October 11	physical fitness assessment	Divide into groups of 3 students Choose a weakness typical of seniors Write the names of the group members and the topic in the shared table
October 18	physical fitness assessment	write down the weakening characteristic and put it in IS
October 25	create an exercise lesson	Physical fitness assessment
November 1	lead an exercise unit with real seniors – 1. group	Physical fitness assessment - real seniors
November 8	lead an exercise unit with real seniors – 2. group	Physical fitness assessment - real seniors
November 15	lead an exercise unit with real seniors – 3. group	Physical fitness assessment - real seniors
November 22	lead an exercise unit with real seniors – 4. group	data analysis and preparation of interpretation of results
November 29	lead an exercise unit with real seniors – 5. group	presentation of the results - groups 1, 2, 3.
December 6	lead an exercise unit with real seniors – 6. group	presentation of the results - groups 4, 5, 6.

Physical activity in the context of aging – types of exercise

e057

CONTENT

- Recommendation
- Strength in older adults
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  - Multitask Balance Training
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Physical activity in older adults recommendations

- **The World Health Organization (WHO) recommends people aged 65 and over 150 minutes of medium-intensity physical activity per week**
  - or at least 75 minutes of high-intensity physical activity per week
  - or an equivalent combination of medium and high-intensity exercise per week

Each activity should be performed for **at least 10 minutes at a time** to be healthy.

- People with poor mobility should do physical activity **to improve balance and prevent falls 3 or more days a week.**
- Of particular importance should be **strength training performed 2 or more days a week** and involving strengthening of **major muscle groups**.

Strength in older adults

Sarcopenia

Definition

Assessment

Strength training and recommendation

for healthy

Modified for health limitations

The types of strength trainings

What is sarcopenia?

- progressive generalized skeletal muscle disease associated with an increased risk of health complications - falls, fractures, physical disability and death.
- syndrome characterized by progressive total loss of skeletal muscle, muscle strength and function
- parameters of sarcopenia - the amount of muscle mass and their function
- measurable variables - muscle mass, muscle strength, muscle performance

Sarcopenia categories by cause

Primary sarcopenia	
Age-related sarcopenia	No other cause evident except ageing
Secondary sarcopenia	
Activity-related sarcopenia	Can result from bed rest, sedentary lifestyle, deconditioning or zero-gravity conditions
Disease-related sarcopenia	Associated with advanced organ failure (heart, lung, liver, kidney, brain), inflammatory disease, malignancy or endocrine disease
Nutrition-related sarcopenia	Results from inadequate dietary intake of energy and/or protein, as with malabsorption, gastrointestinal disorders or use of medications that cause anorexia

Criteria for the diagnosis of sarcopenia

Diagnosis is based on documentation of criterion 1 plus (criterion 2 or criterion 3)

1. Low muscle mass

2. Low muscle strength

3. Low physical performance

EWGSOP conceptual stages of sarcopenia

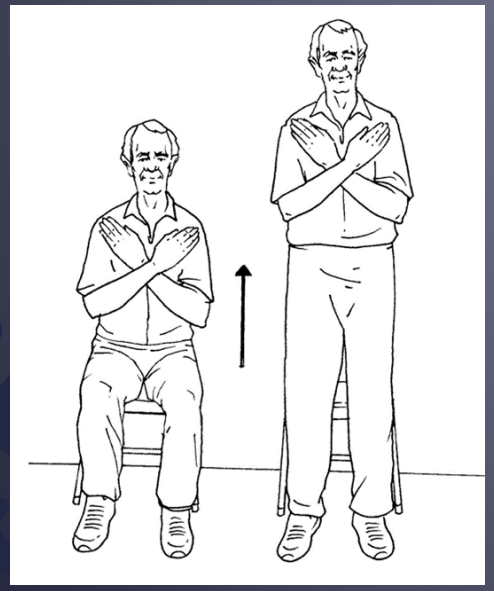
Stage	Muscle mass	Muscle strength		Performance
Presarcopenia	↓			
Sarcopenia	↓	↓	Or	↓
Severe sarcopenia		↓	↓	↓

Measurements of muscle mass, strength, and function in research and practice[a]

Variable	Research	Clinical practice
Muscle mass	Computed tomography (CT) Magnetic resonance imaging (MRI) Dual energy X-ray absorptiometry (DXA) Bioimpedance analysis (BIA) Total or partial body potassium per fat-free soft tissue	BIA DXA Anthropometry
Muscle strength strength	Handgrip strength Knee flexion/extension Peak expiratory flow	Handgrip
Physical performance	Short Physical Performance Battery (SPPB) Usual gait speed Get-up-and-go test Stair climb power test	SPPB Usual gait speed Timed get-up-and-go test

