



Exercise and Diabetes

Here's an update on getting
our diabetic patients to exercise.

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Introduction

In the November/December 2012 issue of *Podiatry Management*, an overview of the state of the evidence concerning the role and benefit of exercise on the management of patients with diabetes was presented. The following discussion will be a review of the latest publications that deal with the challenges, both to clinicians and patients, in instituting what the evidence so clearly demonstrates: exercise is a key in the management of diabetes. Why are patients with diabetes not exercising? How can they be motivated? Also, as in the first review, the role podiatric physicians have in recommending, encouraging, and even supervising the exercise prescription is highlighted.

Issue of the Exercise Prescription and Compliance/Motivation

A comparative study of Pima

Indians in Mexico and the United States demonstrated a prevalence of T2DM of 6.9% and 38% respectively.¹ It is therefore not surprising that exploration of these behaviors is one of the significant areas of investigation. Despite the overwhelming data that supports the benefits of exercise for those with diabetes, it is common to see reports such as one by Herbst, et al. that report that over half of adolescents with T2DM in their cohort of 578 did no regular physical activity.² Similarly, Mu, et al. found that only 12% of a surveyed USA cohort (N = 36,662)

we convince and encourage our patients with diabetes to exercise, and how can we best assist them in this effort?

Patient Barriers for Exercise Compliance

Booth, et al. presents an excellent critique of the many barriers to patient compliance. Some of the major barriers are lack of knowledge about the seriousness of diabetes and the potential complications, lack of motivation, lack of time, circumstances related to socioeconomic condition, and an inability to change

**Though inherited factors
play a role in one's predisposition to develop type 2
diabetes mellitus, many experts believe it is one's
lifestyle that is most significant.**

of patients with diabetes met the American Diabetes Association recommendations for resistance exercise, a percentage that is 9% lower than that in the general population.³ Making changes to one's exercise habits seems more difficult than changing dietary habits, according to a survey by Morrison, et al. A population of "motivated to change lifestyle" patients with diabetes reported they had a much easier time making changes to their diet than to exercise regularly.⁴ This begs the question—given all the reported evidence that exercise is so beneficial for the control of diabetes—how do

old habits.⁵ Walker, et al. describe quality of life issues and so-called low self-efficacy as possible reasons for poor adherence to exercise recommendations.⁶

Conversely, Moonaghi, et al. found that patients with an optimistic attitude are able to utilize the diagnosis of a chronic illness to make significant life changes, such as improving a poor diet, stopping smoking, and getting regular exercise. They refer to this process as "benefit finding" and believe that ultimately, these patients may be healthier than they were before their diagnosis.⁷

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As would be expected, a study by Saleh, et al. demonstrated that those subjects with diabetes who did not adhere to a recommended exercise program had a significant reduction in quality of life—most specifically, poor mobility, reduced self-care, limits in usual activities, as well as increased pain and anxiety.⁸

An interesting barrier noted in recent literature is the concept of walkability. Hosler, et al. designed a survey that asked adults with diabetes about such factors as sidewalks and traffic safety in the communities in which they lived. They concluded that patients with diabetes were more likely to exercise in a community with good walkability.⁹

One reported solution to enhanced compliance may be a greater empowerment of patients regarding their care. Given that patient self-efficacy (self-reliance) as noted above is effective in better adherence to provider recommendations, it would seem imperative that the provider encourage a “take responsibility for your diabetes care” attitude in their patients as well as buoy a partnership in their care.¹⁰ Although the idea that a patient with strong self-efficacy is more compliant and thus will achieve better glycemic control seems self-evident, the authors point out that when a patient exhibits poor compliance, one should consider low self-efficacy and that a referral for counseling may also be in order.⁶

Healthcare Provider Shortcomings

Inadequate Counseling

Although much focus has been placed on how we can educate and encourage those with diabetes to not only become involved in lifestyle changes but also to stick with them, a number of studies are now directed at healthcare providers in a quest to determine shortcomings that result in noncompliance. Despite overwhelming evidence of the benefits of exercise for those with diabetes, few physicians counsel their patients about physical activity.¹¹ Barnes and Schoenborn report that only 32% of

patients queried were provided any sort of physical activity counseling during the past year at their physician’s appointment.¹²

