

### Total Body Orthotic Management (TBOM)

- A specialized orthotic medical treatment for managing patient's with complete to severe physical disability

#### Mission Statement

- The right to full utilization of his or her body system.
- The right to be free of pain and discomfort.
- The right to be as functional as possible.
- The right to achieve a higher quality & dignity of life.

#### Goal of Presentation

- To explain that medical problems associated with immobility are treatable and preventable.
- Educate how TBOM is a bracing system for treating the medical problems associated with immobility.
- To show TBOM save Medicare millions of dollars in treating and preventing the problems of immobility.

#### Diseases TBOM Treats

- |                         |                        |
|-------------------------|------------------------|
| • Immobility            | • Pain                 |
| • Iatrogenic disease    | • Pressure ulcers      |
| • Joint contractures    | • Falls                |
| • Osteoporosis/kyphosis | • Alzheimer's/Dementia |
| • Hyper(hypo)tonicity   | • Fractures            |
| • CVA                   | • Parkinson            |
| • Adult Scoliosis       | • Pneumonia            |

#### TBOM

- A specialized orthotic medical treatment for managing patient's with complete to severe physical disability.
- A system based on integrated application of individual braces to treat bio-mechanical deficits.
- Bio-mechanical principles is understanding the body and how it relates to forces that place stress.
- TBOM, are braces connected to braces.
- TBOM consists of arrays of braces, that are calibrated and custom fitted to counteract (progressively), the multiple specific severe deforming forces.
- Braces that are adjustable, and adjusted, to the patients' medical problems.
- Each brace is counteracting specific medical problems as applied by a orthotist or orthotic clinician.
- TBOM system is based on the understanding of Newtonian bio-mechanical principles.

### Immobility - General Information

- Nurses, have known for many years that immobility and bed rest can have dire consequences. We've made great strides in getting patients out of bed as quickly as possible, we must remain ever vigilant against potential complications that our patients may suffer from long periods of bed rest and immobility. We will be more likely to provide proactive interventions for our patients when we have a better understanding of all the changes that occur within the body during prolonged periods of bed rest or immobility.
- It is the purpose of this presentation to explore methods that will ameliorate the conditions caused by immobilization.
- One such method is total body orthotic management developed by OrthoConcepts.
- Despite the awareness of the problem that dates back to the 1940s, little has been done empirically or in an applied fashion to eradicate the debilitating effects of immobilization upon the health and well-being of the elderly population.
- Immobilization, in response to illness or disability, is one example of what Buckwalter and Stolley (1991) characterized as an iatrogenic factor for the elderly that can lead to iatrogenic disorders.
- In the 1950s and 1960s, providers routinely prescribed strict bed rest of two weeks after childbirth, three weeks after a herniorrhaphy, and four weeks after a myocardial infarction.
- Although often treated as primary therapy, bed rest itself led to lengthy hospitalization, soaring health care costs, and secondary complications.

#### Immobility - Psychological Changes

- Patients frequently exhibit anxiety, apathy, depression, disorientation, passive/aggressive verbal and nonverbal communication, mood swings, listlessness, withdrawal, social isolation, regression, and altered body perception.
- Other notable psychological effects of immobility-bed rest included a diminished ability to concentrate, recall sequential events, problem solve, and perform self-care.

### Immobility - Deconditioned Muscles

- The musculoskeletal system is one of the first systems of the body to suffer the far-reaching effects of immobility, and research has shown that changes not only occur to the muscle fibers but also at a subcellular level in the system.
- The consequences of these changes include the loss of muscle strength and endurance, reduced skeletal muscle fiber size, diameter, and capillarity (atrophy); and contractures, disuse osteoporosis, and degenerative joint disease.
- The severity of muscle deconditioning is related to the duration and magnitude of the activity limitation. If left unchecked, this muscle wasting can lead to long-term sequelae — muscle atrophy, joint ankylosis, and fibro fatty tissue proliferation, which leads to the formation of adhesions, scar tissue, and contractures — impairing functional capacity and permanently damaging the muscle.
- External pressure from lying in one position compresses the skin's capillaries and obstructs its circulation, particularly over the bony prominences, leading to skin breakdown and pressure ulcers.
- Immobilization cause loss of normal muscle contraction in the lower extremities and contributes to venous pooling and venous stasis in dependent parts of the body.
- Slowing of venous circulation, coupled with constant pressure from the weight of the resting body, compresses capillary vessels and raises their internal pressure above normal, damaging the intimal lining.
- As many as 13% of bedridden patients develop deep vein thrombosis. DVT was first strongly identified in persons during World War II when they sat for prolonged periods in air-raid shelters.
- Recent studies have shown that immobile patients are at high risk for development of DVT.
- Immobility and diminished weight bearing has also been linked to a disruption in parathyroid functions, calcium metabolism, and bone formation.
- Resulting osteoporosis places an older adult at risk for pathologic fractures of the vertebrae, hips, pelvis, and shoulder bones.

