

INSULIN ADMINISTRATION: SYRINGES, PORTS, PENS, CSII...

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100 Years of Insulin Therapy: A long Successful Path



DISCLOSURES

- No potential conflict of interest



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OBJECTIVES

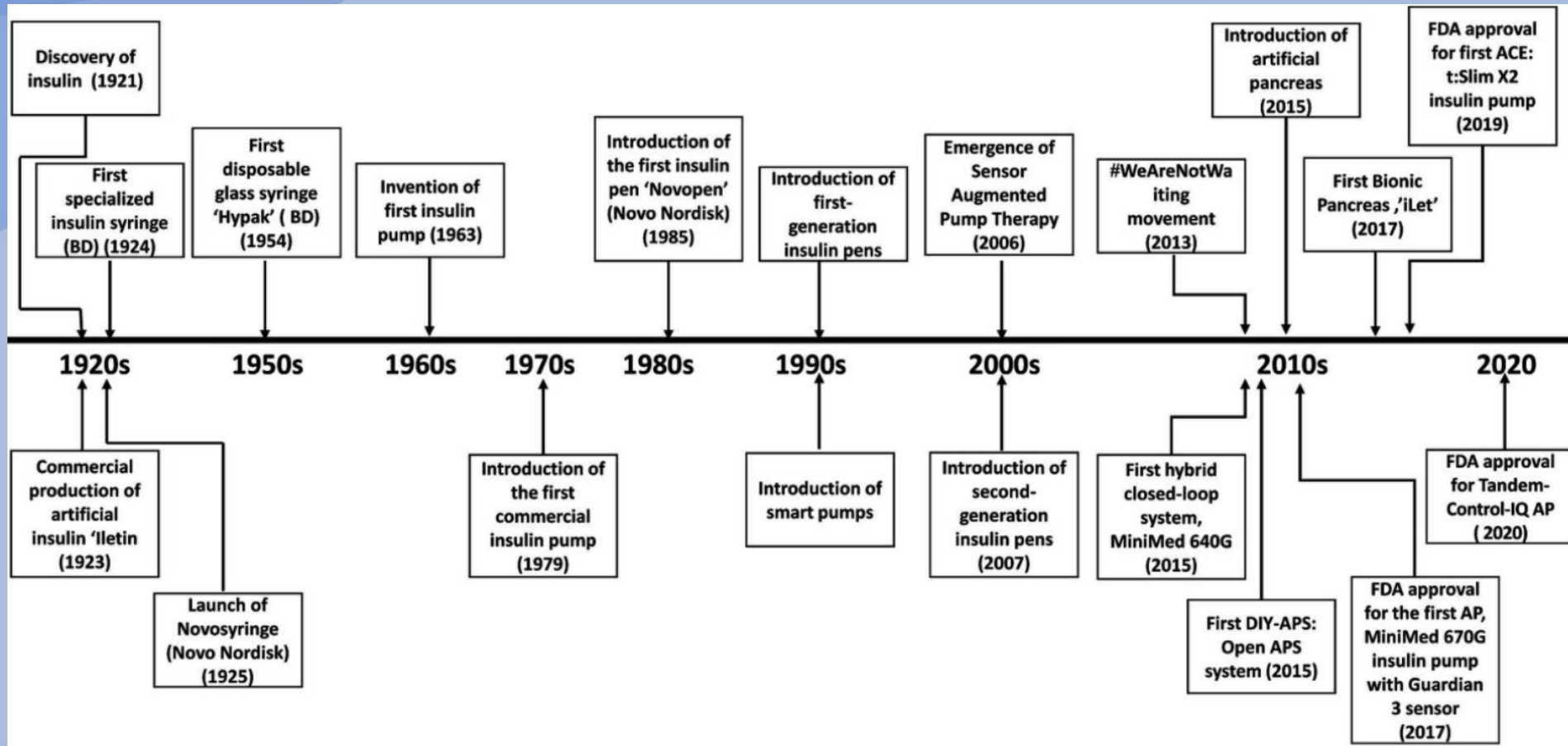
- To become familiar with the different insulin delivery devices available
- To understand the benefits and limitations of each insulin delivery device
- To learn how advances in technology could help achieve better glucose control



