Primary FDM Assessment of Blood Sugar Dysregulation & Oxidative Stress

Lesson Outline

- Assessing the patient with diabetes
- Assessing metabolic dysglycemia in your patients
- Assessing for oxidative stress
- How to treat them all!

Assessment Algorithm - DM II

- Run NAQ and other intake forms esp. diet diary
- Request medical records
- Order comprehensive blood work
  - Chem screen plus CBC & Fasting insulin, CRP, Fibrinogen, Fructosamine, HGB A1C
- They must keep a record of their glucose levels daily
- Full PE exam
- Urinalysis plus oxidata test
- Consider advanced FDM testing

Primary FDM Testing for Metabolic Dysglycemia

- History: N.A.Q. and other forms
- Physical Exam
- Blood Testing
  - ❑Blood Chemistry and CBC Analysis
  - ❑Glucose Insulin Tolerance Testing
- Advanced FDM Testing

Primary FDM Testing

History

Nutritional Assessment Questionnaire (NAQ)

DIET

1. __✓__ Alcohol	12. _____ Margarine
2. __✓__ Artificial sweeteners	13. _____ Milk products
3. __✓__ Candy or other sweets	14. _____ Radiation Exposure (0=no, 1=yes)
4. __✓__ Carbonated beverages	**15. __✓__ Refined flour/ Baked goods**
5. _____ Chewing tobacco	16. _____ Vitamins and minerals
6. _____ Cigarettes	17. _____ Water, distilled
7. _____ Cigars/pipes	18. _____ Water, Tap
8. __✓__ Caffeinated beverages	19. _____ Water, well
9. __✓__ Fast Foods	**20. __✓__ Diet often for weight control**
10. _____ Fried foods	
11. _____ Luncheon meats/ hot dogs	

Nutritional Assessment Questionnaire (NAQ)

Sugar Handling

173. Awaken a few hours after falling asleep, hard to get back to sleep	180. Headache if meals are skipped or delayed
174. Crave sweets	181. Irritable before meals
175. Binge or uncontrolled eating	182. Shaky if meals are delayed
176. Excessive appetite	183. Family members with diabetes (0=none, 1=1 or 2, 2=3 or 4, 3= more than 4)
177. Crave coffee or sugar in afternoon	184. Frequent thirst
178. Sleepy in afternoon	185. Frequent urination
179. Fatigue relieved by eating	

Nutritional Assessment Questionnaire (NAQ)

VITAMIN NEED

186. ✓ Muscles become easily fatigued	200. _____ Whole body or limb jerk as falling asleep
187. ✓ Feel worse, sore after moderate exercise	201. _____ Night sweats
188. ✓ Vulnerable to insect bites	202. _____ Restless leg syndrome
189. ✓ Loss of muscle tone, heaviness in arms/ legs	203. _____ Cheilosis (cracks at corner of mouth)
190. ✓ Enlarged heart, or heart failure	204. _____ Fragile skin, easily chaffed, as in shaving
191. ✓ Pulse slow / below 65 (1 = yes, 0 = no)	205. _____ Polyps or warts
192. ✓ Ringing in the ears / Tinnitus	206. _____ MSG sensitivity
193. ✓ Numbness, tingling or itching in extremities	207. _____ Wake up without remembering dreams
194. ✓ Depressed	208. _____ Take birth control pills
195. ✓ Fear of impending doom	209. _____ Small bumps on back of arms
196. ✓ Worrier, apprehensive, anxious	**210. ✓ Strong light at night irritates eyes**
197. ✓ Nervous or agitated	211. _____ Nose bleeds and / or tend to bruise easily
198. ✓ Feelings of insecurity	212. _____ Can hear heart beat on pillow at night
199. ✓ Heart races	213. _____ Bleeding gums especially when brushing teeth

Nutritional Assessment Questionnaire (NAQ)

