalls
- An easy titration schedule
- Managing in frail/housebound people

Learning outcomes

- Six Steps to Insulin Safety online learning module
- Understanding of the role of Insulin in Diabetes management
- Key facts
 - Considerations for the right insulin
 - Insulin initiation & titration
 - Injection technique
 - Storage, pens, site rotation, disposal of sharps
 - Identification and insulin passports
 - Hypo glycaemia
 - Hyperglycaemia
 - Sick day rules
- What about our housebound and frail patients?
 - When and how to stop
 - End of life

This site is intended for healthcare professionals only

Module on all aspects of insulin safety, developed by the Primary Care Diabetes Society.

← All modules

FREE CPD MODULE

The six steps to insulin safety

An essential module for all those prescribing, managing or administering insulin, with the overall aim of reducing insulin errors in clinical practice. Its focus is on insulin use within the primary-care setting.



SLIDES

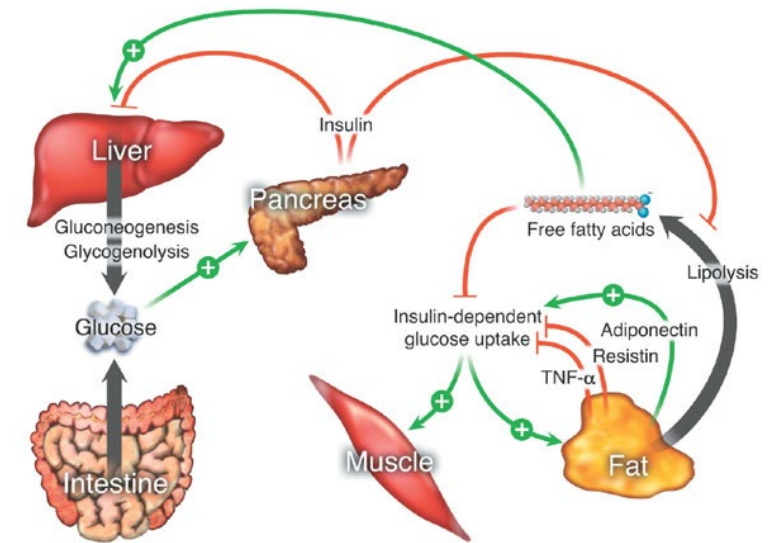
View the slides to explore the

Access

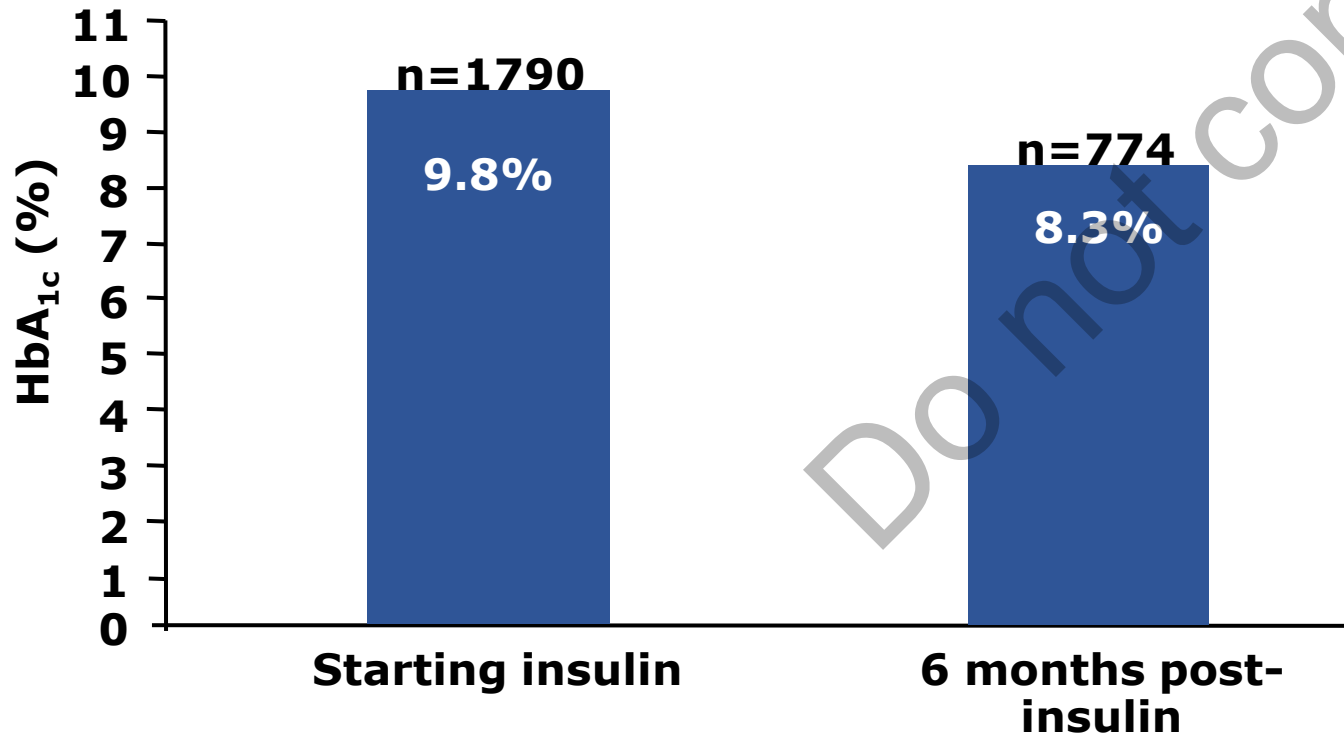
test your knowledge

The role of Insulin

- Ingestion of glucose stimulates release of insulin.
- Insulin reduces blood glucose level by promoting its use by tissues above other energy sources (fat and protein) .
- Insulin also stops the breakdown of energy stores (Adipose tissue and muscle) , that would normally increase blood glucose.



In the UK, HbA_{1c} is often close to 10% prior to insulin initiation



Evidence suggests that even following the introduction of insulin , HbA1c target is still not achieved . This may be due to caution in intensification

DIN-LINK data was used to identify patients with type 2 diabetes issued with their first prescription of insulin between March 2002 and April 2005 in the UK. 2040 patients were identified, of which 1790 patients had an HbA_{1c} reading before the prescription was issued and 774 patients had a second reading of HbA_{1c} six months later.