Curricular Shortcomings

Some researchers believe this paucity of physical activity counseling is due to a lack of formal medical school training in this skill.¹³ A study by Garry, et al. looked at formal training that United States medical students received and found an alarming scarcity of curriculum devoted to the exercise/T2DM connection and related counseling. They cite that only 13% of U.S. medical schools provide a curriculum in the

organizations such as The American Diabetes Association/European Association for the Study of Diabetes (ADA/EASD) and the American Association of Clinical Endocrinologists/American College of Endocrinology (AAACE/ACE), to name a few, have developed practice guidelines that are based in clinical evidence and are designed to assist providers in making specific and patient-centered exercise recommendations to their patients.^{24,25}

Barriers to Exercise Recommendations

From the provider’s perspective, there are barriers to available time

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medical aspects of physical activity.¹⁴ Medical students in the United Kingdom fared no better.¹⁵ Not surprisingly, queried physicians felt inadequately prepared to provide counseling about physical exercise.^{16,17}

Nature of the Recommendation Is Crucial

Other studies found that the nature of the recommendation was instrumental in compliance. Those providers who gave a specific regimen (especially one that was structured and supervised) were more likely to be successful in getting their patients to exercise than those who simply told their patients they needed to “get more exercise” (simple recommendation).¹⁸⁻²⁰ It is also not a surprise that those physicians who are physically active themselves are more successful in motivating their patients about physical exercise.^{14,21-23}

Assisting Healthcare Providers with Practice Guidelines

Given that physicians feel ill-prepared to counsel their patients about exercise, an attempt is underway to assist providers with a “patient-centered” and more individualized exercise recommendation. Major diabetes

and resources for appropriate patient education and utilization of the practice guidelines noted above.²⁶ Besides the issues of time and resources, Lew and DeMaria report on the lack of utilization of the guidelines due to the perceived disconnect of clinical practice and said guidelines by some practitioners.²⁷

Additional Strategies for Motivation

Lastly, some providers and organizations have included certain technologies in an effort to motivate their patients to exercise. Smart phones with apps such as MapMyRun allow patients to record workouts and provide visual and objective feedback to themselves and their providers alike. Objective evidence of compliance not only assists the physician’s treatment plan but also provides data-based enticement, not to mention heightened accountability. Distribution of such items as pedometers to record steps with rewards/incentives for numbers of steps is reported as well.²⁶ Those clinicians whose patients utilize pedometers can put to good use the recent study by Yates, et al., in which a simple increase of 2000 daily steps

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led to a significant reduction in cardiovascular events in those with impaired glucose tolerance.²⁸ Even social media sites have been developed to educate and support those patients with diabetes.²⁹

Practice Guidelines and Evolving Evidence—What Is the Best Exercise Regimen?

As helpful as practice guidelines might be, it is clear from the most recent studies and publications that what constitutes the optimal exercise prescription is far from settled. Therefore, impending changes to the recommended ideal exercise prescription are all but assured.

Many studies have explored what the most effective exercise prescription is as far as aerobic versus resistance versus higher intensity (i.e., interval training) versus steady (constant-longer duration) activity and, for the most part, these studies have been conflicting and/or inconclusive.³⁰⁻³³

Hawley and Gibala are strong proponents for low volume—high intensity interval training (LVHIT), claiming that besides being effective, it is a regimen that better allows a more individualized approach to one's exercise program.³⁴ Likewise, Karstoft, et al. concluded in their study that a walking program using intervals of fast/slow walking was superior to a constant pace, continuous walking program with regard to glycemic control.³⁵

Conversely, a review by Harmer and Elkins supports the premise that volume of exercise (times per week of participation) is more important than duration of a single session or increasing the intensity.³⁶

Given the greater expense and issues with access that someone wanting to do resistance exercise (free weights and machines) may encounter, McGinley, et al. considered the possibility that a patient could substitute resistance bands which would be far less expensive and more readily accessible. Their review determined, however, that resistance band training did not result in the statistically significant improvement on glycemic

control that occurs with resistance exercise.³⁷

It should be noted that the practice guidelines outlined above were developed in part to specifically answer (with the best evidence to date) the optimal exercise regimen for a given patient with diabetes based on the many demographic factors specific to that patient.

Exercise as Prevention

Besides a significant effort to institute exercise for the management of diabetes, many investigations and publications are focused on the benefits of exercise in the prevention of diabetes.³⁸ A prospective study from

General Medicine and Sports Medicine courses.