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TIMELINE



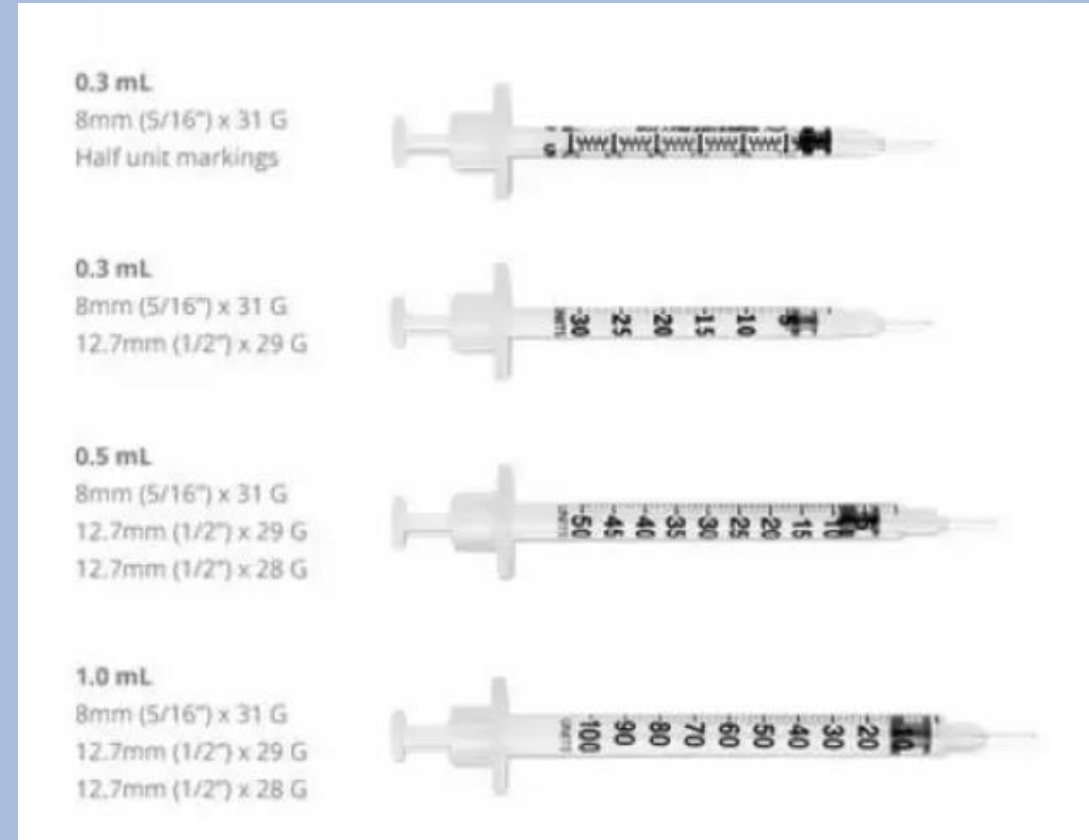
Kesavadev, Jothydev et al. "Evolution of Insulin Delivery Devices: From Syringes, Pens, and Pumps to DIY Artificial Pancreas." *Diabetes therapy : research, treatment and education of diabetes and related disorders* vol. 11,6 (2020): 1251-1269.



TIMELINE



INSULIN SYRINGES



INSULIN SYRINGES

ADVANTAGES

- Cheaper
- Can mix different insulins into one syringe, therefore, avoiding two injections for two different insulins

DISADVANTAGES

- Unable to measure less than half a unit, especially for pediatric patients
- Longer training period
- Psychologic impact