Insulin Therapy and the NHS Today

Significant numbers of people who could benefit from insulin therapy do not get offered or take the opportunity to start insulin

Too many people using insulin suffer from...

Hypoglycaemia

Blood glucose swings

Weight gain

Complications

Insulin Replacement Therapy - the challenge for healthcare professionals

how can we help people use insulin in the right way to help them achieve agreed HbA1c targets without suffering the consequences of hypoglycaemia, blood glucose swings or weight gain?"

Why do we integrate Insulin Therapy into daily life?

- Stay healthy
- Prevention of ketoacidosis
- Relieve symptoms of hyperglycaemia
- Normalise lifestyle
- Maintain long-term health
- Prevent complications

Insulin Replacement Therapy – key questions

When do we consider insulin therapy?

Type 1 diabetes

Type 2 diabetes for rescue treatment or when other therapies are not appropriate?

How do we start?

How many injections?

What types of insulin(s)?

What kind of device(s)?

What size of needles?

What dose of insulin(s)?

What about orals?

How do we help people use insulin?

Self-management?

Dose titration and adjustment?

Food, activity, day-to-day life?

Illness?

NICE Guidelines

- Guidelines have been published that suggest when insulin should be considered in Type 2 diabetes (Ng28 , 2022)
- Consider insulin if a person is acutely unwell and with osmotic symptoms

Rescue therapy

For symptomatic hyperglycaemia, consider insulin or a sulfonylurea and review when blood glucose control has been achieved.

- Consider insulin during intensification if oral therapies are not effective

Insulin therapy

When dual therapy has not continued to control HbA1c to below the person's individually agreed threshold, also consider insulin-based therapy (with or without other drugs).

TA 288 Dapagliflozin

TA 336 Empagliflozin

TA 315 Canagliflozin

Insulin Replacement Therapy

- the decisions



Right Insulin



Right Regimen

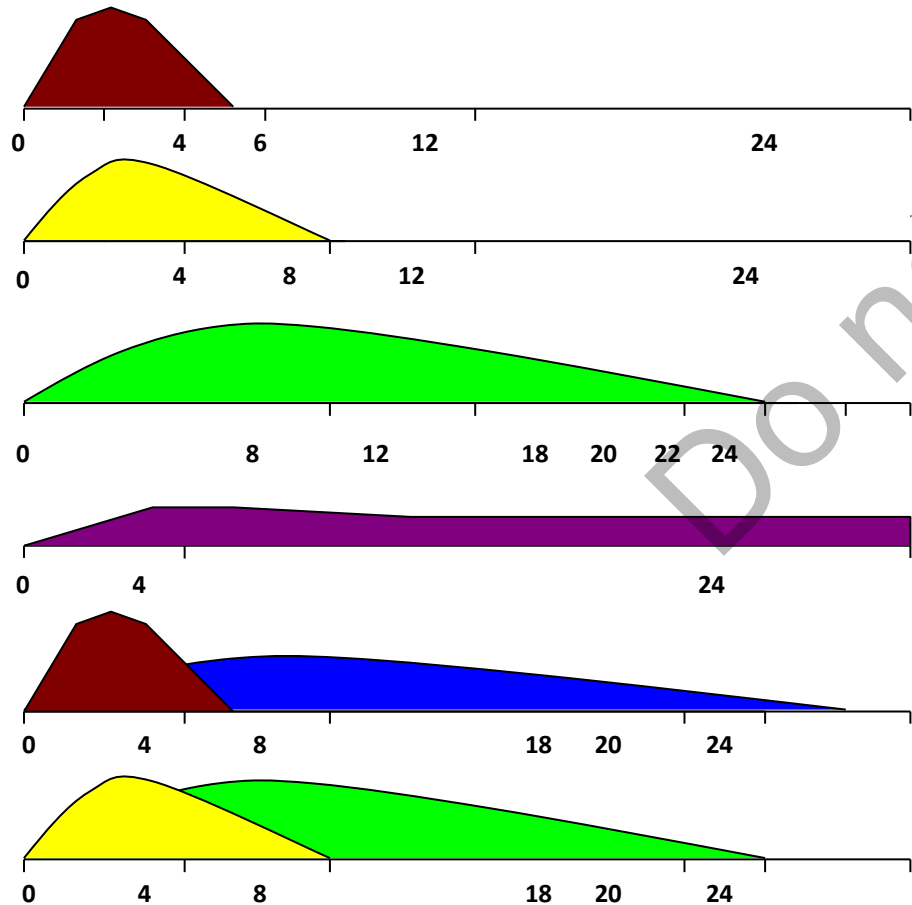


Right Delivery System



Right Dose

The onset and duration of Insulin



Rapid-acting analogue

Short-acting (soluble/regular)

Intermediate Acting (isophane / NPH)

Long acting analogue

Rapid-intermediate mixture

Short-intermediate mixture

The insulin start

Evidence has suggested it is often best to start with a basal insulin to add onto current regimen

NICE suggest that NPH insulin should be first choice

Insulatard /
Insuman/Humulin I

Titration Regimens - the starting dose

There are two
alternative
suggestions that can
be considered:-

10units basal insulin at night

- May consider a smaller dose of insulin if low BMI or other concerns/ risks
 - Frailty
 - Reduced cognition/ understanding
 - Vulnerable – living alone
 - Other co-morbidities that may affect glucose absorption / diet

Start dose to be the lowest fasting blood glucose reading

- This may be useful in those who are overweight and likely to be insulin resistant

Titration Regimens - increasing the insulin dose

Check daily fasting blood glucose levels

Set an individualised target for this glucose level

- Normally aiming for 6-8mmol/l

Base insulin increase depending on three consecutive glucose readings

- Increase insulin dose by 2units or by 10% (which ever is the larger) until target is reached

Consider setting reviews

- Contact every 2-3 weeks Or
- Contact when target is reached Or
- Contact if target has not been reached and dose is now more than 0.3units / Kg or 0.5units / Kg of body weight

Rate of insulin titration

- Too rapid titration / intensification may cause problems
 - Precipitation retinal changes
 - Absolute / relative hypoglycaemia