Exercise Prescription AND Podiatric Physicians

As the patient population grows more aware of the benefits of exercise for overall health and weight management, they will seek out advice and direction from their physicians, especially those of us with an interest/expertise in sports medicine. Given the typical patient population of the podiatric practitioner, it stands to reason that many of these patients will be persons with diabetes. Awareness of the current state of the evidence regarding exercise and

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1991 to 2007 of 4,554 women with gestational diabetes found that those who increased their exercise level by 2.5 hours/week had a 47% lower risk of developing T2DM later in life. The risk was inversely proportional to the amount exercised.³⁹ Given the less than optimal dietary and exercise habits seen in a cohort of 1,228 pre-diabetics,⁴⁰ it would be reasonable to expect that clinicians should consider recommending exercise to their patients who are pre-diabetic and/or considered at-risk for developing diabetes.⁴¹

Relevance to the Podiatric Clinician and Profession

As previously noted, medical school curriculae appear remiss in neglecting to include study of the exercise/diabetes relationship, most especially with regard to exercise counseling. One of the objectives of this paper is to encourage the colleges of podiatric medicine to include (if they do not already) a discussion of the benefits of exercise for diabetes management in their curriculum. Indeed, this topic, including the exercise prescription, is presented in our curriculum at The Arizona School of Podiatric Medicine, in both in the

diabetes will assist the practitioner in the counseling of these patients. This may be especially important in assisting patients with a choice of exercise not only in which they are interested but also that is best suited to lower extremity health.

Conclusions

- 1) The evidence is overwhelming that exercise is beneficial in the management of diabetes.
- 2) The prevalence of patients with diabetes who are engaged in regular physical activity is poor.
- 3) The low participation of persons with diabetes in regular physical exercise is a result of poor motivation, lack of knowledge, lack of time, socioeconomic conditions, and an inability to change old habits. Also at fault is inadequate training and/or motivation of the provider.
- 4) Diabetes organizations have developed Practice Guidelines based on current evidence to assist providers in determining the optimal exercise prescription.
- 5) Exercise appears to not only be an effective tool in the management of diabetes but also in the prevention of diabetes.

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6) The curriculum of colleges of podiatric medicine should include discussion of the exercise-diabetes connection and implementation of an exercise recommendation.

7) Given the large number of patients with diabetes seen in podiatric practices and also the fact that so many podiatric physicians have an expertise in sports medicine, podiatric physicians are uniquely positioned to participate in the exercise prescription for patients with diabetes. **PM**