ADRENAL

214. _____ Tend to be a "night person"	227. _____ Arthritic tendencies
215. _____ Difficulty falling asleep	228. _____ Crave salty foods
216. _____ Slow starter in the morning	229. _____ Salt foods before tasting
217. _____ Keyed up, trouble calming down	230. _____ Perspire easily
218. _____ High blood pressure (normal 120/80)	231. _____ Chronic fatigue, or get drowsy often
219. _____ Headache after exercising	232. _____ Afternoon yawning
220. _____ Feeling wired or jittery if drinking coffee	233. _____ Afternoon headache
221. _____ Clench or grind teeth	234. _____ Asthma, wheezing or difficulty breathing
222. _____ Calm on the outside, troubled inside	235. _____ Pain on the medial or inner side of the knee
223. _____ Chronic low back pain, worse with fatigue	236. _____ Tendency to sprain ankles or "shin splints"
224. _____ Become dizzy when standing up suddenly	237. _____ Tendency to need to wear sunglasses
225. _____ Difficult maintaining manipulative correction	238. _____ Allergies and / or hives
226. _____ Pain after manipulative correction	239. _____ Weakness, dizziness

Check foods or drinks that you consume a minimum of 3 days or more each week.

☐ Almonds	☐ Cod	☐ McDonalds Food	☐ Pumpkin
☐ Almond Butter	☐ Coffee	☐ Millet	☐ Quinoa
☐ Alcohol	☐ Corn	☐ Mung Bean	☐ Radish
☐ Apples	☐ Crab	☐ Mushroom	☐ Rye
☐ Avocado	☐ Cranberry	☐ Mustard	☐ Safflower
☐ Asparagus	☐ Cashew	☐ Milk, Cow	☐ Sage
☐ Bagels	☐ Cheese	☐ Milk, Goat	☐ Salt
☐ Barley	☐ Cucumber	☐ Milk, Rice	☐ Salmon
☐ Bananas	☐ Chocolate	☐ Milk, Almond	☐ Scallops
☐ Burger King	☐ Desserts	☐ Milk, Soy	☐ Sausage
☐ Burger	☐ Deli Sandwich	☐ Mexican Food	☐ Slim Fast
☐ Bean, Lima	☐ Eggplant	☐ Malt	☐ Sweet & Low
☐ Bread, White	☐ Ensure	☐ Nutmeg	☐ Sesame
☐ Bread, Wheat	☐ Flounder	☐ NutriSweet	☐ Shrimp
☐ Bread, Rye	☐ Fried Foods	☐ Oatmeal, Regular	☐ Snapper
☐ Bagels	☐ French Fries	☐ Oatmeal, Instant	☐ Soft Drinks
☐ Biscuits	☐ French Toast	☐ Olive	☐ Sole
☐ Bean, Pinto	☐ Garlic	☐ Onion	☐ Sour cream
☐ Bean, String	☐ Ginger	☐ Orange Juice	☐ Soybean
☐ Broccoli	☐ Grape	☐ Oregano	☐ Spinach
☐ Brazil Nuts	☐ Grits	☐ Oyster	☐ Strawberry
☐ Brussel Sprouts	☐ Greek Food	☐ Orange	☐ Sunnalee
☐ Blueberries	☐ Grapefruit	☐ Papaya	☐ Sugar
☐ Butter	☐ Grape nuts	☐ Parsley	☐ Sunflower
☐ Cabbage	☐ Haddock	☐ Pop/Tarts	☐ Salad Bar
☐ Cereal, Special K	☐ Ham	☐ Peanuts	☐ Sardines
☐ Cereal, Bran flakes	☐ Halibut	☐ Peanut butter	☐ Squash
☐ Cereal, Cornflakes	☐ Herring	☐ Peas	☐ Taco bell food
☐ Cereal, _____	☐ Hot Dogs, Pork	☐ Peach	☐ Tea, Black
☐ Cereal, _____	☐ Hot Dogs, Beef	☐ Pecan	☐ Tea, Decaffeinated
☐ Celery	☐ Hamburgers	☐ Pepper	☐ Thai food
☐ Cantaloupe	☐ Hardees Food	☐ Pepper, Green	☐ Tomato
☐ Candy	☐ Honey	☐ Perch	☐ Trout
☐ Chinese Food	☐ Italian Food	☐ Pineapple	☐ Tuna
☐ Cream Cheese	☐ Ice Cream	☐ Pancakes	☐ Turkey
☐ Carrot	☐ Indian Food	☐ Protein Shakes, Soy	☐ Tangerine
☐ Chicken	☐ Jack in the box food	☐ Protein Shakes, Milk	☐ Vinegar
☐ Chili Pepper	☐ Japanese Food	☐ Protein Shakes,	☐ Walnut
☐ Cinnamon	☐ Jelly	☐ Whey	☐ Waffles
☐ Clam	☐ Ketchup	☐ Protein Shakes,	☐ Whitefish
☐ Cloves	☐ Lamb	☐ _____	☐ Wheat
☐ Cocoa-Chocolate	☐ Lemon	☐ Protein Shakes,	☐ Wendy's food
☐ Carnation Drink	☐ Lentil	☐ _____	☐ Yeast, Bakers
☐ Chewing gum, sweetened	☐ Lettuce	☐ Plum	☐ Yeast, Brewers
☐ Chewing gum, sugar free	☐ Lime	☐ Pork	☐ Yogurt
☐ Coconut	☐ Lobster	☐ Peanut	☐ Yam
	☐ Mackerel	☐ Potato, sweet	☐ Zucchini
	☐ Margarine	☐ Potato, White	