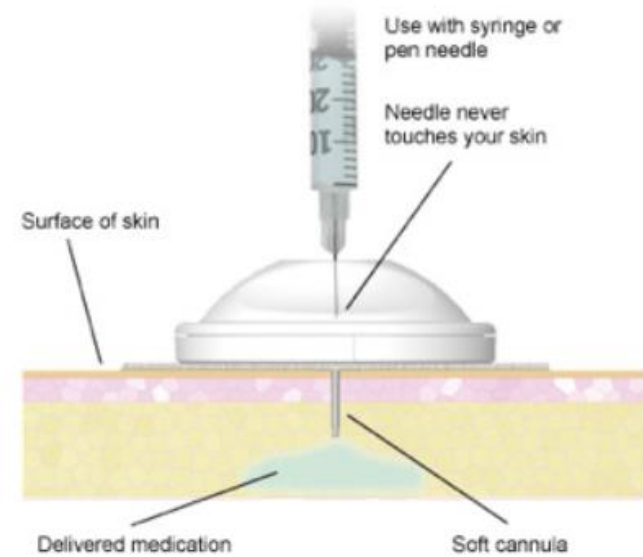
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INJECTION AIDS: IPORT



Standard vs. Injection Port



No needle remains under the skin



INJECTION AIDS: I-PORT

ADVANTAGES

- Reduces frequency of multiple injections
- Ideal for patients with needle phobia
- Eliminates direct injection to skin and multiple puncture for injections

DISADVANTAGES

- Insurance coverage



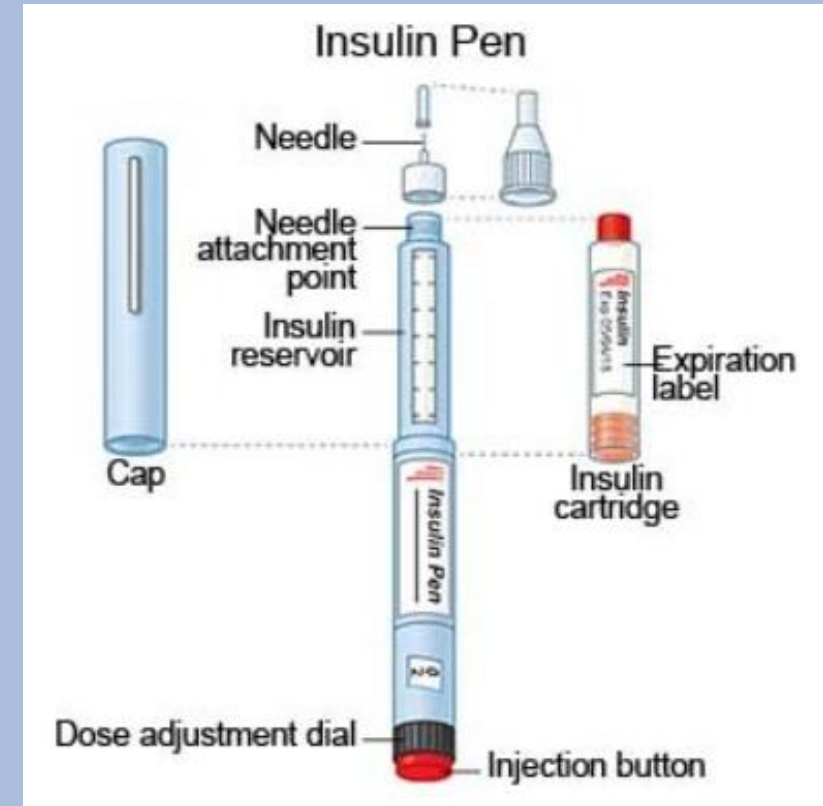
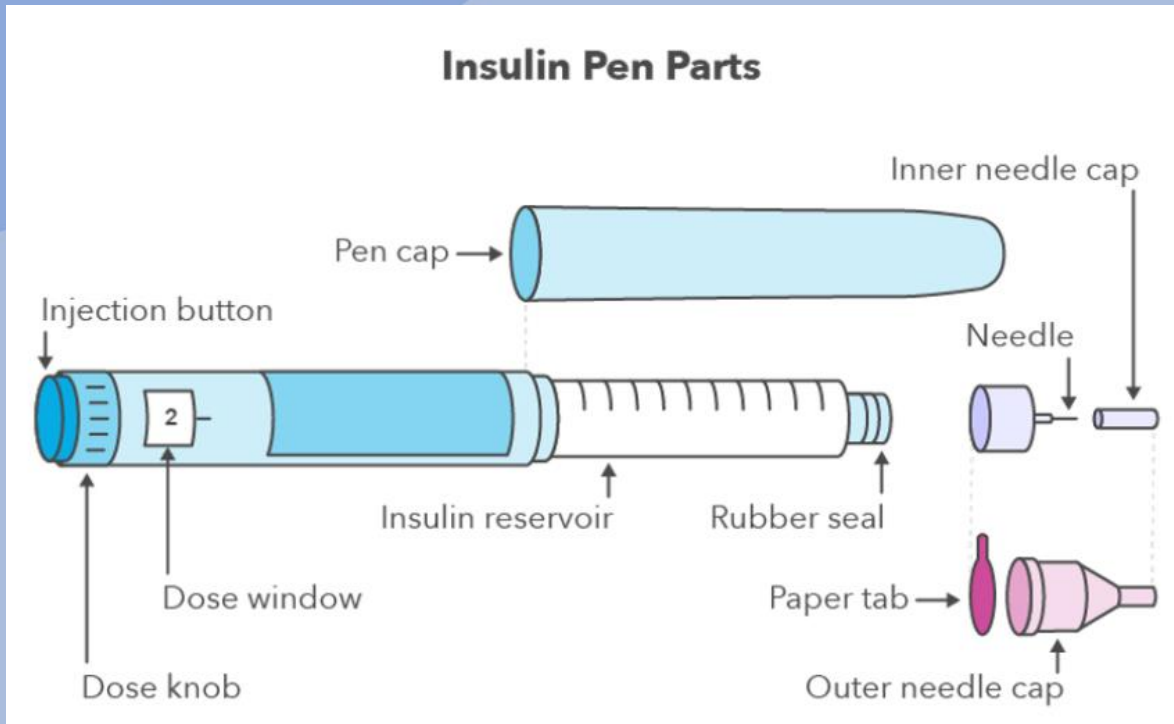
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INJECTION AIDS: INJECT-EASE