References

- Schulz LO, Bennett PH, Ravussin E, Kidd JR, Kidd KK, Esparza J, Valencia ME. Effects of traditional and western environments on prevalence of type 2 diabetes in Pima Indians in Mexico and the U.S. *Diabetes Care*. 2006 Aug;29(8):1866-71.
- Herbst A, Kapellen T, Schober E, Graf C, Meissner T, Holl R; Impact of regular physical activity on blood glucose control and cardiovascular risk factors in adolescents with type 2 diabetes mellitus—a multicenter study of 578 patients from 225 centres. *Pediatr Diabetes*. 2014 Jun 2.
- Mu L, Cohen AJ, Mukamal KJ. Resistance and aerobic exercise among adults with diabetes in the U.S. *Diabetes Care*. 2014 Aug;37(8):e175-6. doi: 10.2337/dc14-0619.
- Morrison Z, Douglas A, Bhopal R, Sheikh A; Understanding experiences of participating in a weight loss lifestyle intervention trial: a qualitative evaluation of South Asians at high risk of diabetes. *BMJ Open*. 2014 Jun 20;4(6):e004736.
- Booth AO, Lewis C, Dean M, Hunter SJ, McKinley MC. Diet and physical activity in the self-management of type 2 diabetes: barriers and facilitators identified by patients and health professionals. *Prim Health Care Res Dev*. 2013 Jul;14(3):293-306.
- Walker RJ, Smalls BL, Hernandez-Tejada MA, Campbell JA, Egede LE. Effect of diabetes self-efficacy on glycemic control, medication adherence, self-care behaviors, and quality of life in a predominantly low-income, minority population. *Ethn Dis*. 2014 Summer;24(3):349-55.
- Karimi Moonaghi H, Namdar Areshtanab H, Jouybari L. The efficacy of optimism: benefit finding in the treatment of diabetes in Iranian patients. *ISRN Nurs*. 2014 Mar 18;2014:371296.
- Saleh F, Mumu SJ, Ara F, Hafez MA, Ali L. Non-adherence to self-care practices & medication and health related quality of life among patients with type 2 diabetes: a cross-sectional study. *BMC Public Health*. 2014 May 7;14:431.
- Hosler AS, Gallant MP, Riley-Jacome M, Rajulu DT. Relationship between objectively measured walkability and exercise walking among adults with diabetes. *J Environ Public Health*. 2014;2014:542123.
- Anderson RM, Funnell MM, Butler PM, Arnold MS, Fitzgerald JT, Feste CC. Patient empowerment. Results of a randomized controlled trial. *Diabetes Care*. 1995 Jul;18(7):943-9.
- Barnes PM, Schoenborn CA. Trends in adults receiving a recommendation for exercise or other physical activity from a physician or other health professional. *NCHS Data Brief*. 2012 Feb;(86):1-8.
- US Department of Health and Human Services, Centers for Disease Control and Prevention, National Center for Health Statistics. Trends in adults receiving a recommendation for exercise or other physical activity from a physician or other health professional. Available from: <http://www.webcitation.org/6NyEU6Zsy> [cited 10 March 2014].
- Dacey ML, Kennedy MA, Polak R, Phillips EM. Physical activity counseling in medical school education: a systematic review. *Med Educ Online*. 2014 Jul 24;19:24325.
- Garry J, Diamond J, Whitley T. Physical activity curricula in medical schools. *Acad Med* 2002; 77: 818-20.
- Weiler R, Chew S, Coombs N, Hamer M, Stamatakis E. Physical activity education in the undergraduate curricula of all UK medical schools. Are tomorrow's doctors equipped to follow clinical guidelines? *Br J Sports Med* 2012; 46: 1024_6.
- Hebert E, Caughy M, Shuval K. Primary care providers' perceptions of physical activity counselling in a clinical setting: a systematic review. *Br J Sports Med* 2012; 46: 625_31.
- Joyce CL, O'Tuathaigh CM. Increased training of general practitioners in Ireland may increase the frequency of exercise counselling in patients with chronic illness: A cross-sectional study. *Eur J Gen Pract*. 2014 Apr 15.
- Sanghani NB, Parchwani DN, Palandurkar KM, Shah AM, Dhanani JV. Impact of lifestyle modification on glycemic control in patients with type 2 diabetes mellitus. *Indian J Endocrinol Metab*. 2013 Nov;17(6):1030-9.
- Murano I, Asakawa Y, Mizukami M, Takihara J, Shimizu K, Imai T. Factors increasing physical activity levels in diabetes mellitus: a survey of patients after an inpatient diabetes education program. *J Phys Ther Sci*. 2014 May;26(5):695-9.
- Umpierre D, Ribeiro PA, Kramer CK, Leitão CB, Zucatti AT, Azevedo MJ, Gross JL, Ribeiro JP, Schaan BD. Physical activity advice only or structured exercise training and association with HbA1c levels in type 2 diabetes: a systematic review and meta-analysis. *JAMA*. 2011 May 4;305(17):1790-9. Review.
- Abramson S, Stein J, Schaufele M, Frates E, Rogan S. Personal exercise habits and counseling practices of primary care physicians: a national survey. *Clin J Sport Med* 2000; 10: 40_8.
- Lobelo F, Duperly J, Frank E. Physical activity habits of doctors and medical students influence their counselling practices. *Br J Sports Med* 2009; 43: 89_92.
- Morishita Y, Miki A, Okada M, Tsuboi S, Ishibashi K, Ando Y, Nagata D, Kusano E. Exercise counseling of primary care physicians in metabolic syndrome and cardiovascular diseases is associated with their specialty and exercise habits. *Int J Gen Med*. 2014 Jun 17;7:277-83.
- Handelsman YI, Mechanick JL, Blonde L, Grunberger G, Bloomgarden ZT, Bray GA, Dagogo-Jack S, Davidson JA, Einhorn D, Ganda O, Garber AJ, Hirsch IB, Horton ES, Ismail-Beigi F, Jellinger PS, Jones KL, Jovanovi? L, Lebovitz H, Levy P, Moghissi ES, Orzcek EA, Vinik AI, Wyne KL; AACE Task Force for Developing Diabetes Comprehensive Care Plan. American Association of Clinical Endocrinologists Medical Guidelines for Clinical Practice for developing a diabetes mellitus comprehensive care plan. *Endocr Pract*. 2011 Mar-Apr;17 Suppl 2:1-53.
- American Diabetes Association. Standards of medical care in diabetes—2014. *Diabetes Care*. 2014 Jan;37 Suppl 1:S14-80.
- Yacoub TG. Combining clinical judgment with guidelines for the management of type 2 diabetes: overall standards of comprehensive care. *Postgrad Med*. 2014 May;126(3):85-94.
- Lew WY, DeMaria AN. The divergence between clinical guidelines and practice. *J Am Coll Cardiol*. 2013 Jan 8;61(1):41-3.
- Yates T, Haffner SM, Schulte PJ, Thomas L, Huffman KM, Bales CW, Califf RM, Holman RR, McMurray JJ, Bethel MA, Tuomilehto J, Davies MJ, Kraus WE. Association between change in daily ambulatory activity and cardiovascular events in people with impaired glucose tolerance (NAVIGATOR trial): a cohort analysis. *Lancet*. 2014 Mar 22;383(9922):1059-66.
- Lee R, Whitley HP. Use of social media to support patients with diabetes mellitus. *Consult Pharm*. 2014 Jan;29(1):53-7.
- Zanusso S, Jimenez A, Pugliese G, Corigliano G, Balducci S. Exercise for the management of type 2 diabetes: a review of the evidence. *Acta Diabetol*. 2010 Mar;47(1):15-22.