Consider a more active titration if :-

- Osmotic symptoms
 - This implies acute loss of insulin production and more rapid control of glucose may preserve B Cell function in type 2
- Ketones present
 - Suggest decompensation due to insulin deficiency and a more rapid correction will stop worsening of metabolic issues
- Acute illness
- Steroids prescribed

Consider a slower titration if:-

- Hyperglycaemia present for several weeks +
- Frail / elderly
- Poor understanding or ability to monitor
- Known Retinopathy

Titration Regimens

- when increasing the insulin dose doesn't appear to be working

Review should be considered if there appears to be a poor response to insulin

Revisit the basics

- Storage of insulin
- Injection technique
 - Appropriate use of device
 - Injection sites
- Diet and lifestyle change
- Influence of other therapies that may have been started or stopped

Advise blood glucose monitoring other times of the day

Consider alternative regimen before further up titration of basal insulin

- Addition of bolus quick acting insulin before food
- Twice daily mixed insulin
- Addition of other therapies

Options /
Alternative
regimens

Meal Time Bolus
insulin

Basal Bolus regimen

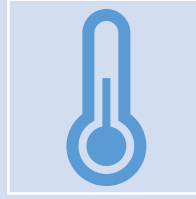
Mixed Insulin

Practicalities

Storage of insulin

- Insulin is a protein and must be kept in a certain state to remain active
 - Insulin should be kept refrigerated to maintain its' shelf life
 - Insulin should NOT be frozen
 - It can remain at room temperature for up to 30days
 - If outside the fridge for more than 30days, it should be disposed of

Insulin Storage



Store injectables in current use at room temperature

Avoid direct sunlight , temperature extremes



Unopened devices to be stored in the refrigerator

Avoid freezing



Never leave needle on device

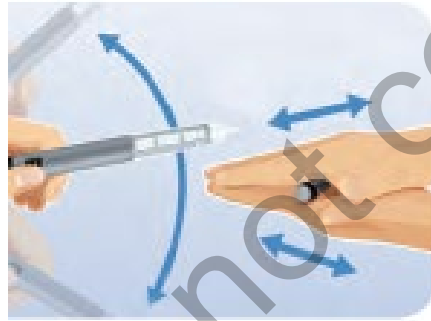
Do not copy

Preparation of insulin

- If the insulin is cloudy , it will require suspension
- Advise on 'rock and roll' technique

Insulin
Suspension

Rock & Roll



Do not copy

Correct use of the device



4: If the insulin is cloudy type, gently invert 10 times and roll between palms of hands 10 times to fully mix it.



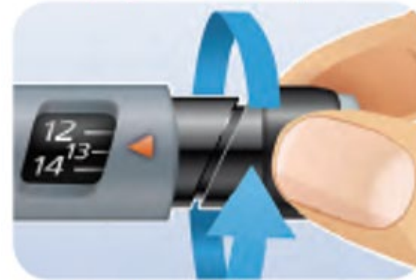
7: Hold the pen in your fist; keep your thumb away from the dose button. With the pen at 90 degrees to the skin surface, gently push the needle through the skin into the injection site.



5: Test dose, set the dial to 2 units and with the needle tip pointing upwards and away from you but still visible press the dose button. You should see a bead of insulin appear at the needle tip. Repeat if no insulin appears.



8: Push down the dose button with your thumb. Hold the needle in the injection site for a full ten seconds after you have finished pushing the dose button. Then gently remove the needle from the skin.



6: Set your dose.



9: Remove the used pen needle and place in sharps box ready for safe disposal.

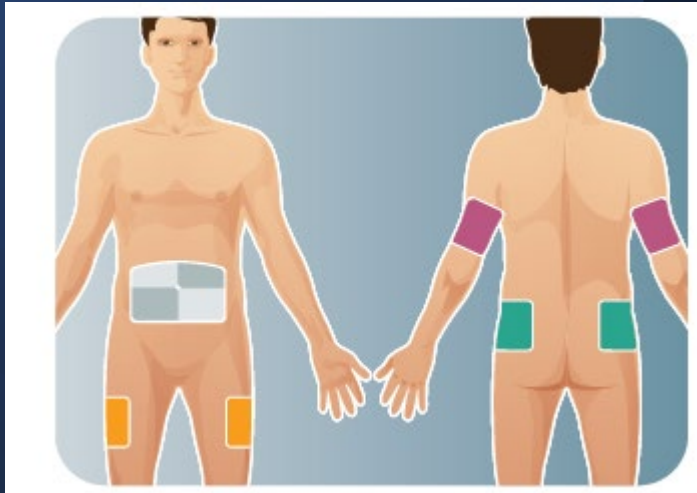
DIABETES CARE IN THE UK
FIT UK Forum
for Injection
Technique UK

The UK Injection
Technique
Recommendations
3rd Edition



Optimising
Diabetes Care

Keep injection sites healthy:-



Always inspect site prior to injection.

Avoid injecting into sites showing :-

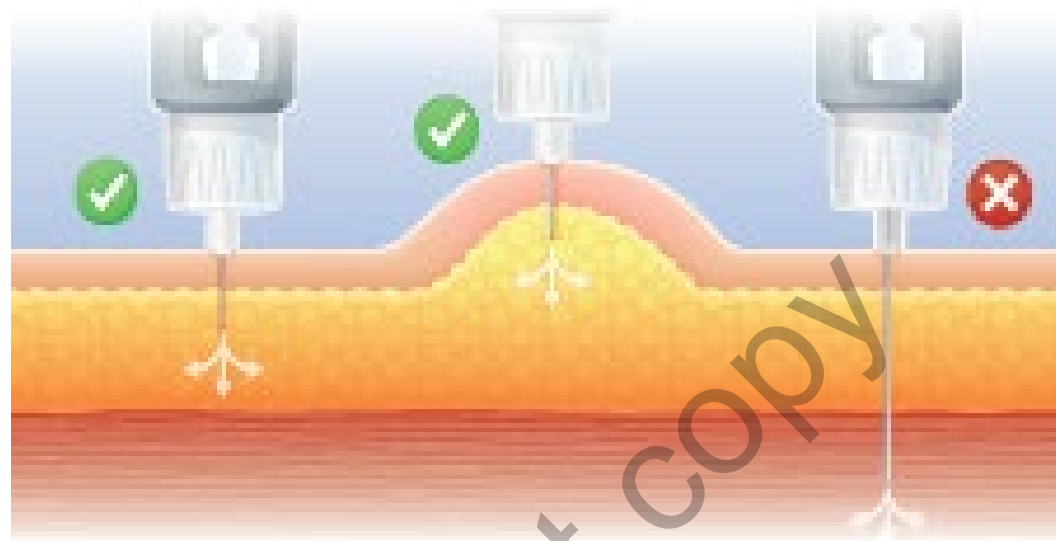
- Lipo-hypertrophy
- Oedema
- Inflammation
- Infection