INSULIN PENS



INSULIN PENS

Long-Acting Insulin Pens

Generic	Brand	Conc.
	Lantus	U-100
Glargine	Basaglar	U-100
	Toujeo	U-300
Detemir	Levemir	U-100
Degludec	Tresiba	U-100
		U-200



Rapid-Acting Insulin Pens

Generic	Brand	Conc.
Aspart	Novolog	U-100
	Fiasp	U-100
Lispro	Humalog	U-100
		U-200
	Admelog	U-100
Glulisine	Apidra	U-100



INSULIN PENS

ADVANTAGES

- Ease of use
- Discreet
- Easy to carry
- Better treatment compliance
- Less pain due to shorter/thinner needles available

DISADVANTAGES

- More expensive than syringes
- Does not allow mixing of insulin types



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NEXT GENERATION/INTELLIGENT INSULIN PENS



INPEN



NEXT GENERATION/INTELLIGENT INSULIN PENS

ADVANTAGES

(in addition to the advantages of regular pens)

- Memory function (2nd generation- “smart” pens)
 - Stores the date, time, and amount of previous doses
- Bluetooth-enabled wireless with smartphone interphase/app (3rd generation- connected pens)
 - Dose calculator
 - Active insulin
 - Dose reminder
 - Insulin temperature monitoring
 - Integrated with CGM's

DISADVANTAGES

- Same as 1st generation insulin pens



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INSULIN PUMPS/CSII



**OMNIPOD and
OMNIPOD DASH
(PATCH PUMPS)**



MEDTRONIC PARADIGM



INSULIN PUMPS/CSII

ADVANTAGES

- Resembles physiologic delivery of insulin
- Lifestyle flexibility
- Less daily injections
- Permits multiple adjustments throughout day
- More accurate and smaller dosing
- More data accessible to patient and physician
- Improves glycemic targets (HbA1c, Time in Range (TIR))