Summary

Decreased muscle strength is a major clinical manifestation of sarcopenia. Low hand grip is a very good predictor of health complications and correlates with muscle strength in the arms and lower limbs.
The recommended method is to determine the maximum hand grip force with a hand dynamometer.
However, in the elderly, evaluation may be limited by hand disease (hand arthrosis, forearm fracture stage, carpal tunnel syndrome, paresis, etc.), the patient's inability to understand the instruction, and lack of motivation.
Hand grip is considered pathological in women less than 16 kg, in men less than 27 kg.



Alternatively, the muscular strength of the lower limbs can be measured using the "Chair stand" test, ie a test of standing from a chair without the help of arms 5 times in a row at maximum speed. Sarcopenia is evidenced by the inability to stand without support, or a time longer than 15 seconds for both sexes.

Resistance (strength) training

…increased amount of muscle mass can induce many health benefits and increase life quality (Barbalho et al., 2018)

New recommendation

2–3 sets of **1–2 multijoint exercises per major muscle group, achieving intensities of 70–85% of 1 repetition maximum** (1RM), **2–3 times per week**, including power exercises performed at higher velocities in concentric movements with moderate intensities (Fragala, 2019)

Resistance training programs for older adults should follow the principles of individualization, periodization, and progression.

Positive Physiological Adaptations to Resistance Exercise Training in OA

A properly designed training program can enhance the muscular strength, power, and neuromuscular functioning of older adults.

Functional Benefits of Resistance Exercise Training for OA

A properly designed resistance training program can **improve**

- **mobility, physical functioning, performance** in activities of daily living (ADL), and **maintain the independence** of OA.
- an older adult's **resistance to injuries and falls**.
- the **psychosocial well-being** of older adults.

Considerations for Frailty, Sarcopenia, or other Chronic Conditions

Resistance training programs can be adapted

- for OA with frailty, mobility limitations, cognitive impairment, or other chronic conditions.

Age-related loss of muscle mass (originally termed sarcopenia) has an estimated prevalence of 10% in OA than 60 years, rising to 50% in OA than 80 years.

The loss of muscle mass is gradual, starting after age 30 and accelerating after age 60.
Previous longitudinal studies have suggested that muscle mass declines by 1.0–1.4% per year in the lower limbs, which is greater than the loss of muscle mass in the upper limbs.

The rate of decline in muscle strength with age is 2–5 times greater than declines in muscle size.

Given these links, grip strength has been labeled a "**biomarker of aging**".
Declines in muscle power have been shown to be more important than muscle strength in the ability to perform daily activities

Resistance training general recommendations for healthy older adults.†

Program variable	Recommendation†	Details
Sets	1–3 sets per exercise per muscle group	1 set for beginners and older adults with frailty progressing to multiple sets (2–3) per exercise.
Repetitions	8–12 or 10–15	Perform 6–12 reps with variation for muscular strength for healthy older adults. Perform 10–15 repetitions at a lower relative resistance for beginners.
Intensity	70–85% of 1RM	Begin at a resistance that is tolerated and progress to 70–85% of 1RM using periodization. Lighter loads are recommended for beginners, or individuals with frailty, or special considerations such as cardiovascular disease and osteoporosis. Exercises should be performed in a repetition-range intensity zone that avoids going to failure to reduce joint stress.
Exercise selection	8–10 different exercises	Include major muscle groups targeted through multijoint movements (e.g., chest press, shoulder press, triceps extension, biceps curl, pull-down, row, lower-back extension, abdominal crunch/curl-up, quadriceps extension or leg press, leg curls, and calf raise).
Modality	Free-weight or machine-based exercises	Beginners, frail older adults, or those with functional limitations benefit from machine-based resistance training (selectorized weight or pneumatic resistance equipment), training with resistance bands, and isometric training. High functioning older adults gain added benefit from free-weight resistance training (e.g., barbells, dumbbells, kettlebells, and medicine balls).
Frequency	2–3 days per week, per muscle group	Perform on 2–3 nonconsecutive days per week, per muscle group, may allow favorable adaptation, improvement, or maintenance.
Power/explosive training	40–60% of 1RM	Include power/explosive exercises where high-velocity movements are performed during the concentric phase at moderate intensities (i.e., 40–60% of 1RM) to promote muscular power, strength, size, and functional tasks.
Functional movements	Exercises to mimic tasks of daily living	Healthy, high functioning older adults benefit from the inclusion of multijoint, complex, and dynamic movements, with base of support or body position variations.