### Immobility - Cardiovascular System

- Prolonged immobility sets in motion a cascade of damage in the cardiovascular system.
- Changing positions from upright to supine triggers fluid shifts that raise central venous pressure and activate renal and hormonal receptors to cause diuresis.
- When the venous pooling in the lower extremities and an often reduced oral intake are added to fluid-shift effects, stroke volume and cardiac output may deteriorate.

### Immobility - Consequences for Every System

- Loss of muscle mass, strength and endurance
- Decreased plasma and blood volume
- Decreased ventricular volume
- Increased hemoglobin and hematocrit
- Diuresis
- Venous stasis
- Bone demineralization
- Increased heart rate at rest
- Decreased resting and maximum stroke volume
- Decreased maximum cardiac output
- Decreased maximal oxygen uptake
- Increased venous compliance
- Increased risk, venous thrombosis and thromboembolism
- Decreased orthostatic tolerance
- Increased risk of atelectasis and pulmonary emboli
- Impaired taste-smell, as well as difficulty in swallowing while in a recumbent position, all contribute to a reduction in appetite and fluid intake
- A negative nitrogen balance caused by catabolic processes from immobilization occurs as early as the sixth to the tenth day and can cause anorexia.
- Diminished peristalsis, associated with inactivity, impaired fluid intake, and physiological fluid shifts, can lead to constipation, nausea and vomiting, or even paralytic ileus, further augmenting the patient's fluid deficit.
- Patients on prolonged bed rest, especially the elderly, are susceptible to complications of urinary retention and mineral loss
- The supine position hinders drainage of urine from the renal pelvis to the bladder.
- Patients often have difficulty using a urinal or bedpan because of the supine position or feeling embarrassed.

### Immobility - Consequences for Every System

- Avoidance of urinating can lead to over distention of the bladder muscle. As the bladder becomes more distended, patients may lose the sensation to void and experience even more difficulty, resulting in urinary retention, stasis, and infection.
- Non-weight bearing — particularly not using the longitudinal bones — hastens demineralization of calcium and phosphorous from bones, predisposing the patient to renal calculi.

### Iatrogenic Factor of Immobilization

- The iatrogenic factor of immobilization has been clearly documented in the literature and linked to numerous disorders.
- Any disease or disability that extremely limits a person's functioning, and or activity, i.e. hemiparesis, paralysis, paraplegia, quadriplegia, fracture, dementia, are considered immobilized.
- Immobilization in the form of prolonged bed rest may appear to be therapeutic, but its side effects guarantee continued disability.
- They also extend this definition to include "the treatment of all health care practitioners and may also encompass non-treatment when treatment is indicated.
- As Harper and Lyles (1988) have concluded, prolonged bed rest "causes physiological changes in most organ systems with significant complications."
- Prolonged immobilization for the ill person becomes more critical when that ill person is also old.
- When one views the adverse effects of immobilization as compounding the effects of illness and aging, it is clear why the odds for the elderly are heavily in favor of continued morbidity instead of recuperation and wellness.

### Iatrogenic Disease

- Institute of Medicine said the number of deaths from medical mistakes every year may total 98,000.
- Medical mistakes may cost the U.S. \$29 billion a year
- May be the fifth highest cause of death -- behind heart disease, cancer, stroke and lung obstructive lung diseases.
- Adverse drug reaction or complications induced by non-drug medical interventions.
- As a disease induced by a drug prescribed by MD, after a medical or surgical procedure, and environmental events.

### Iatrogenic Disease

#### Risk Factors In Elderly

- Drug induced iatrogenic disease.
  - Multiple chronic diseases.
  - Multiple physicians.
  - Hospitalization.
  - Medical or surgical procedures.
- #### Steps In Prevention
- Identifying patients at high risk.
  - Early recognition & treatment of illness.
  - Close management of chronic illness.
  - Iatrogenic diseases are preventable.
  - Interventions that can prevent complications.

### Joint Contracture

- Contractures are a common but preventable consequence of prolonged physical immobility among nursing home residents.
- Reduce mobility and increase the risk of other outcomes of decreased mobility, such as pressure ulcers.
- Immobility plays a major role in the development of joint contractures.
- Patients with conditions limiting mobility are at high risk for joint contracture.
- Prolonged immobility from critical illness can also be expected to predispose patients to experience joint contractures.
- Joints, ligaments, tendons, muscle and skin are the moving parts of the body, all have a normal range of motion (ROM) that is necessary for the proper performance of physical tasks.
- Joint contracture is the loss of contractile force and shortening of muscle fiber, total muscle length (i.e. hip, knee, ankle, foot, shoulder, elbow, wrist, hand and spine).
- Contractures of multiple joints compound the patient's difficulties in performing activities of daily living and leisure pastimes and impose a burden on health care providers and on family members.
- The most frequent and functionally limiting contractures are ankle plantar flexion contractures (which limit independent transfers and ambulation) and contractures of the intrinsic muscles of the hand (which limit eating, dressing and writing).
- Prolonged immobility during the critical illness may predispose patients to the development of joint contractures, (2 weeks or > in ICU).