Inject only into a clean site

- with clean hands
- Cleanse site with domestic soap if required
- Not alcohol wipes

Always rotate sites

Never reuse needles



Insulin injected into a muscle will be absorbed quickly

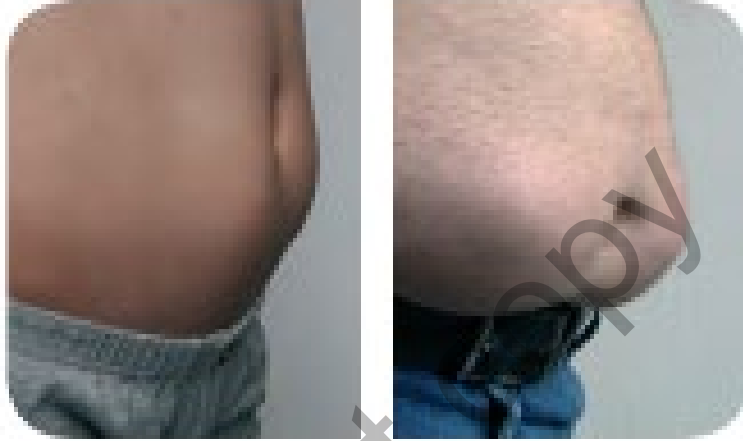
- Increased blood glucose variability
- Increased risk of hypo-glycaemia

Muscular injections tend to hurt

Longer needles increase risk of inter-muscular injections



Needle Length



Lipo-hypertrophy

- Lipo-hypertrophy can take months to years to resolve
- Switching to normal sites will often require a reduction in insulin dose
 - Caution :-
 - too much can lead to Hyperglycaemia / ketosis
 - Too little can lead to Hypoglycaemia

Needle Safety

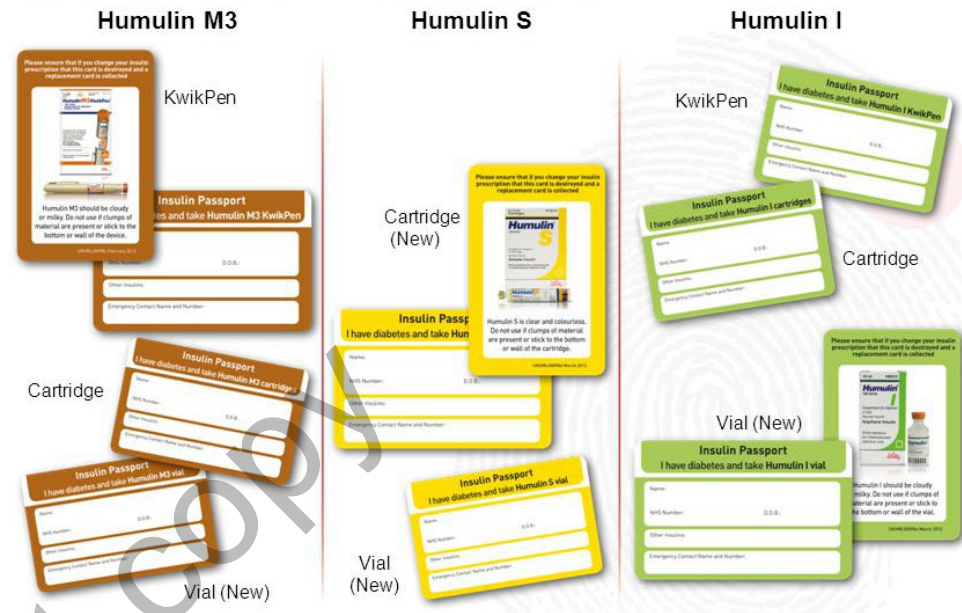
Sharps bin



Needle safety devices



Insulin passports



Insulin passports are a means by which a person can identify what insulin they are on and acts as a safety mechanism

- Identifying the person has diabetes and on insulin
 - So if unconscious , they can be checked for hypoglycaemia and treated
- Ensuring that the correct insulin is prescribed , dispensed and administered.

Good
understanding
and safety is
important

Understanding of what insulin does

Knowledge of type of insulin

- Include means of identification (Insulin Passports)

Appropriate diet and lifestyle

- Include hobbies / driving/ eating out and alcohol

How to monitor glucose appropriately

When to monitor ?

Depends on reason

- **Safety**
 - Glycaemia for health (pregnancy / ketosis risk)
- **Dose adjustment**
 - Carbohydrate /insulin matching
- **Risk**
 - Driving / occupation
- **Lifestyle**
 - Activity / exercise
- **Regimen**
 - Oral therapy / insulin type and regimen

Interpretation of results

- Evidence that monitoring results in a change

Glucose monitoring

The monitoring of glucose should be timely and appropriate to the individual.

The type of monitoring will be influenced by patient choice but also on need and risk

People who require frequent glucose monitoring may be considered appropriate to offer non-blood testing such as CGM (Continual Glucose monitoring) or using a sensor FreeStyle Libre/Dexcom one.

New indication for prescribing Sensors

- Health Technology Wales has published new guidance recommending flash glucose monitoring for all people with diabetes who are treated with insulin in Wales (i.e both type 1 and type 2 diabetes):

HTW Guidance:

The evidence supports the routine adoption of Freestyle Libre flash glucose monitoring to guide blood glucose regulation in people with diabetes who require treatment with insulin.

- The use of Freestyle Libre flash glucose monitoring in these people improves the proportion of time that the blood glucose is in target range and reduces time in hypo and hyperglycaemia.
- Health economic modelling indicates that the use of Freestyle Libre flash glucose monitoring is a cost effective intervention compared to finger-prick self monitoring of blood glucose with incremental cost effectiveness ratios (ICERs) of £4,706 and £13,137 per QALY for type 1 and type 2 diabetes, respectively."