DISADVANTAGES

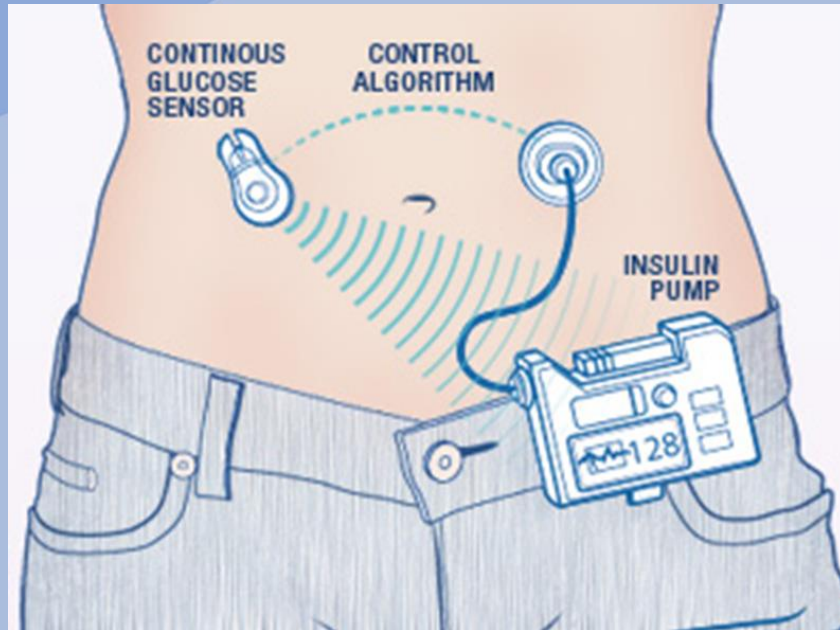
- Requires more patient training and compliance
- Cannula/infusion set detachment or kinking
- Skin irritation
- More expensive



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SENSOR AUGMENTED (SAP) INSULIN PUMPS



2006: 1st SAP pump. Medtronic Minimed Paradigm
REAL-Time



SENSOR AUGMENTED (SAP) INSULIN PUMPS

ADVANTAGES

- Low glucose suspend which allows slowing down rate of blood glucose decrease



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SAP-PLGM INSULIN PUMPS (predicted low glucose suspension)



MEDTRONIC MINIMED 630G + GUARDIAN



SAP-PLGM INSULIN PUMPS (predicted low glucose suspension)

ADVANTAGES

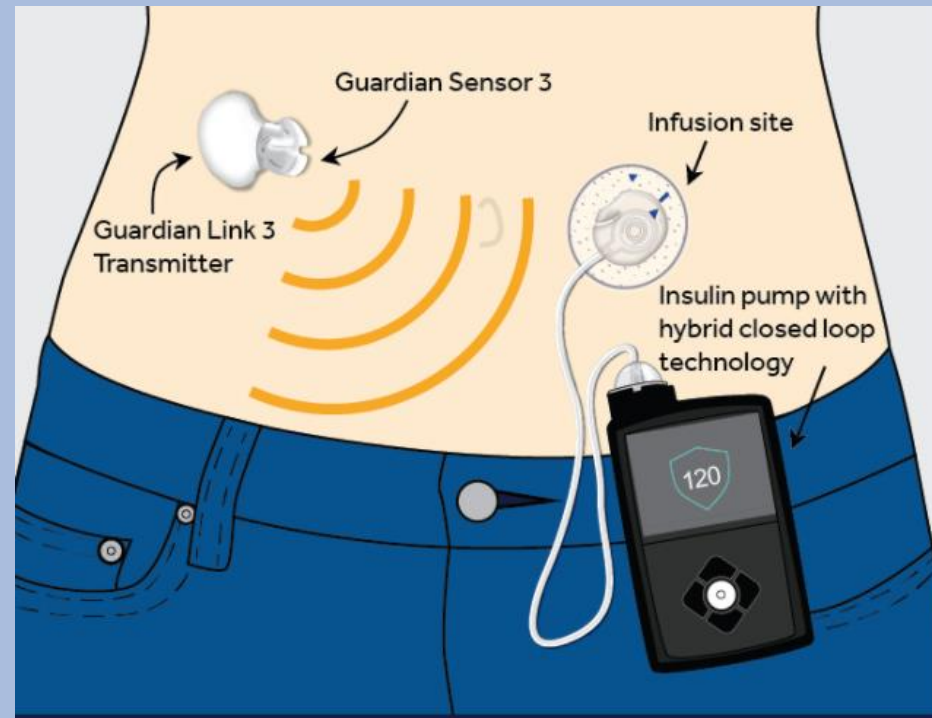
- It predicts future blood sugar by the rate of decrease and suspends insulin infusion prior reaching hypoglycemia
- Reduces incidence of hypoglycemia especially nocturnal



