

wound healing perspectives®

A CLINICAL PATHWAY TO SUCCESS

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→ TYPE II DIABETES AND WOUND HEALING

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Diabetes and wound healing

Over 20 million Americans have diabetes. Having type 2 diabetes increases the risk for many serious complications including vascular disease, blindness, diabetic foot ulcers, and end-stage renal disease. Approximately 15% of people with diabetes will develop a foot ulcer due to neuropathy or vascular disease. Diabetes remains the leading cause of non-traumatic amputation and having an amputation had a significant impact on five-year survival. In 2006, National Healing treated over 8,000 patients with diabetes and a lower extremity wound.

Treating these complex patients requires a multidisciplinary team committed to patient and family education. Motivating patients to improve their diet and increase their exercise can have an impact on healthcare spending. Family education can increase awareness for those with a hereditary disposition. As healthcare professionals it is crucial to deliver a consistent message about the benefits of diet and exercise for patients. At National Healing Wound Centers, we help each patient take control of their disease.

This issue of *Wound Healing Perspectives* is designed to help you tailor your approach to each patient's needs as you touch the lives of this rapidly growing group.

Sincerely,



Robert Kirsner, MD, PhD
Chairman, Medical Advisory Board

Development of type 2 diabetes

Several risk factors are associated with the development of type 2 diabetes, also known as adult-onset diabetes. These include heredity, age, diet, inactivity, sedentary lifestyle, and obesity.

Although the exact causes of type 2 diabetes are still unclear, the disease has a strong hereditary connection. According to www.dlife.com, individuals who have a parent or sibling with type 2 diabetes have a ten to 15% chance of developing the disease. What's more, the risk is much higher if that sibling is an identical twin.

For those with a genetic tendency toward the disease, type 2 diabetes can be triggered by such environmental factors as inactivity or poor diet. According to www.healthatoz.com, women who have had gestational diabetes during pregnancy have an increased risk of acquiring type 2 diabetes later in life. In addition, women who give birth to babies weighing nine pounds or more also have an increased risk of developing the disease.



ALTHOUGH THE EXACT CAUSES OF TYPE 2 DIABETES ARE STILL UNCLEAR, THE DISEASE HAS A STRONG HEREDITARY CONNECTION.

Race also may determine one's likelihood of getting the disease. Type 2 diabetes is more common among Native Americans, African-Americans, and Hispanics when compared with Caucasians and Asians.

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Dietary modifications

Following a healthy diet is key to preventing type 2 diabetes. According to Hu et al, previous studies have shown that individuals have a reduced risk of acquiring type 2 diabetes if they consume a diet high in cereal fiber and polyunsaturated fat but low in saturated fat, trans fats, and glycemic load, which suggests the disease can be prevented with behavior modification.

In terms of carbohydrate intake, the ADA recommends that diabetes patients focus on total carbohydrate intake rather than the type of carbohydrate being consumed. According to a 2001 ADA study by McIntosh and Miller, individuals should consume 20-35 grams of total fiber from soluble and insoluble sources a day, including fruits, vegetables, and whole grains.

Caffeine also may reduce glucose uptake, according to a 2005 study by Lee, Hudson, Kilpatrick, Graham, and Ross, although the clinical implications of these findings remain to be determined. ■

Nutrition and diet

Nutrition Guidelines for Diabetics

The ADA has specific goals of medical nutrition therapy for people with diabetes. This includes achieving and maintaining near-normal levels of blood glucose through an adequate diet, sufficient physical activity, as well as the possible use of hypoglycemic agents and/or insulin. Additional goals include achieving optimal serum lipid levels, consuming adequate calories to maintain desirable weight, preventing or treating diabetes-related disease, improving overall health by maintaining a balanced

- Since sucrose does not increase glycemia to a greater extent than isocaloric amounts of starch, sucrose and sucrose-containing foods do not need to be restricted; however, they should be substituted for other carbohydrate sources or, if added, covered with insulin or other glucose-lowering medication.
- Non-nutritive sweeteners are safe when consumed within the acceptable daily intake levels established by



encouraged.

- Individuals receiving fixed daily insulin doses should try to be consistent in day-to-day carbohydrate intake.
- Carbohydrate and monounsaturated fat together should provide 60-70% of energy intake. However, the metabolic profile and need for weight loss should be considered

A HEALTHY DIET SHOULD INCLUDE CARBOHYDRATES FROM WHOLE GRAINS, FRUITS, VEGETABLES, AND LOW-FAT MILK.

intake of the macronutrients and micronutrients, and consuming adequate amounts of water.