Has there ever been a food that you have craved or really "pigged out" on over a period of time?

_____

_____

_____

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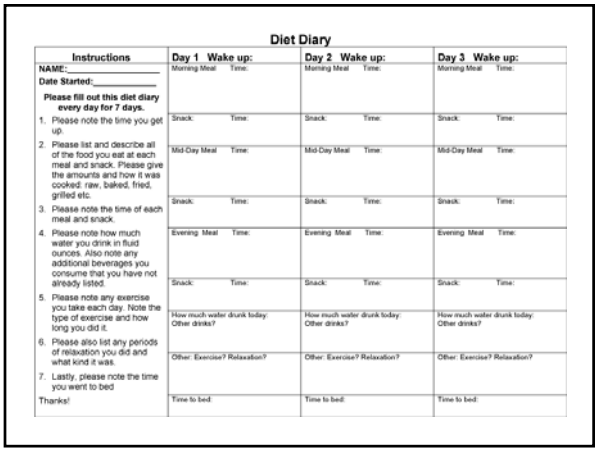


Diet Diary

Instructions	Day 1 Wake up:	Day 2 Wake up:	Day 3 Wake up:
NAME:_____ Date Started:_____ **Please fill out this diet diary every day for 7 days.**	Morning Meal Time:	Morning Meal Time:	Morning Meal Time:
1. Please note the time you get up.	Snack: Time:	Snack: Time:	Snack: Time:
2. Please list and describe all of the food you eat at each meal and snack. Please give the amounts and how it was cooked: raw, baked, fried, grilled etc.	Mid-Day Meal Time:	Mid-Day Meal Time:	Mid-Day Meal Time:
3. Please note the time of each meal and snack.	Snack: Time:	Snack: Time:	Snack: Time:
4. Please note how much water you drink in fluid ounces. Also note any additional beverages you consume that you have not already listed.	Evening Meal Time:	Evening Meal Time:	Evening Meal Time:
5. Please note any exercise you take each day. Note the type of exercise and how long you did it.	Snack: Time:	Snack: Time:	Snack: Time:
6. Please also list any periods of relaxation you did and what kind it was.	How much water drunk today: Other drinks?	How much water drunk today: Other drinks?	How much water drunk today: Other drinks?
7. Lastly, please note the time you went to bed	Other: Exercise? Relaxation?	Other: Exercise? Relaxation?	Other: Exercise? Relaxation?
Thanks!	Time to bed:	Time to bed:	Time to bed:

Assessing Risk for Dysglycemia

Primary FDM Testing

Physical Signs Associated with Metabolic Dysglycemia

- Increasing B.P.
- Ear lobe crease
- Multiple Pigmented skin tags
- Adult acne
- Cataracts
- Slow wound healing
- Tinea
- White patches on inside of cheek
- Chronic bladder infections

Assessing Your Patient's Risk

- Identify patient's Body Mass Index
- Identify central obesity
- Identify other risk factors:
  - ❑high blood pressure
  - ❑Hyperlipidemia
  - ❑High fasting blood glucose and insulin
  - ❑Family history of premature heart disease
  - ❑Family history of DM
  - ❑High processed meat
  - ❑Long Menstrual Cycles
  - ❑Peridontal disease
  - ❑Physical inactivity
  - ❑Cigarette smoking

Measuring B.M.I.