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HYBRID CLOSED-LOOP SYSTEM



**2017: 1st Hybrid Closed-Loop System.
MEDTRONIC MINIMED 670G + GUARDIAN 3**



HYBRID CLOSED-LOOP SYSTEM

ADVANTAGES

- Automatically controls basal insulin delivery every 5 minutes based on CGM data in order to keep blood sugars at a set target



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ALTERNATE CONTROLLER ENABLED (ACE) INSULIN PUMPS



**TANDEM T:SLIM X2 WITH BASAL IQ AND
CONTROL IQ**



ALTERNATE CONTROLLER ENABLED (ACE) INSULIN PUMPS

ADVANTAGES

- Can be combined with different components of diabetes technologies and devices (CGM, meters, cell phones...)
- It gives micro-boluses of insulin when blood glucose levels increase



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DO-IT-YOURSELF ARTIFICIAL PANCREAS/LOOPERS



RILEY LINK

- Not FDA approved














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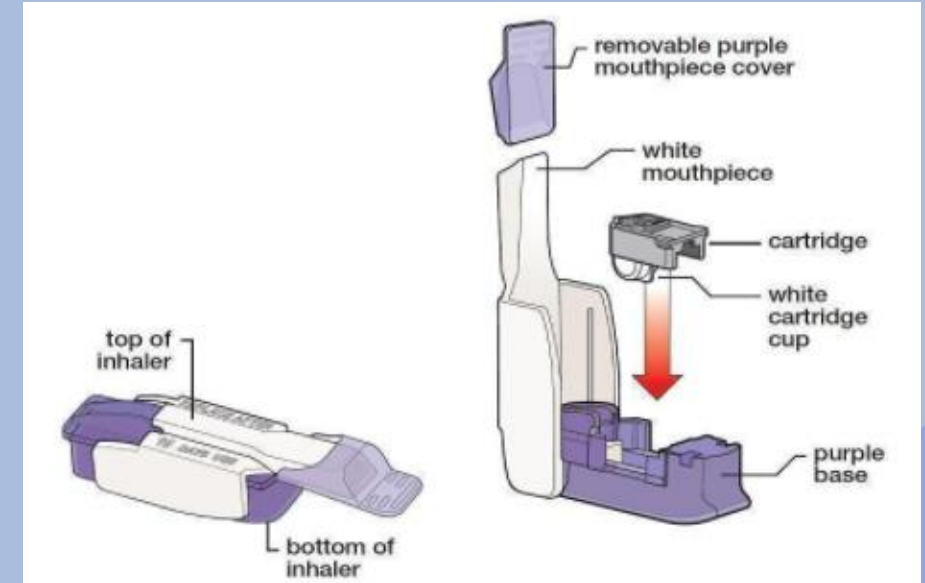


INSULIN INHALERS



AFREEZA

INJECTED MEALTIME INSULIN DOSE	AFREEZA DOSE	# OF CARTRIDGES NEEDED		
		4 UNIT (BLUE)	8 UNIT (GREEN)	12 UNIT (YELLOW)
UP TO 4 UNITS	4 UNITS			
5-8 UNITS	8 UNITS			
9-12 UNITS	12 UNITS		+	 OR 
13-16 UNITS	16 UNITS	 		
17-20 UNITS	20 UNITS		+	
21-24 UNITS	24 UNITS	 		



INSULIN INHALERS

ADVANTAGES

- Rapid acting
- Short duration
- Improvement in post prandial hyperglycemia
- Not injectable

DISADVANTAGES

- Requires pulmonary function testing
- Dosing not as precise
- Insurance coverage barriers



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NEAR FUTURE TECHNOLOGY

- Bionic pancreas
- Artificial pancreas
- Implanted pancreas
- Jet insulin injectors



THANK YOU



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