The ADA's nutrition guidelines for diabetics now emphasize a diet high in monounsaturated fat so diabetics are no longer limited to a high-carbohydrate/low-fat diet, offering diabetics many more food choices and less restrictions. Below are the ADA's recommendations:

- A healthy diet should include carbohydrates from whole grains, fruits, vegetables, and low-fat milk.

the Food and Drug Administration.

- Individuals receiving intensive insulin therapy should adjust their pre-meal insulin doses based on the carbohydrate content of meals.
- Although the use of low glycemic index foods may reduce postprandial hyperglycemia, there is not sufficient evidence of long-term benefit to recommend the use of low glycemic index diets as a primary strategy in food/meal planning.
- Consuming dietary fiber, upwards of 50 grams per day, is

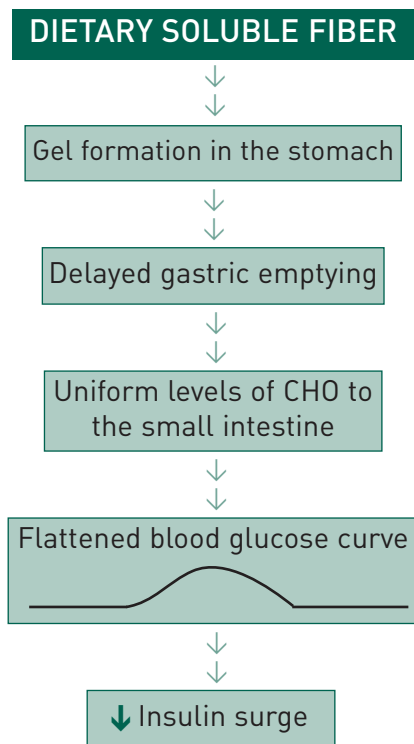
when determining the monounsaturated fat content of the diet.

- Sucrose and sucrose-containing foods should be eaten in the context of a healthy diet. ■

SOURCE: EVIDENCE-BASED NUTRITION PRINCIPLES AND RECOMMENDATIONS FOR THE TREATMENT AND PREVENTION OF DIABETES AND RELATED COMPLICATIONS, DIABETES CARE, JANUARY, 2002, AMERICAN DIABETES ASSOCIATION.

The significance of fiber

According to McIntosh and Miller, consuming a high-fiber diet may help people with type 2 diabetes achieve reductions in blood glucose and lipid levels. Whether people with diabetes can achieve and maintain a fiber intake of 25-50 g/day for more than 6 weeks is unknown. Many consumers with diabetes need additional nutrition education to incorporate more high fiber food into their usual diets. The impact of increasing fiber consumption among people with diabetes in poor metabolic control is worthy of investigation. ■



Dietary Soluble Fiber figure. Possible mechanism by which soluble dietary fiber lowers serum glucose. Note: CHO = carbohydrate. SOURCE: MCINTOSH, ADA

Development of type 2 diabetes *(continued from page 1)*

Other risk factors for developing type 2 diabetes include taking specific drugs, such as diuretics and steroids in addition to chronic stress, low birth weight, associated fetal malnourishment, and gene mutations [dlife.com].

The risk for developing type 2 diabetes also increases with age. According to healthatoz.com, half of all new cases of the disease occur in people over the age of 55. Yet according to a 2005 American Diabetes Association (ADA) study by Koopman, Mainous, and Diaz, that age threshold may be getting lower, as more cases of

the disease have been found in younger individuals.

Authors of this study used figures from the National Health and Nutrition Examination Survey (NHANES), a series of surveys conducted across the United States, which included a household interview, a medical exam, as well as laboratory and other testing. Researchers compared results from two NHANES studies, one which ran from 1988 to 1994 and the other from 1999 to 2000. When the two time periods were compared, data revealed that the age of diagnosis dropped six years from the earlier study. In the

earlier NHANES, the average age of diagnosis for type 2 diabetes was 52 years. In the later NHANES, the average age was 46 years.

Indeed, the most important determinant for type 2 diabetes is being overweight. According to a 2001 study by Hu, Manson, Stampfer, and Colditz, individuals with a body-mass index at the high end of the normal range (25 or above) are associated with an increased risk of diabetes. Weight loss and weight control, therefore, are the most effective ways to reduce the risk of getting type 2 diabetes. ■

The glycemic index

The glycemic index (GI) is used to control appetite and manage weight and blood glucose levels. The GI ranks carbohydrate-rich foods by how much they raise blood glucose levels relative to white bread, which has a GI of 100.