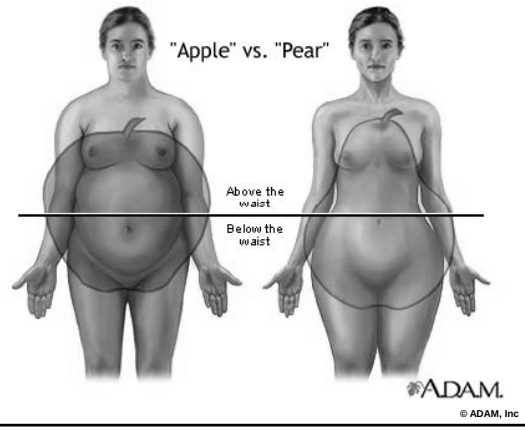
- Get patient's height and weight
- Input data: (http://www.halls.md/ideal-weight/body.htm)

Results:

Adults	Women	Men
Underweight	<19.1	<20.7
In normal range	19.1 – 25.8	20.7 – 26.4
Marginally overweight	25.8 – 27.3	26.4 – 27.8
Overweight	27.3 – 32.3	27.8 – 31.1
Very overweight or obese	>32.3	>31.1
Severely obese	35 – 40	
Morbidly obese	40 – 50	
Super obese	50 – 60 kg/m2	

Measuring Central Obesity

- Measure waist at level of navel
- Measure waist at level of hips
- Divide waist measurement by hip measurement
- **Results**:
  - ❑Ratio > 1 for men
  - ❑Ratio > 0.8 for women
- **Interpretation**:
  - ❑Central obesity, increased risk of metabolic syndrome

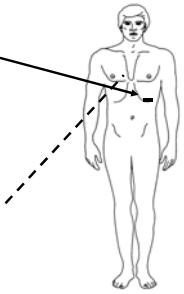


Functional Evaluation of Blood Sugar and Pancreas

Endocrine Pancreas Reflex Point
Location: 7th intercostal space on the left hand side. Mid-mamillary line.

T6 and T7 on Right side

Location: Palpate for tenderness to the right of T6 and T7 close to the spine. A pancreas indicator when tender.



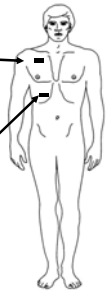
Functional Evaluation of Blood Sugar and Liver

Liver Reflex Point

Location: On the 3rd rib 3 inches to right of sternum at costochondral junction.

Direction of force: Anterior to posterior

Liver/Gallbladder Reflex Point
Location: 6th intercostal space on the right hand side. Mid-mamillary line.



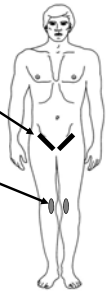
Functional Evaluation of Blood Sugar and Adrenals

Inguinal Ligament Tenderness

Location: Unilateral tenderness on palpation is a strong

Medial Knee Pain
Location: Tenderness at insertion of sartorius at the pes anserine

Other Tests:
•Ragland's Test for Postural Hypotension
•Paradoxical Pupillary Response Test



Primary FDM Testing

In-Office Lab Testing: Urinalysis

Urine Dipstick Analysis

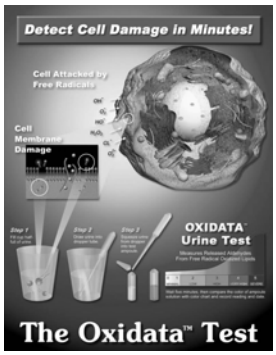
- Good test to run on all patients you suspect have metabolic dysglycemia
- Look for increased protein (microalbuminuria)
- Look for increased glucose
- Look for increased ketones

Oxidata Free Radical Test

Oxidata Test Directions

- Draw 1 ml of urine into dropper supplied with kit
- Break open the top of the glass ampoule, which contains reagent
- Place urine into ampoule
- Wait 5 minutes, then interpret the color change from the chart and record the result

