



Type 2
Diabetes

Introduction

The HUR type 2 diabetes (T2D) concept is designed to be used in strength training as a therapeutic modality in treatment of T2D by using the HUR's Natural Transmission method.

The Natural Transmission Method is a resistance strength training method based on pneumatic technology. The method allows for resistance to be adapted in response to the muscle's own force production, regardless of the speed of movement. An intelligent technology system for automated reporting, close to zero starting load, 100 g/1 kg increments in resistance, range limiters and additional support with connected outcome measures to document the effectiveness, enables the T2D patient to start strength training safely when on appropriate medication.

The HUR T2D concept helps the rehabilitation professional to provide best practice exercise-as-medicine, based on the latest international treatment guidelines, to help the T2D patient to engage in regular weekly physical activity and to follow an exercise training regimen.



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Type 2 diabetes concept: Background and overview

T2D is characterized by chronic hyperglycemia due to decreased insulin secretion, insulin action or both. It is a progressive condition in which the body becomes resistant to the normal effects of insulin.

The diagnosis of T2D is based on the level of glucose at which retinopathy occurs, but macrovascular complications, such as coronary, cerebrovascular and peripheral artery disease, appear earlier and are often present when T2D is diagnosed. It has been reported that >60% of people with T2D develop a cardiovascular disease. The global prevalence of diabetes has increased markedly from 1980 to 2014 (108 vs. 422 million).

All the international guidelines aim at achieving

and maintain optimal blood glucose, lipid and blood pressure levels to prevent or delay development of diabetic complications. Along with a proper diet, smoking cessation and medical treatment, **exercise training and physical activity more generally has been shown to be an important cornerstone in the treatment of T2D.**

Exercise increases energy demand and glucose and fatty acid uptake into active muscles and a greater part of energy is produced from glucose when exercise intensity is increased. In addition to glucose metabolism, regular exercise training and increased daily habitual physical activity have direct effects on several risk factors in subjects with T2D including increased muscle mass and cardiorespiratory fitness,

decreased LDL cholesterol, decreased blood pressure, improved weight management, reduction of symptoms of depression, and improved health-related quality of life.

The HUR T2D concept helps the health care professional to provide best practice exercise-asmedicine, based on the latest international treatment guidelines, to help people with T2D to engage in regular weekly physical activity and to follow an exercise training regimen.



The role of strength training in treatment of T2D

Both regular endurance and strength training are important determinants in the treatment of T2D. Since skeletal muscle is the primary tissue for glucose and triglyceride metabolism and a crucial determinant of resting metabolic rate, the role of strength training is essential. It is necessary to train skeletal muscle groups separately to maximize whole body skeletal muscle fiber recruitment.

Therefore, regular strength training should be an integral part of daily life of persons with T2D.

Strength training in persons with T2D is feasible, well tolerated, and beneficial. It is also worth mentioning that, in addition physiological health benefits, strength training is associated with improvements in quality of life.

Outcome measures

In order to gather information on the baseline status and effectiveness of exercise training, each patient is evaluated individually. **The main target is to achieve and maintain optimal blood glucose.** Since both cardiorespiratory and muscle fitness have prognostic value in T2D patients, they can be recommended as main outcome measures of exercise training interventions.

Assessment of lipid profile, blood pressure, and body weight are highly recommended to be used as outcome measures. Furthermore, when existing comorbidities or other needs are registered, other appropriate outcome measures may be performed. These may include assessment of balance, questionnaires related to an individual's experience of pain, symptoms of depression, and health-related quality of life.

The maximal isometric strength of big muscle groups can be evaluated by the **HUR Performance Recorder** for the assessment of side-to-side differences and to

document changes in strength after the intervention. The Performance Recorder can be directly connected to all HUR exercise machines, which are equipped with the isometric testing sensor attachment.