Resistance training guidelines for older adults with frailty.†

Variable	Recommendation
Resistance training	Perform 2–3 times per week, with 3 sets of 8–12 repetitions at an intensity that starts at 20–30% of 1RM and progresses to 80% of 1RM.
Power	Include power exercises performed at high speed of motion and low to moderate intensity (i.e., 30–60% of 1RM) to induce marked improvements in the functional task performance.
Functional training	Include exercises in which daily activities are simulated, such as the sit-to-stand exercise, to optimize the functional capacity.
Endurance training	Complements resistance training adaptations. Begin once strength and balance are improved. May include walking with changes in pace, incline and direction, treadmill walking, step-ups, stair climbing, and stationary cycling. Start at 5–10 min and progress to 15–30 min. The Rate of Perceived Exertion scale is an alternative method for prescribing exercise intensity, and an intensity of 12–14 on the Borg scale seems to be well tolerated.
Balance training	Include several exercise stimuli, such as line walking, tandem foot standing, standing on one leg, heel-toe walking, stepping practice, and weight transfers from one leg to the other.
Progression	Include gradual increases in the volume, intensity, and complexity of the exercises.

Summary of exercise modifications.*

Condition	Modification
Frailty	Start at a lower resistance, progress more slowly, limit end point to volitional fatigue (start at 8–12 reps at 20–30% of 1RM and progress to 80% of 1RM).
Mobility limitations	Consider exercises in seated position.
Mild cognitive impairment	Select simple exercises. May require extrainstruction and demonstration.
Diabetes	Monitor blood glucose before and after training. Consider special considerations of associated cardiovascular disease, nerve disease, kidney disease, eye disease, and orthopedic limitations.
Osteoporosis	Begin at a lower intensity. Train balance, but exert extra care to prevent falls. Focus on form and technique and use caution with bending and twisting. Include postural exercises (spinal extension).
Joint pain or limited range of motion (arthritis)	Double-pinned machines may restrict ROM for joint pain, discomfort, and/or limited ROM. To allow for training through the pain-free part of the ROM and attain a training effect.
Poor vision, equilibrium and balance (falling), low-back pain, and dropping weights	Consider weight machines (as opposed to free weights).

Currently, resistance training programs in the geriatric context include three approaches:

- high-intensity resistance training at a moderate movement speed with a load of 70-80% of one repetition maximum (1RM)
- high-velocity or power training conducted at maximum speed during the concentric phase and released at moderate speed during the eccentric phase of the exercise, with loads of 20–80% of 1RM;
- eccentric resistance training (also called negative resistance training) conducted at moderate movement speed with high mechanical loads.

Traditional Resistance Training

- Today, it is well known that resistance training using heavy loads (>70% of 1RM) is more effective than low-intensity training.
- It seems that resistance training increases strength but has less-clear effects on balance abilities.
- The well-documented impact of strength training in the elderly is on bone mineral content, which affects the risk of fractures associated with falls.

Power or High-Velocity Resistance Training

- The ability to generate force rapidly in advancing age declines more steeply than maximal strength
- and is more relevant for preventing a fall than the capacity to produce maximal strength.

- And that's why it's important to apply high-velocity and power training programs…