Oxidata Free Radical Test



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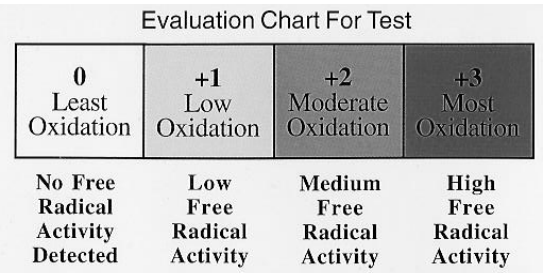


Oxidata Test Results

Clear or 0	Abnormally reduced oxidation and low ATP function
Pink or +1	Normal: optimum oxidation
Red or +2	Moderate oxidation
Dark red or +3	High oxidation

Primary FDM Testing

Blood Testing

Blood Sugar Dysregulation Markers on Chem Screen

- Fasting Blood Glucose
- Fasting Insulin
- Hemoglobin A1C
- LDH
- Blood Fats: Cholesterol, HDL & LDL, triglycerides
- Liver function tests: SGOT, SGPT, GGT
- Other tests: CRP, Fructosamine, Fibrinogen
- Glucose (Insulin) Tolerance Test

Fasting Blood Glucose

- The normal range is 65 – 99 mg/dl or 3.61 – 5.49 mmol/L
- Optimal range: 80 – 90 mg/dl or 4.44 – 4.99 mmol/L

Fasting Insulin

- The normal reference range is 6 – 27 µIU/mL
- Optimal range: Under 5 µIU/mL

Fasting Glucose & Insulin

Dysfunction	Fasting Insulin	Fasting Glucose
None	Normal	Normal
Insulin Resistance	↑↑	Normal or ↑
Type I DM	↓↓	↑↑
Hypoglycemia	Normal or ↑↑	↓↓

Hemoglobin A1C- Background

- Abnormal protein glycation
- Advanced Glycolylation End Products and Free Radicals

Hemoglobin A1C- Reference Ranges

- The normal range is 4.5% - 5.7% or 0.041 – 0.057
- Optimal <4.5% or <0.045
- Hypoglycemic tendencies: <4.0% or 0.004

Hemoglobin A1C- Why is it important?

- Monitoring Glucose Status in diabetics and pre-diabetics
- Evaluating Cardiac risk

Hemoglobin and Cardiac Risk

- "Glycemic control and coronary heart disease risk in persons with and without diabetes: the atherosclerosis risk in communities study".
  - Selvin E, Coresh J, Golden SH, et al. Arch Intern Med. 2005 Sep 12;165(16):1910-6.

LDH

- The normal reference range is 1 – 240 U/L
- Optimal range: 140 – 200 U/L

Types of Hypoglycemia

1. Reactive Hypoglycemia

2. Liver Glycogen problems
   1. Glycogen release
   2. Glycogen storage

Hypoglycemia- Pattern

- Suspect hypoglycemia if you see the following pattern:
  - ❑Decreased blood glucose (<80 mg/dl or 4.44 mmol/L)
  - ❑Decreased LDH (<140 U/L)
  - ❑Decreased Hemoglobin A1C (<4.0% or 0.030)

Blood Fats

	Lab Range	Optimal Range
TGs	50 – 150 mg/dL 0.34 – 1.7 mmol/L	70 – 110 0.79 – 1.24
Chol.	100 – 200 mg/dL 3.36 – 5.2 mmol/L	150 – 220 3.9 – 5.69
HDL	40 – 90 mg/dL 1.03 – 2.32 mmol/L	> 55 >1.42 mmol/L
LDL	< 130 mg/dL <3.36 mmol/L	< 120 <3.10 mmol/L

Other Findings Associated with Increased Risk

- Increased serum iron
- Low C-Peptide levels
- Low testosterone
- Increased C-reactive protein
- Increased fructosamine
- Increased fibrinogen

C-Reactive Protein- Reference Ranges

- **Normal reference range:**
  - Men: 0 – 3 mg/L
  - Women: 0 – 3 mg/L
- **Optimal reference range:**
  - Men: <0.55 mg/L
  - Women <1.5 mg/L

Elevated CRP Levels

- Increased risk of heart disease and stroke
- Increased Alzheimer's risk
- Depression
- Diabetes
- C-reactive protein and IL-6 predict death

Fructosamine

- Normal Reference Range: 0 – 285 umol/L
- Optimal Range: <228
- >230 shows beginning stages of poorly controlled blood sugar