"Based on the clinical and cost effectiveness evidence, the Appraisal Panel concluded that the evidence supports the routine adoption of FLFGM for people with diabetes (of any type) who require treatment with insulin.

- It was noted that there are a range of additional specific scenarios in which FLFGM may also potentially offer benefit, such as:
 - - people who cannot use current forms of glucose monitoring, or for whom use may be distressing, such as those with dementia, learning disabilities or needle phobias;
 - - people who need extra care or assistance with glucose monitoring, such as children or the elderly;

Hypoglycaemia

- Classified as a blood glucose $< 4\text{mmol/l}$
 - But symptoms may be felt at higher levels depending on rate of fall of the glucose
 - Be aware that symptoms may ne be very clear in older ages and patients on certain medications such as B Blockers
- Discuss
 - Likely symptoms
 - Management of low blood glucose

Some patients may be more at risk of Hypoglycaemia than others.

Criteria for assessing Hypo-glycaemic risk:-

Major Criteria

- History of previous Major Hypo-glycaemia
- Hypo-glycaemia unawareness
- Severe renal deficiency eGFR <30ml/min
- Dementia or Cognitive Functional Decline
- Frailty / Elderly

Minor Criteria

- Previous Hypo-glycaemia
- Mild renal insufficiency eGFR <60ml/min
- Duration diabetes >10yrs
- Age >70yrs
- Autonomic neuropathy
- Low BMI <22Kg/m²
- Polypharmacy
- Lack diabetes education

The Management of Hypoglycaemia (a Blood Glucose <math><4\text{mmol/l}</math>)

If conscious and able to swallow, treat with a fast-acting carbohydrate by mouth.

- Fast-acting carbohydrates include glucose liquid, glucose tablets, glucose 40% gels (e.g. *Glucogel*[®], *Dextrogl*[®], or *Rapilose*[®]), pure fruit juice, and sugar (sucrose) dissolved in an appropriate volume of water.
- Orange juice should not be given to patients following a low-potassium diet due to chronic kidney disease
- Chocolates and biscuits should be avoided if possible, as they have a lower sugar content and their high fat content may delay stomach emptying.
- If necessary, repeat treatment after 15 minutes, up to a maximum of 3 treatments in total.

Once blood-glucose concentration is above 4 mmol/litre and the patient has recovered,

- a snack providing a long-acting carbohydrate should be given to prevent blood glucose from falling again (e.g. two biscuits, one slice of bread, 200–300 mL of milk (not soya or other forms of 'alternative' milk, e.g. almond or coconut), or a normal carbohydrate-containing meal if due).

Insulin should not be omitted if due, but the dose regimen may need review.

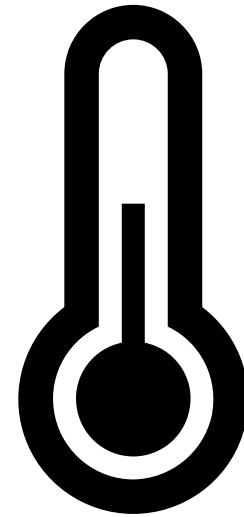
Hypoglycaemia which does not respond (blood-glucose concentration remains below 4 mmol/litre after 30–45 minutes or after 3 treatment cycles), should be treated with intramuscular [glucagon](#) or [glucose](#) 10% intravenous infusion.

Hyperglycaemia

- Discuss
 - what levels may cause concern
 - Reasons for elevation
 - Reduced insulin availability (Missed dose / poor injection/storage insulin)
 - Lack of activity
 - Food ingestion
 - Illness
- Management
 - Insulin dose change / fluids / when to seek advice
- The need if appropriate for ketone testing

Sick Day Rules

What is meant by “ Sick Day Rules” ?



S.I.C.K.

S (Sugar)

- Blood glucose levels can rise during illness even if the person is not eating
- Advise to increase blood glucose monitoring if the person has access to it
- Diabetes medications (sulfonylureas and insulin doses) may need to be increased temporarily during illness to manage these raised glucose levels

I (Insulin)

- NEVER stop insulin
- Insulin doses may need to be increased during illness, especially if ketones are present

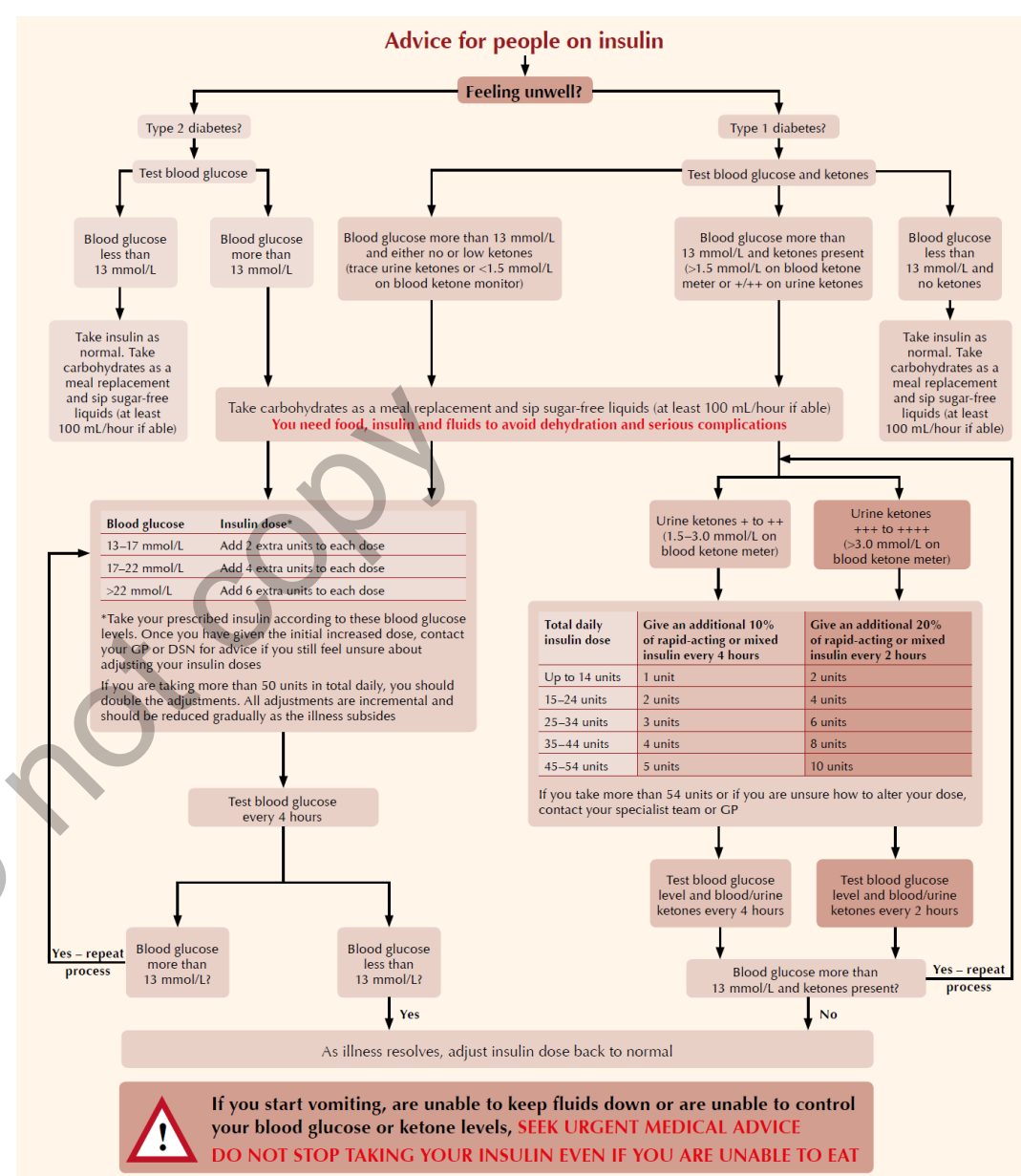
C (Carbohydrate)