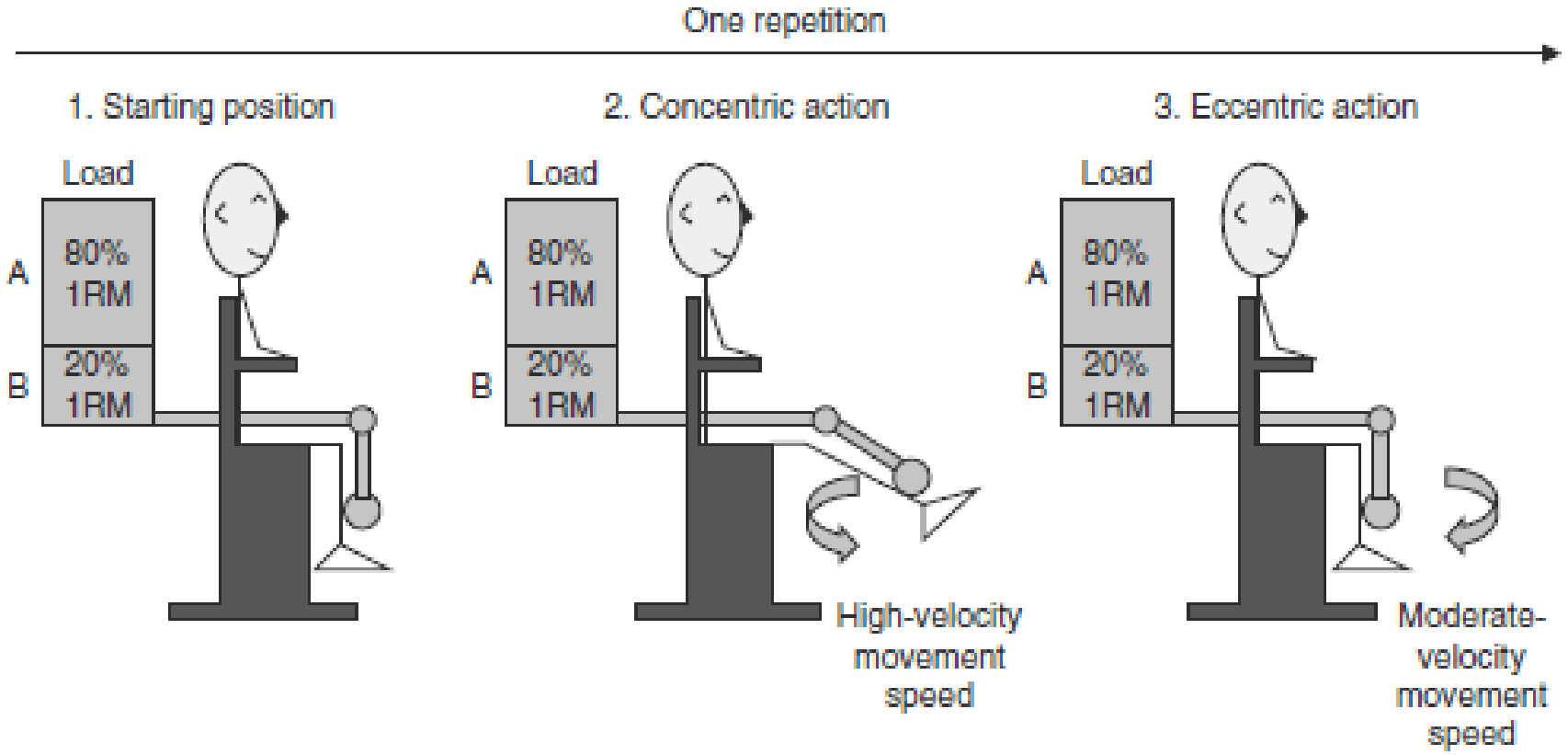


Fig. 6. Schematic description of power or high-velocity resistance training. **1RM** = one-repetition maximum.

Eccentric resistance training (also called negative resistance training)

The eccentric resistance training is hard to doing because the performance of resistance training in isolated eccentric contraction mode requires special training equipment (e.g. an isokinetic device).

This is why eccentric resistance training was mainly applied in a scientific context and to a lesser extent in intervention programs.

Balance Training in Older Adults

- Traditional Balance Training
- Perturbation-Based Balance Training
- Multitask Balance Training

Traditional Balance Training

- More recently, the application area of balance training was expanded to the geriatric population with the purpose of fall prevention.
- However, in contrast to resistance training, there are hardly any scientific guidelines concerning contents, optimal duration and intensity in balance training.
- Static and dynamic exercises on stable and unstable surfaces during bipedal or monopedal stance with eyes open or closed represent the core of traditional balance training.

Perturbation-Based Balance Training

- This approach is based on the fact that slips and trips account for 30–50% of falls in community-dwelling older adults.
- Thus, compensatory strategies for recovery of equilibrium play a vital functional role in preventing falls.
- Successful balance recovery can be achieved through different movement strategies (ankle, hip and step strategies).