The index has several limitations:

- It does not measure how fast blood glucose levels increase.
- Carbohydrate complexity and fiber content can change the GI value.
- Foods have different values depending on ripeness, preparation method, and when eaten with certain other types of food.
- GI values vary from person to person and the time of day food is eaten.

Although it can help patients fine-tune their food choices and improve post-meal blood glucose levels, the best strategy is to monitor total grams of carbohydrates. ■



The ADA's "Diabetes Food Pyramid" vs. the USDA "MyPyramid"

Fiber and glucose control

Although some debate exists about the significance of fiber on metabolic control among people with type 2 diabetes, according to a 2001 study by McIntosh and Miller, patients with type 2 diabetes who consumed a diet high in fiber-rich foods (e.g., 50 grams of fiber per day, 50% soluble) for six weeks had significant improvement in glycemic control and lipid panels when compared to patients who consumed a diet with moderate amounts of fiber (e.g., 25 grams of fiber per day, 50% soluble).

Consuming a diet rich in soluble and insoluble fiber has other reported benefits as well. Not only do individuals feel satiated, total energy intake and adiposity are reduced, and constipation, diverticuli, and other gastrointestinal tract disorders can be prevented [McIntosh, et al]. ■

In April 2005, the United States Department of Agriculture (USDA) released a new food guidance system replacing the former Food Guide Pyramid. The new system, called "MyPyramid," provides a set of tools based on calorie requirements to help Americans make healthy food choices.

The ADA's "Diabetes Food Pyramid" divides food into six groups, which vary in size. The largest group—comprised of grains,

For one, it does not classify the food but rather groups foods based on their carbohydrate and

protein content. In order to consume the same carbohydrate content in each serving, the portion sizes vary. For example, foods such as potatoes and other starchy vegetables are grouped together with the grains, beans, and starchy vegetables instead of with traditional vegetables. In addition, cheese is in the meat group instead of the milk group.

The Diabetes Pyramid gives diabetics a range of

servings recommended daily among the meals and snacks one eats each day.

Portion size also differs from what is recommended by the USDA. For example, a serving of pasta or rice is $\frac{1}{3}$ cup in the Diabetes Food Pyramid and $\frac{1}{2}$ cup in the USDA pyramid. A serving of fruit juice is $\frac{1}{2}$ cup in the Diabetes Food Pyramid and $\frac{3}{4}$ cup in the USDA pyramid. This variation in portion size is needed to make the carbohydrates about the same in all the servings listed. ■

THE ADA RECOMMENDS THAT INDIVIDUALS DIVIDE THE NUMBER OF SERVINGS RECOMMENDED DAILY AMONG THE MEALS AND SNACKS ONE EATS EACH DAY.

beans, and starchy vegetables—is on the bottom of the chart, which means that diabetics should eat more servings of these foods than any other food group. The smallest group—which includes fats, sweets, and alcohol—is at the top of the pyramid, meaning that diabetics should eat very few servings of these food groups.

The Diabetes Food Pyramid is different from the USDA's "MyPyramid."

servings. For those following the minimum number of servings in each group, about 1,600 calories should be consumed. For those who eat at the upper end of the range, approximately 2,800 calories are allowed. The exact number of servings depends on the person's diabetes goals, calorie and nutrition needs, as well as lifestyle and food preferences. The ADA recommends that individuals divide the number of



Nutrition and wound healing

Proper wound healing can be a problem for diabetic patients. The increased glucose level in individuals with diabetes causes cell walls to become rigid, which impairs blood flow through the small vessels at the wound surface, impeding red blood cell permeability and flow, states Nancy Collins in a 2003 article. What's more, this chain of events leads to impaired hemoglobin release of oxygen and nutrient deficits in the wound [Collins, 2003].

Decreased immune function also contributes to poor wound healing in patients with diabetes. When blood glucose levels are persistently elevated, chemotaxis (the process when additional white cells move to the site of an infection) and phagocytosis (the ingestion of bacteria by white cells) are compromised [Collins]. Both of these processes are key to controlling wound infections.

According to Collins, diabetic infections also take longer to heal because of delayed macrophage introduction and diminished leukocyte migration, which cause a

prolonged inflammatory phase in the wound healing cascade.