Fibrinogen- Reference Ranges

- The normal range is 193 – 423 mg/dl (milligrams per deciliter) or 1.93 – 4.23 g/L.
- Optimal 200 – 300mg/dL

Syndrome X/Metabolic Syndrome- Pattern

The syndrome is characterized by the following:

- ❑High serum triglycerides (>110)
- ❑High cholesterol (>220)
- ❑Decreased HDL cholesterol (<55)
- ❑Increased serum insulin (>5)
- ❑Increased Blood glucose (>100)
- ❑HGB-A1C (>4.5% or 0.045)
- ❑Increased weight gain and obesity
- ❑High blood pressure

Oxidative Stress

- Chem. screen as an assessment of oxidative burden
- Cholesterol as an antioxidant
- RBC Hemolysis and Oxidative Stress

Oxidative Stress- pattern

- Oxidative stress should be investigated If a total cholesterol level is suddenly below its historical level, and is seen with:
  - Decreased albumin (<4.0) and platelet level
  - Decreased lymphocyte count (<20)
  - Increased total globulin (>2.8) and Uric acid level (>5.9)
  - Increased Ferritin, bilirubin and LDL levels

Advanced FDM Testing

- Glucose Tolerance Testing
- Organic acid testing
- Oxidative Stress Testing
- Element Testing
- Male and Female Hormone Testing

Advanced FDM Testing

Glucose Tolerance Test (GTT)

GTT – Client Instructions

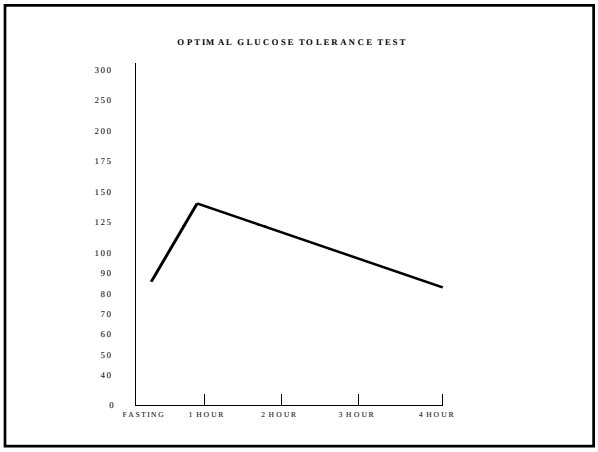
- Eat nothing after 9:00 p.m. the night before the test.
- Drink nothing but water.
- Take prescription medication as prescribed.
- Come to the office in comfortable clothes, prepared to stay for four hours.
- Bring water and reading material.
- Client should stay in the office during the entire test to ensure test accuracy and to stay on time.

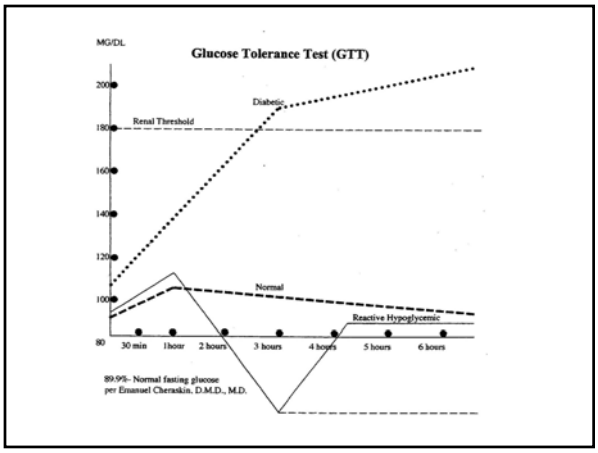
GTT Testing Instructions

- The first question is “When did you last eat?”
- Obtain the fasting glucose reading via the glucometer.
- Once taken, immediately give the client the measured carbohydrate drink. Ask them to consume as quickly as possible.
- Once the client has finished the carbohydrate drink, set a timer for one hour.
- When the timer goes off, reset the timer for one hour and obtain the one hour glucose reading.
- Ask the client how they are feeling. Note any symptoms.
- Repeat this process each hour until the final reading is obtained.
- Explain the results to client and recommend the appropriate dietary recommendations.