- Ensure the person maintains hydration and carbohydrate intake
- If the person is not able to eat or is vomiting, advise to replace meals with sugary fluids
- If blood glucose levels are high, maintain fluid intake with sugar-free fluids
- If blood glucose levels are low, encourage regular intake of sugary fluids

K (Ketones)

- In type 1 diabetes, advise to check for ketones every 2–4 hours (also patients on SGLT2 therapies)
- Give extra rapid-acting insulin doses (in addition to regular doses) based on total daily
- insulin dose needs alteration if ketones are present –
- Advise to drink plenty of water to maintain hydration and flush through ketones

Insulin management at times of illness



⚠ If you start vomiting, are unable to keep fluids down or are unable to control your blood glucose or ketone levels, SEEK URGENT MEDICAL ADVICE

DO NOT STOP TAKING YOUR INSULIN EVEN IF YOU ARE UNABLE TO EAT

Useful reading and leaflets

- NICE CG169 – Acute kidney injury: prevention, detection and management
- TREND-UK – Managing diabetes during intercurrent illness in the community
- “Sick day rules” in patients at risk of acute kidney injury: an interim position statement from the Think Kidneys Board

Abbreviations

ACE=angiotensin-converting enzyme; AKI=acute kidney injury; ARB=angiotensin receptor blocker; DKA=diabetic ketoacidosis; HHS=hyperosmolar hyperglycaemic state; NSAID=non-steroidal anti-inflammatory drug; SGLT2=sodium-glucose cotransporter 2

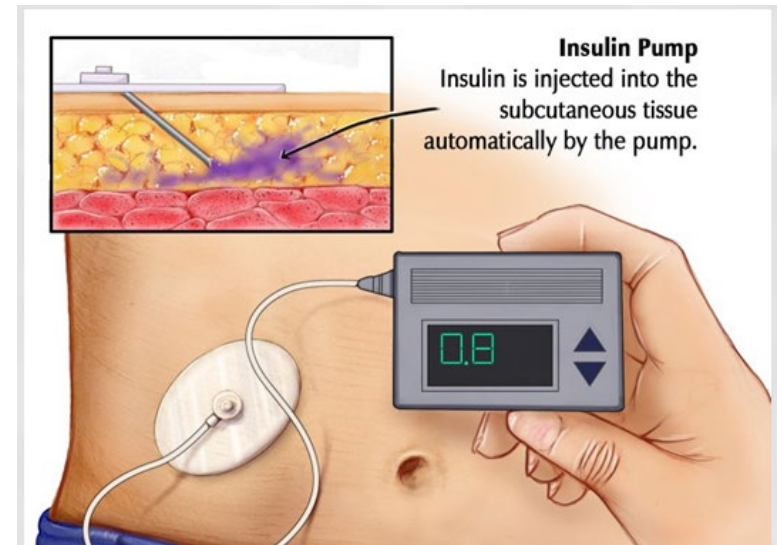
Insulin Pump Therapy

An insulin pump is a battery-operated device that provides regular insulin throughout the day.

The insulin is provided via a cannula, inserted under the skin. This can be left in for two to three days before it needs to be replaced and moved to a different insulin injection site.

When eating, extra insulin can be given using the pump. ('bolus dose').

The specialist nurse and dietitian will help work out how much insulin is needed



Prescribing for pump users

Rapid acting insulin for pump

Adequate number of BGM test strips to allow for (normally minimum 200/month)

- Pre and post prandial blood glucose
- Nocturnal blood glucose
- Continuous Glucose Monitoring (Sensors)
- Exercise testing
- Sick day rules

Ketone test strips (ideally for blood)

Emergency pack

- Glucagon
- Spare basal and rapid insulin via pens in case of pump failure
- Pen needles