Malnutrition also has been linked to the development of pressure ulcers, according to Zulkowski in a 2006 article citing research involving older adults in nursing homes. Additional research also revealed that older adults with eating problems and/or weight loss issues also carry an increased risk of developing pressure ulcers [Zulkowski]. An increased amount of protein is required for the body to heal properly, and sufficient hydration aids in tissue perfusion since dehydration affects blood volume, circulation, and skin turgor [Zulkowski].

Some medications, such as the anabolic steroid oxandrolone, have been prescribed to people with significant unintentional weight loss. Although research specific to elderly patients is lacking, research conducted on burn patients taking oxandrolone suggests favorable results. These patients were able to regain weight and muscle mass two to three times faster than patients

receiving nutrition alone [Zulkowski]. Protein-calorie malnutrition should be considered in wound healing, notes Collins, since patients with diabetes often have a progressive loss of lean body mass, which is then replaced with a metabolically inactive fat mass. Hyperglycemia also impedes wound healing, so proper nutrition (also known as medical nutrition healing) should be discussed during wound healing visits. Many different nutritional approaches to diabetes are now available, including the no concentrated sweets diet, the exchange system, carbohydrate counting, and the glycemic index. The diet ultimately should be tailored to the individual's preference and personality. For example, certain patients may prefer to follow a simple diet approach while others a more precise approach [Collins]. ■

Adding an exercise program

For patients with type 2 diabetes, exercise is not only beneficial but pivotal in managing the disease. According to a 2004 ADA study by Zinman, Ruderman, Campagne, Devlin, and Schneider, physical activity may improve insulin sensitivity and help to decrease elevated blood glucose levels into the normal range. Exercise also helps in glycemic control, can reduce levels of triglyceride-rich very-low-density lipoprotein, as well as reduce hypertension.

Since each individual has a different fitness level depending on their age and current level of physical activity, a standard recommendation for diabetic patients is that the exercise regimen start with a five-to-ten-minute aerobic warm-up period comprised of walking or cycling at low intensity [Zinman et al, 2004]. Muscles should then be stretched and the exercise activity should follow. A cool down lasting about five to ten minutes to lower the heart rate to its pre-exercise level should conclude each session. ■

Exercise and diabetes

Physical activity increasingly is being used as a therapeutic tool for patients with diabetes or those at risk for developing the disease. Studies have shown that decreasing levels of activity and the increase in obesity are to blame for the type 2 diabetes epidemic. For patients with type 2 diabetes, physical activity improves the metabolic abnormalities of type 2 diabetes, improves insulin sensitivity, and aids in diminishing elevated blood glucose levels into the normal range. For these reasons, the ADA recently revisited its position statement on the relationship between exercise, physical activity, and diabetes to include both physical activity and resistance training [Zinman, Ruderman, Campaigne, Devlin, and Schneider, 2004].

Before indicating an exercise program or increasing a patient's level of exercise, a patient

with diabetes mellitus should undergo all appropriate diagnostic studies. Exams should screen for the presence of macro- and microvascular complications that could worsen with exercise. A medical history and physical examination should focus on the symptoms of disease affecting heart and blood vessels, eyes, kidneys, and the nervous system. A graded exercise test may also help if a patient is about to start a moderate-to-high intensity exercise program [Zinman et al].

At least 150 minutes per week of moderate-intensity aerobic physical activity and/or at least 90 minutes per week of vigorous aerobic exercise is recommended for people with type 2 diabetes. In type 2 diabetes patients, glycemic control was significantly improved when exercise was combined with acarbose treatment

(median dose 245 mg/day), as reflected by a decrease in A1C levels and fasting plasma glucose concentration, stated a 2006 ADA study by Wagner, Degerblad, Thorell, and Nygren.