GTT Glucose Ranges

Time	Range	Result
Fasting	80 - 90 mg/dL or 4.44 – 5.00 mmol/L	Normal
One hour glucose	130 – 150 mg/dL or 7.22 – 8.33 mmol/L	Optimal, no reference range
Two hour glucose	< 75 mg/dL or 4.16 mmol/L 75 – 140 mg/dL or 4.16 – 7.77 mmol/L 141 – 199 mg/dL or 7.83 – 11.05 mmol/L > 200 mg/dl or 11.10 mmol/L	Hypoglycemia Normal Metabolic Syndrome Diabetes
3 hour glucose	Blood sugar should have normalized by now. Diabetics will continue to have high sugars	
Add all 4 values together: <500 is normal 500 – 800 borderline diabetic > 800 diabetic		



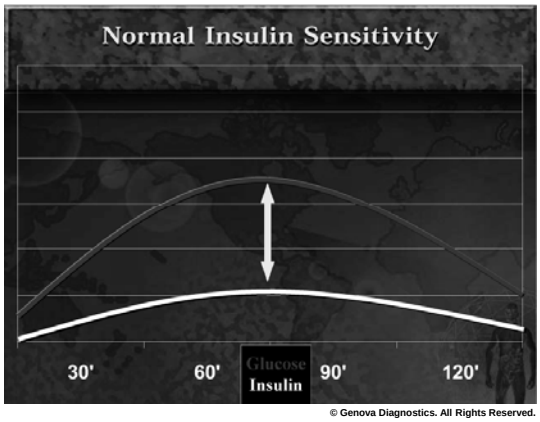


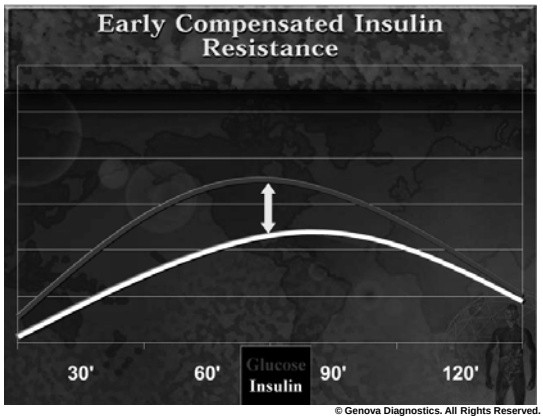
Advanced FDM Testing

Glucose Insulin Tolerance Testing

GITT Insulin Ranges

Time	Range	Result
Fasting Insulin	0 – 3 µIU/ml 5 and under µIU/ml >15 µIU/ml	Consider DM I Normal Metabolic syndrome
Two hour post prandial insulin	< 22 µIU/ml 22 - 49 µIU/ml above 50 µIU/ml	Consider DM I Normal Insulin Resistance/Metabolic Syndrome