Prescribing for Pump patients

Vials

- Barrels or carts

Monitoring equipment

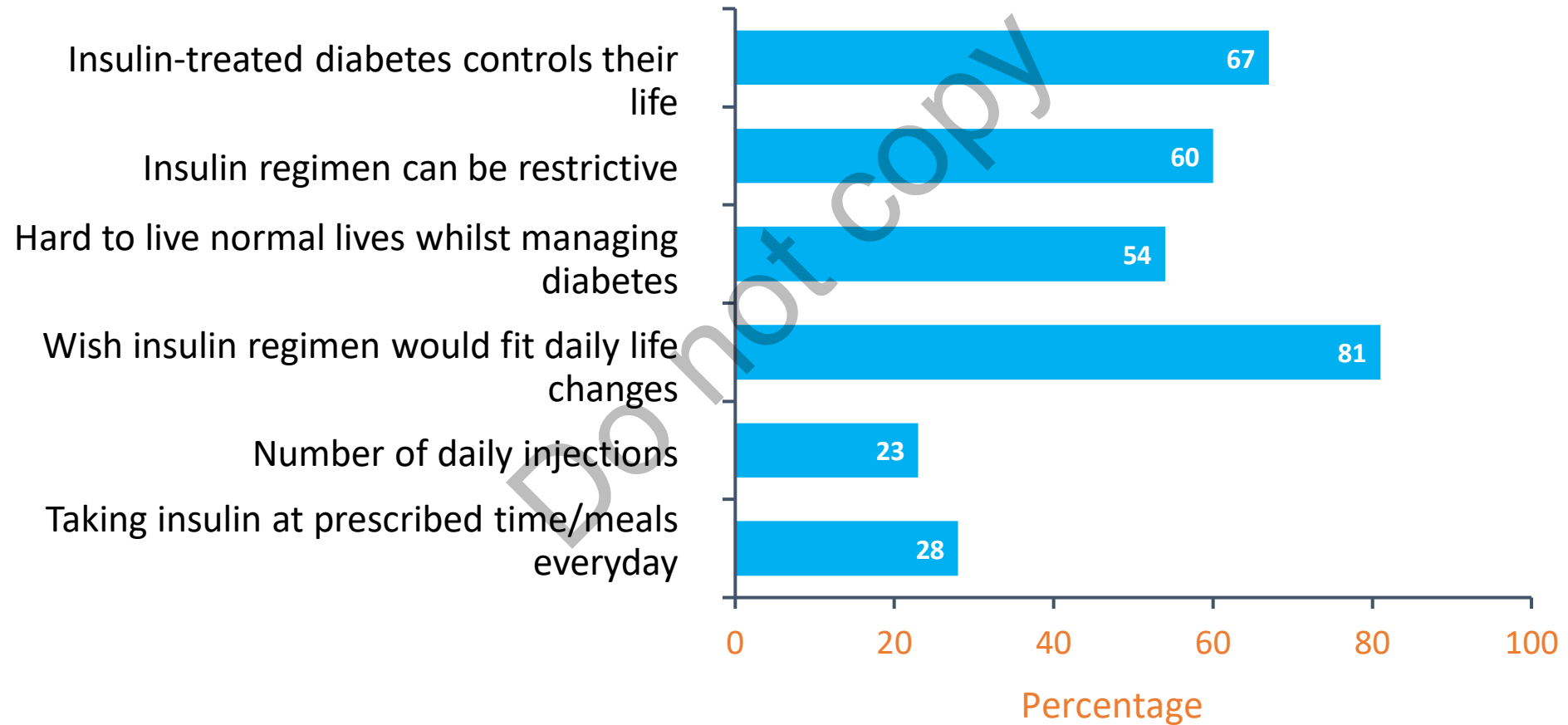
- Glucose testing
- Ketone testing

Spare insulin pens

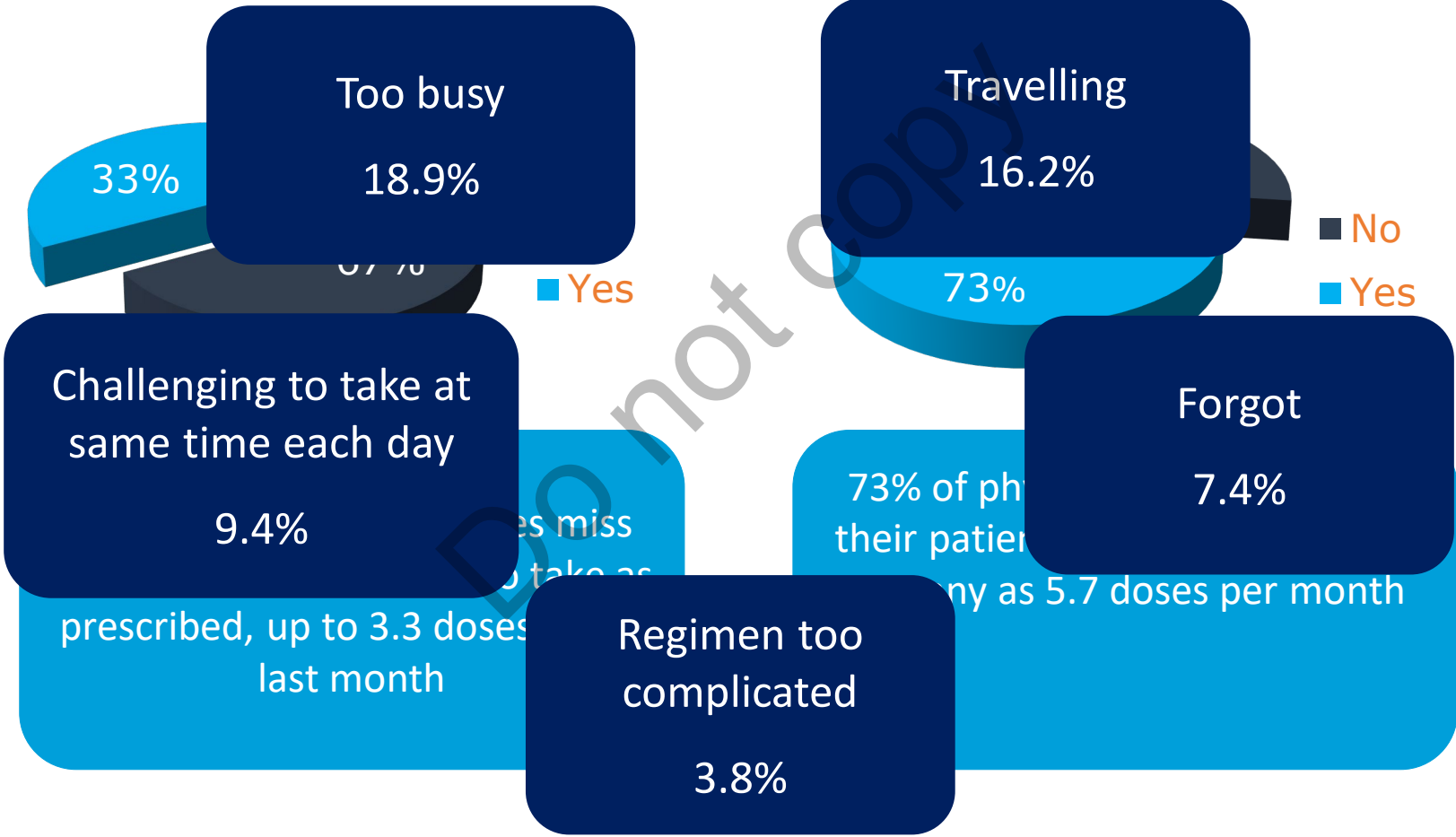
- And insulin in case of pump failure
- Remember both bolus insulin and basal insulin will be needed