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³¹ Little JP, Gillen JB, Percival ME, Safdar A, Tarnopolsky MA, Punthakee Z, Jung ME, Gibala MJ. Low-volume high-intensity interval training reduces hyperglycemia and increases muscle mitochondrial capacity in patients with type 2 diabetes. *J Appl Physiol* (1985). 2011 Dec;111(6):1554-60.

³² Gillen JB, Gibala MJ. Is high-intensity interval training a time-efficient exercise strategy to improve health and fitness? *Appl Physiol Nutr Metab*. 2014 Mar;39(3):409-12.

³³ Gillen JB, Little JP, Punthakee Z, Tarnopolsky MA, Riddell MC, Gibala MJ. Acute high-intensity interval exercise reduces the postprandial glucose response and prevalence of hyperglycaemia in pa-

tients with type 2 diabetes. *Diabetes Obes Metab*. 2012 Jun;14(6):575-7.

³⁴ Hawley JA, Gibala MJ. What's new since Hippocrates? Preventing type 2 diabetes by physical exercise and diet. *Diabetologia*. 2012 Mar;55(3):535-9.

³⁵ Karstoft K, Christensen CS, Pedersen BK, Solomon TP. The acute effects of interval- vs. continuous-walking exercise on glycemic control in subjects with type 2 diabetes: a cross-over, controlled study. *J Clin Endocrinol Metab*. 2014 Jun 6:jc20141837. [Epub ahead of print]

³⁶ Harmer AR, Elkins MR. Amount and frequency of exercise affect glycaemic control more than exercise mode or intensity. *Br J Sports Med*. 2014 Apr 23.

³⁷ McGinley SK, Armstrong MJ, Boulé NG, Sigal RJ. Effects of exercise training using resistance bands on glycaemic control and strength in type 2 diabetes mellitus: a meta-analysis of randomised controlled trials. *Acta Diabetol*. 2014 May 21. [Epub ahead of print]

³⁸ Aguiar EJ, Morgan PJ, Collins CE, Plotnikoff RC, Young MD, Callister R. The PULSE (Prevention Using LifeStyle Education) trial protocol: a randomised controlled trial of a type 2 diabetes prevention programme for men. *Contemp Clin Trials*. 2014 Aug 1. pii: S1551-7144(14)00117-7.

³⁹ Bao W, Tobias DK, Bowers K, Chavarro J, Vaag A, Grunnet LG, Strøm M, Mills J, Liu A, Kiely M, Zhang C. Physical activity and sedentary behaviors associated with risk of progression from gestational diabetes mellitus to type 2 diabetes mellitus: a prospective cohort study. *JAMA Intern Med*. 2014 Jul;174(7):1047-55.

⁴⁰ Taylor LM, Johnson ST, Vallance JK, Stadnyk J, Basualdo-Hammond C. Food and Physical Activity Behaviours of Adults Attending a Prediabetes Education Class. *Can J Diabetes*. 2014 Jun 3. pii: S1499-2671(14)00046-X.

⁴¹ Bushman B. Promoting exercise as medicine for prediabetes and prehypertension. *Curr Sports Med Rep*. 2014 Jul-Aug;13(4):233-9.



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