Early Compensated Insulin Resistance
30'
60'
Glucose
Insulin
90'
120'
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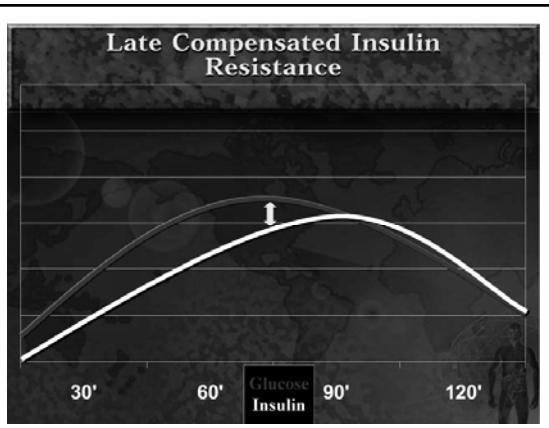
Late Compensated Insulin Resistance
30'
60'
Glucose
Insulin
90'
120'
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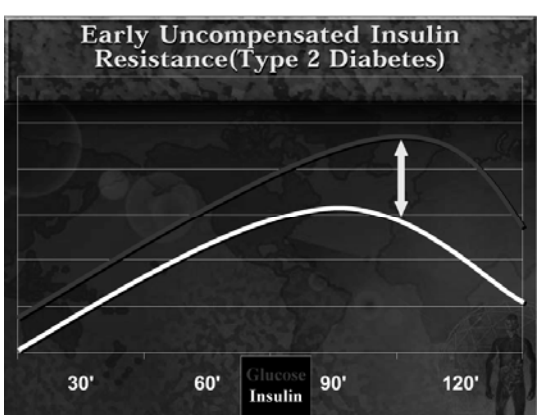
Early Uncompensated Insulin Resistance(Type 2 Diabetes)
30'
60'
Glucose
Insulin
90'
120'
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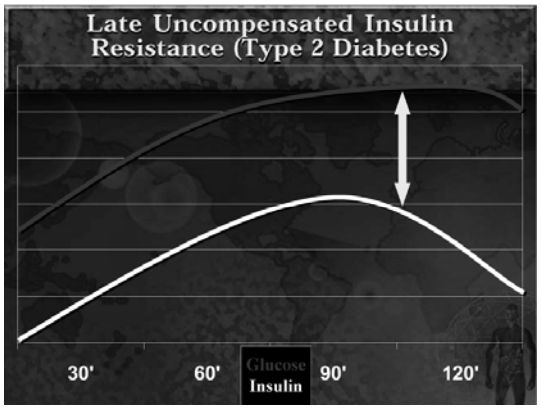
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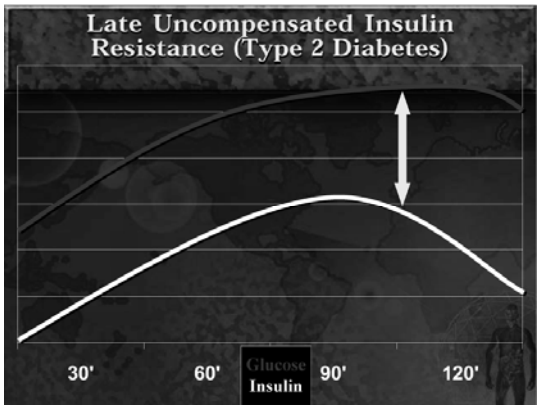
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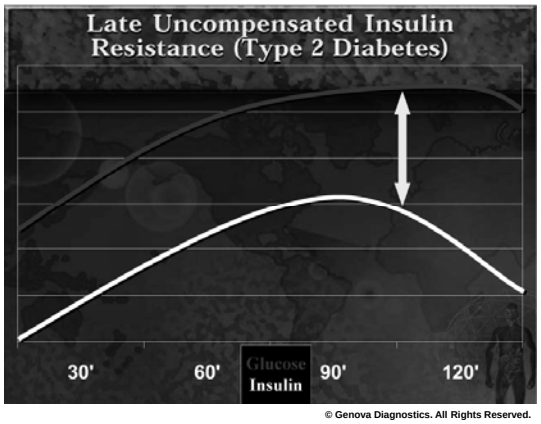
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120'
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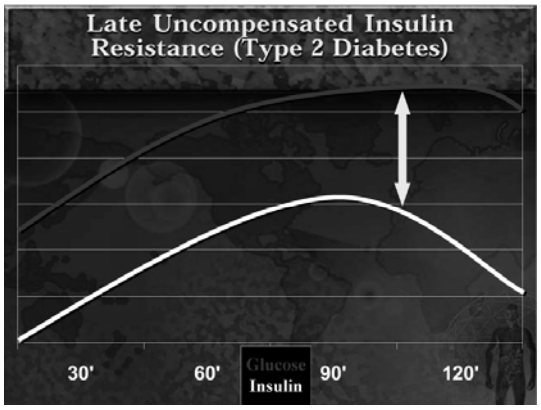

Putting it Together: Glycemic Dynamics

Element	Early Insulin Resistance	Late Insulin Resistance	Diabetes
HGB-A1C	N or ↓	N or ↑	↑↑
Fasting Glucose	N or ↓	N or ↑	↑↑
Fructosamine	N	↑	↑↑
Postprandial glucose (2 hour)	N or ↓	↑	↑↑
Fasting insulin	N	↑	↑↑
DHEA	↓	↓	↓
Cortisol	↓ or ↑	↑	↑
Postprandial insulin (2 hour)	↑	↑↑	↑↑