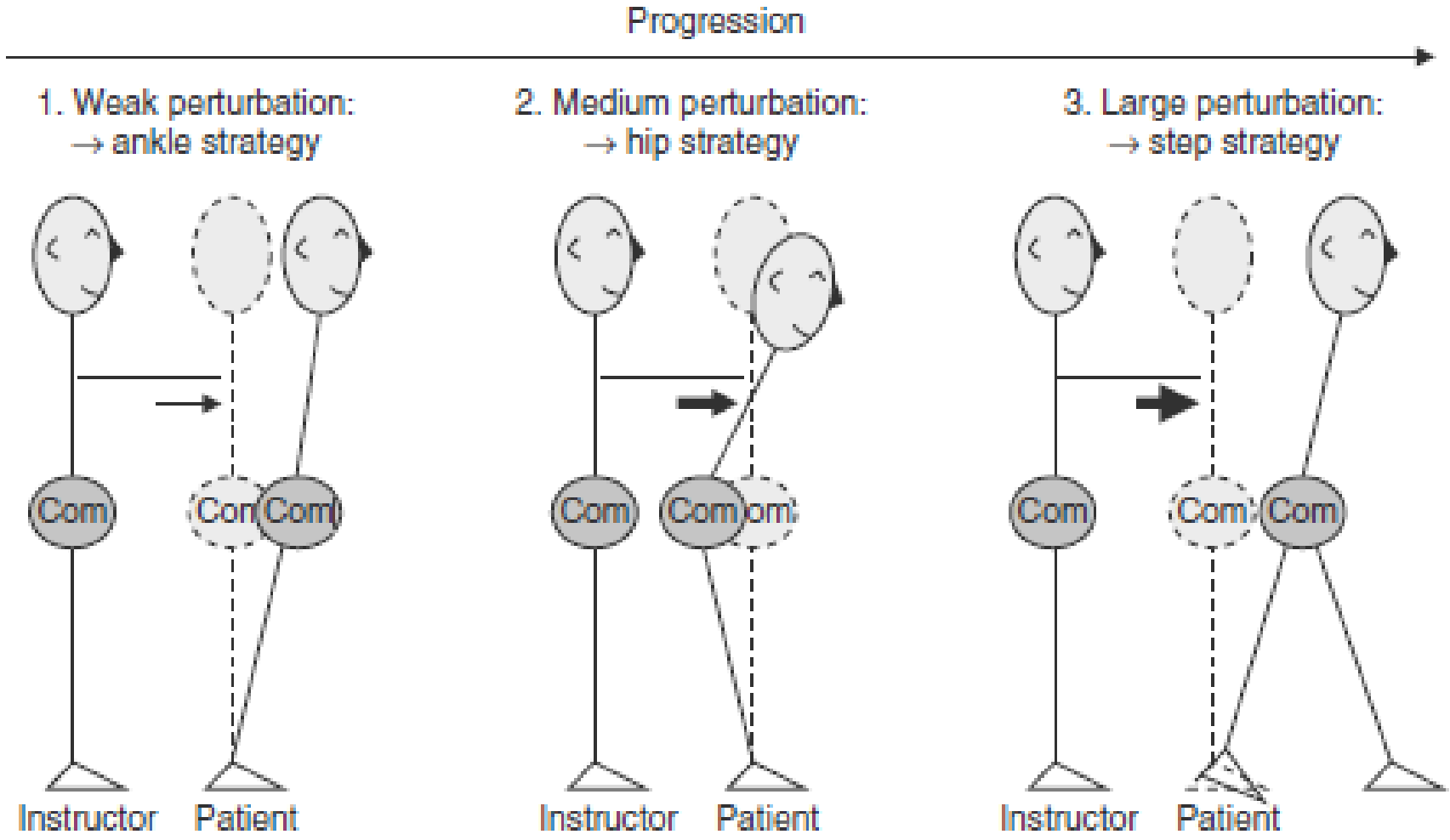


Fig. 3. Schematic illustration of progression in perturbation-based balance training. **Com** = centre of mass (the three different arrow thicknesses indicate an increase in the applied severity of the perturbation).

Multitask Balance Training

Effective fall prevention programs should also include multitasking balance exercises, as gait instability and thus the risk of falling increases even when joint attention or dual tasks (e.g., talking) are performed.