Pen needles

GAPP – patient-cited issues with insulin treatment



Insulin Doses Are Being Missed Or Not Taken As Prescribed



Frail elderly or
End of Life

Reducing /
stopping
insulin



Due to change in circumstance ,
regimens may need review and be
changed.



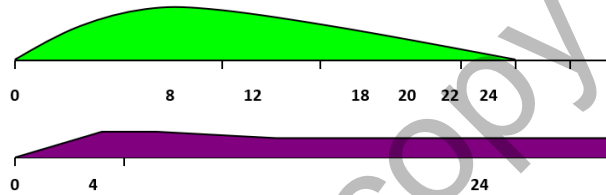
Insulin may need to be reduced ,
altered or even stopped



Consider what may issues may
cause a need for change

Consider in which scenario would you consider human vs analogue basal insulin

- Elderly
- Pregnancy
- Living alone
- Type1 / Type 2
- Pancreatic exocrine insufficiency
- Occupation
- Steroid use
- End of life



Intermediate Acting (isophane / NPH)

Long acting analogue

Confusion
Frailty
Dexterity
Dietary regimen
Glucose monitoring
Attainment of targets
Glycaemic risk

Poor control
despite
reasonable
dose of insulin

Consider

Compliance issues

Insulin issues

Equipment issues

Injection sites

Insulin type/ dose

Insulin resistance

Other therapies affecting
control

Diet

lifestyle

insulin administration

- Dosing
- Timing

Poor control
despite
reasonable
dose of insulin

Consider

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Equipment issues

Injection sites

Insulin type/ dose

Insulin resistance

Other therapies affecting
control

Correct insulin being dispensed

Insulin in date

Insulin being stored appropriately

Poor control
despite
reasonable
dose of insulin

Consider

Compliance issues

Insulin issues

Equipment issues

Injection sites

Insulin type/ dose

Insulin resistance

Other therapies affecting
control

Needles

- Correct size /type
- Regular change
- Both caps removed
- Correctly put on pen (Not bent)
– always advise on air shot

Poor control
despite
reasonable
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Injection sites

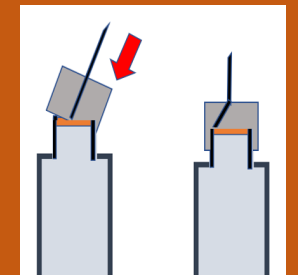
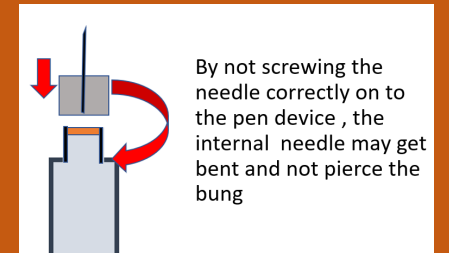
Insulin type/ dose

Insulin resistance

Other therapies affecting control

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Poor control
despite
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Consider

Compliance issues

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Needles

- Correct size /type
- Regular change
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– always advise on air shot

Device

- Correct use of device
 - Dialling correct dose
 - Pressing plunger to administer insulin
- Correct device for insulin
- Cartridge being changed, if appropriate
- Cartridge / pen not damaged
- Pen (if not disposable) no more than 2 years old

Poor control
despite
reasonable
dose of insulin

Consider

Compliance issues

Insulin issues

Equipment issues

Injection sites

Insulin type/ dose

Insulin resistance

Other therapies affecting
control

Appropriate sites

Site rotation

Health of injection areas

- Trauma
- Lipodystrophy

Poor control
despite
reasonable
dose of insulin

Consider

Compliance issues

Insulin issues

Equipment issues

Injection sites

Insulin type/ dose

Insulin resistance

Other therapies affecting
control

Over treatment

- causing silent hypoglycaemia and rebound

Glucose profiles

- Fasting vs Post prandial control

Poor control
despite
reasonable
dose of insulin

Consider

Compliance issues

Insulin issues

Equipment issues

Injection sites

Insulin type/ dose

Insulin resistance

Other therapies affecting
control

Metabolic syndrome

Hypothyroid

Endocrinopathies

Poor control
despite
reasonable
dose of insulin

Consider

Compliance issues

Insulin issues

Equipment issues

Injection sites

Insulin type/ dose

Insulin resistance

Other therapies affecting
control / other illnesses

Steroids

Oral hypoglycaemic agents

Illnesses causing stress

- Physical
- Emotional

Illnesses affecting digestion

- PEI
- Gastroparesis

When starting Insulin therapy in Adults with type 2 diabetes use a structured education programme

The programme should include:-

Insulin use

Review

Education

When starting Insulin therapy in Adults with type 2 diabetes use a structured education programme

The programme should include:-

Storage of insulin

Correct use of device

Injection technique

- Including rotating sites and avoiding repeated injections at the same point within sites
- Sharps disposal

Review

Education

When starting Insulin therapy in Adults with type 2 diabetes use a structured education programme

The programme should include:-

Storage of insulin

Correct use of device

Injection technique

- Including rotating sites and avoiding repeated injections at the same point within sites
- Sharps disposal

Continuing telephone support

Self monitoring

Dose titration to target levels

Education

Summary

Living with insulin is different for each patient, a complex mix of their physical and social characteristics

Different insulins, regimens and methods of delivery allow tailoring to an individual needs

Education and effective use of SMBG are crucial to successful use of insulin therapy

Balance needs to be struck between HbA1c target and risk of hypoglycaemia and weight gain