Two clinical trials published in late 2002 provide strong evidence for the value of resistance training in people with type 2 diabetes, which improves insulin sensitivity to about the same extent as aerobic exercise. As a result, today the American College of Sports Medicine (ACSM) recommends a resistance training regimen for type 2 diabetics whenever possible. ■

Aerobic exercise

When considering aerobic activity, there are several points for the diabetic patient to remember, according to Zinman et al. For one, special precautions should be taken when the physical activity involves the feet. The use of silica gel or air midsoles as well as polyester or blend (cotton/polyester) socks will help prevent blisters and keep feet dry, important for minimizing trauma to the feet. Similarly, for those with peripheral neuropathy, proper footwear is essential. As a result, individuals must inspect their feet closely for blisters and other potential damage before and after physical activity. Individuals should also maintain adequate hydration when exercising, especially in the heat. Fluid should be taken early and frequently throughout the exercise sessions. Although high resistance exercise with weights is considered acceptable for young individuals with diabetes, it is not wise to recommend it to older people with long-standing diabetes [Zinman et al]. ■

EXERCISES FOR DIABETIC PATIENTS WITH LOSS OF PROTECTIVE SENSATION	
Recommended exercise	Contraindicated exercise
Swimming	Treadmill
Bicycling	Prolonged walking
Rowing	Jogging
Chair exercises	Step exercises
Arm exercises	
Other non-weight-bearing exercise	

Metabolic syndrome

Are your patients' waistlines getting bigger? If they measure more than 34 inches around, these individuals should be examined carefully since a large waist could be one sign of metabolic syndrome.

Defined as a cluster of risk factors associated with obesity, an estimated 24% of Americans over age 20 and 44% of Americans over age 50 have metabolic syndrome. The syndrome can represent a very serious health danger for your patients. For example, it can significantly increase a patient's risk of developing atherosclerosis, stroke, and peripheral vascular disease. Patients are also up to 3.5 times more likely to die from

coronary heart disease if they have metabolic syndrome than someone who does not.

Metabolic syndrome is also a strong predictor of diabetes. It's very rare to have diabetes without also having metabolic syndrome. The two together push a patient's risk of heart disease up by 50%.

If your patient has three of the following five risk factors, he/she could have metabolic syndrome:

- A waist circumference more than 34 inches (more than 40 inches in men)
- A fasting blood glucose level at or above of 110 mg/dL
- Triglycerides at or above 150 mg/dL

- An HDL-cholesterol level below 50 mg/dL (at or below 40 mg/dL in men)

- A blood pressure level at or above 130 mm Hg systolic or 85 mm Hg diastolic

The best treatment option for patients with metabolic syndrome is to lose weight and exercise, which if accomplished, can improve every one of the five markers. One large study found metabolic syndrome completely disappeared in 30% of participants who rode a stationary bike three times a week (starting at 30 minutes a session and working their way up to 50 minutes) for 20 weeks. ■

SOURCE: THE NATIONAL WOMEN'S HEALTH REPORT

Getting your patients started

Helping patients find a personal reason to exercise may be the key in getting them to adopt an exercise program more readily, states Marrero (2005). This can be done by discussing the various health, social, and psychological benefits of exercise. Selecting the right exercise program and the suitable form of exercise for the patient is the next step. Thus, administering a graded exercise test also is recommended.

Individuals should be aware of any physical limitations that might result in physical discomfort or potentially cause a health threat. According to the ACSM, diabetics should undergo a medical exam to determine the existence of any musculoskeletal/orthopedic concerns that may prompt them to omit certain exercises. Similarly, any existing co-morbidities should be identified and considered in the exercise prescription. For example, if the patient has an open wound, he/she should take special precautions and consult a primary care physician before starting an exercise program. Others may need to use alternate equipment, such as an incumbent bicycle, for example [Marrero]. ■

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Working with a Wound Healing Center

One of the questions physicians ask most frequently is “When should I refer my patients to a Wound Healing Center?” This is particularly important as advances continue in wound healing techniques, technology, and materials. Patients with under-

lying diseases, such as diabetes, are at high risk for hard-to-heal wounds or other skin disorders that require a wound specialist’s attention. Physicians at Wound Healing Centers have experience treating large numbers of diabetic patients and work closely

with the primary care physician and other specialists in healing their wounds, while always reporting back to the primary care physician who specializes in the patient’s overall care. ■

CONTACT YOUR LOCAL WOUND HEALING CENTER IF

- Your diabetic patient has a wound that persists for more than 30 days with standard wound treatment
- Your diabetic patient has a chronic wound and neuropathy
- Your diabetic patient has a chronic wound and has hypoxia
- Your diabetic patient has necrotic tissue or foreign debris such as sutures at the wound site
- Your diabetic patient has a chronic wound and a remote infection
- Your diabetic patient has a chronic wound that involves deeper soft tissues or bone
- Your diabetic patient has a chronic wound with purulent drainage, surrounding cellulitis or inflammation, edema, exposed bone or joint, sinus tracts, or deep abscesses



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