Recommended HUR equipment for treatment of T2D

HUR T2D GYM



1 5540
LEG PRESS
REHAB



2 5310
3 ABDOMEN/
BACK REHAB



4 5140
CHEST PRESS
REHAB



5 5530
6 LEG EXTENSION/
CURL REHAB



7 5120
8 PUSH UP/
PULL DOWN REHAB



Performance
Recorder PR1



for 5-10 min
warm-up and
cool-down
for example:



12 3110
BICEPS/ TRICEPS



11 5175
OPTIMAL RHOMB
REHAB



9 5340
10 TWIST REHAB

Strength training prescription for HUR devices for T2D

The primary objective is to transfer appropriate strength training programs into clinical practice and, first and foremost, to help persons with T2D to integrate the training programs into their daily life.

To facilitate a lifelong commitment to regular exercise, outlines for six-month workout programs (both beginner and advanced) are presented below.



Strength training program for T2D patients (beginner and advanced) for six months.

Type 2 Diabetes, Strength Training program for 24 weeks: Beginner							
Week	Weekly volume	Series	Reps	% 1-RM	RPE	Rest intervals	Stage
1 - 2	2	1	15	30 - 40	10	90 - 120	Familiarization
3 - 4	2	1	15	30 - 40	10	90 - 120	Familiarization
5 - 6	2 - 3	2	10 - 15	40	10	90 - 120	Training
7 - 8	2 - 3	2	10 - 15	40	10 - 12	90	Training
9 - 10	2 - 3	2	10 - 15	40 - 50	10 - 12	90	Training
11 - 12	2 - 3	2	10 - 15	40 - 50	12	60 - 90	Training
13 - 14	2 - 3	2 - 3	10 - 12	50 - 60	12	60 - 90	Training
15 - 16	2 - 3	2 - 3	10 - 12	50 - 60	12	60 - 90	Training
17 - 18	3	3	10	60	13 - 14	60 - 90	Training
19 - 20	3	3	10	60	13 - 14	60 - 90	Training
21 - 22	3	3 - 4	8 - 10	70 - 80	14 - 15	60 - 90	Training
23 - 24	3	3 - 4	8 - 10	70 - 80	14 - 15	60 - 90	Training

***Weekly volume:**
exercise sessions weekly
Series: series for each muscle or muscle group
Reps: repetitions in each series
% 1-RM: % of one repetition maximum
RPE: ratings of perceived exertion (Borg's scale 6-20)
Rest intervals: in seconds
Stage: target level of exercise training.

Type 2 Diabetes, Strength Training program for 24 weeks: **Advanced**

Week	Weekly volume	Series	Reps	% 1-RM	RPE	Rest intervals	Stage
1 - 2	2 - 3	2 - 3	10 - 15	50	12	90	Training
3 - 4	2 - 3	2 - 3	10 - 15	50	12	90	Training
5 - 6	2 - 3	2 - 3	10 - 15	50	12	90	Training
7 - 8	2 - 3	2 - 3	10 - 15	50	12	90	Training
9 - 10	2 - 3	2 - 3	10 - 12	60 - 70	12 - 14	60 - 90	Training
11 - 12	2 - 3	2 - 3	10 - 12	60 - 70	12 - 14	60 - 90	Training
13 - 14	2 - 3	2 - 3	10 - 12	60 - 70	12 - 14	60 - 90	Training
15 - 16	3	2 - 3	10 - 12	60 - 70	12 - 14	60 - 90	Training
17 - 18	3	3 - 4	8 - 10	70 - 80	14 - 16	60 - 90	Maintenance
19 - 20	3	3 - 4	8 - 10	70 - 80	14 - 16	60 - 90	Maintenance
21 - 22	3	3 - 4	8 - 10	70 - 80	14 - 16	60 - 90	Maintenance
23 - 24	3	3 - 4	8 - 10	70 - 80	14 - 16	60 - 90	Maintenance

***Weekly volume:**

exercise sessions weekly

Series: series for each muscle or muscle group

Reps: repetitions in each series

% 1-RM: % of one repetition maximum

RPE: ratings of perceived exertion (Borg's scale 6-20)

Rest intervals: in seconds

Stage: target level of exercise training.

References

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