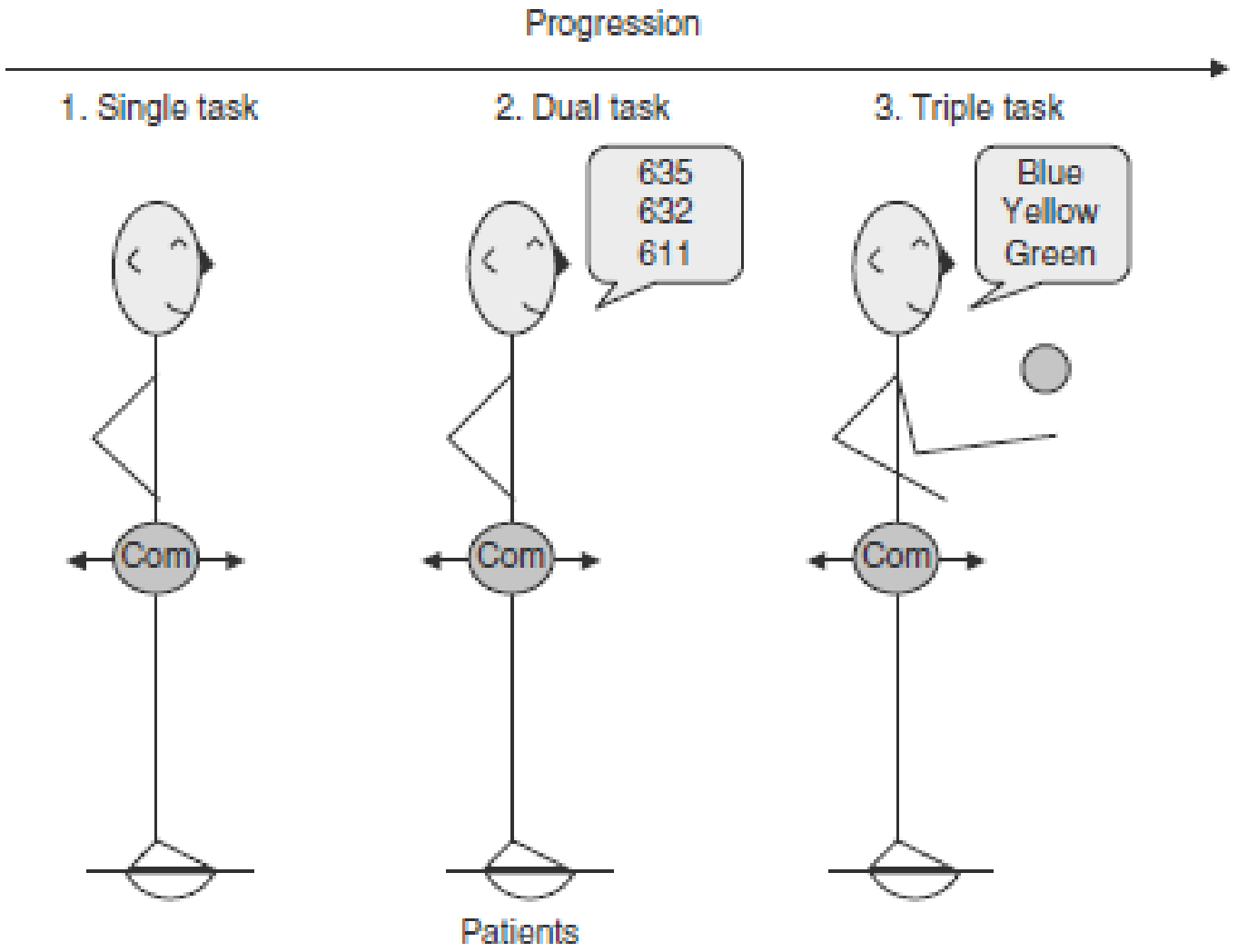


Fig. 4. Schematic illustration of progression in multitask balance training. **Com** = centre of mass (arrows indicate displacements of the Com).

TEST - Multitask Balance Training

1) step up
2) stand on your left foot
3) close your eyes
4) count all the letters of your first and last name
5) remember that number
6) start lifting your knees alternately
7) count each leg lift
8) count repeatedly to the number you remember from task 4)
9) connect the thumb with each finger, it doesn't matter in which order

Endurance training

Some appropriate endurance exercises include walking, Nordic walking, hiking, jogging, cycling, swimming, dancing, or cross country skiing.

One of the best physical activities is walking.

Benefits of regular walking (confirmed by scientific studies):

- reduces the risk of heart and vascular diseases (cardiovascular diseases); myocardial infarction; breast cancer; diabetes (more precisely type 2 diabetes)
- osteoporosis prevention; varicose veins; flat foot
- get better sleeping
- reduces stress
- improves memory, creativity

credit requirements

- Active participation in classes
- Describe the exercise unit and submit IS
- Design and lead an exercise unit with real seniors
- Choose one diagnostic method (strength measurement, balance measurement, gait analysis,...), measure a real senior and comment on the result.
- Describe, insert into IS and then present at the lecture