### Joint Contracture

#### Online Survey, Certification and Reporting (OSCAR)

- The prevalence of contractures in nursing homes is between 24% and 75%.
- 28.9% of approximately 386,000 nursing home residents have contractures.
- These staggering numbers reflect a 20% increase in the rate of contractures since 1999.
- Contractures are a common but preventable consequence of prolonged physical immobility.
- Disuse atrophy (wasting of muscle fiber) leads to the loss of an 1/8" of muscle for each week of inactivity.
- Partially used muscle will begin to atrophy when exerting less than 20% of its maximum force.
- Strength can decrease by 50% as soon as three days after inactivity.
- Muscle contractures cause loss of motion.
- Contractures are corrected by modalities to increase the compliance or stretch ability of collagen that is followed by if necessary ROM exercises, serial casting or orthotic braces.
- Orthotic braces can do much to retard progression of joint contractures and muscle atrophy.

#### Contractures & Loss of Function in Alzheimer's Pt's

- Contractures are frequently used as quality indicators for nursing homes.
- OBRA of 1989 specified that facilities must ensure that residents who enter their facilities without contractures do not experience a reduction in their ROMs without justifiable reasons.
- In the older population, the most common causes of contractures are immobility from illness, surgery, or neuromuscular diseases such as stroke, Parkinson's disease, and dementia.
- Contractures can, in themselves, lead to additional serious conditions in patients with AD. These include pain, circulation problems, pressure sores, wounds, and sometimes even fractures of joints or bones.
- In patients with stroke, the unopposed spastic contraction of muscle groups commonly leads to contractures.
- Contractures are associated with impaired ambulation, pain, decreased functional status, and pressure ulcers.
- On complications of stroke, contractures were found in 60% of the patients over the ensuing 12 months.

### Contractures & Loss of Function in Alzheimer's Pt's

- Contractures are associated with institutionalization.
- It is in severe AD where a near vegetative, immobile stage occurs. As the disease progresses, patients progressively have more difficulty walking and become bedridden.
- Not surprisingly, Souren et al found a striking correlation between the degree of functional decline and occurrence of contractures in persons with AD.
- While most contractures occur in this final stage of AD, acute conditions in the earlier stages of AD can lead to contractures that have significant effects on the care of these individuals.
- For example, hip fractures, subsequent hospitalization, and institutionalization can result in contractures at the knee that prevent successful rehabilitation and ambulation.
- This can result in substantial increases in the long-term care resources needed by these patients.

#### How Immobilization in Alzheimer's Patients Leads to Contractures

- Immobility has detrimental effects on cardiovascular, respiratory, gastrointestinal, musculoskeletal, urinary, metabolic, and psychosocial effects.
- Contractures have also been seen to increase risk of spontaneous fractures in NH residents.
- Immobility is a common denominator in joint contractures, including those in persons with AD.
- Even without risk factors such as fractures, arthritis, and neurological damage, immobility causes the joint capsule to undergo changes that can produce a contracture.
- A review done by Farmer and James showed that in immobilization, muscle weakness, paralysis, or spasticity can lead to contracture formation in neuromuscular disease.
- A muscle immobilized in a shortened position leads to reduction in muscle fiber length due to a loss of serial sarcomere. There is also a resultant remodeling of the intramuscular connective tissue leading to increased muscle stiffness.

### Pressure Ulcers

- Pressure ulcers are a serious and common medical condition in U.S. nursing homes, and remain an important public health problem.
- 2.5 million people develop pressure ulcers each year.
- 60,000 die each year as a direct result of pressure ulcer.
- Pressure ulcers cost \$9.1 to \$11.6 billion per year in the U.S.
- Care ranges from \$20,900 to \$151,700 per pressure ulcer, 2007 Medicare estimate.
- More than 11% (159,000) nursing home residents had pressure ulcers.
- Residents aged 64 years and under were more likely than older residents to have pressure ulcers.
- Residents of nursing homes for a year or less were more likely to have pressure ulcers than those with longer stays.
- Each pressure ulcer added \$43,180 in cost to a hospital stay.
- One in five nursing home residents with a recent weight loss had pressure ulcers.
- 2nd most common claim after wrongful death and greater than falls.
- Pressure sores are usually caused by unrelieved pressure to the bony parts of the body such as the heels, ischial tuberosity, sacrum, spine resulting in damage to the skin and the underlying tissue.
- Often times a pressure sore is a symptom of neglect and/or abuse with patients that are in a wheelchair or bedbound.
- Pressure sores typically occur when patients especially the elderly, must stay in bed for a prolonged period of time due to aging, injury or illness.
- In general, the elderly are at higher risk for developing pressure sores because of normal aging changes to the skin.
- Pressure sores can be lessened by frequent turning.
- Minimizing the force exerted at points of contact.
- Maximizing the area of each point of contact.
- Pressure sores occur over bony areas, hip, knees, heel, spine.
- Skin circulation is obstructed, and skin perfusion ceases over the bony prominences of a recumbent patient, causing infarction of skin bedsores.

## Falls

- Cost to treat falls among older adult in U.S. is \$19 billion.
- One in three adults age 65 and older falls each year.
- Of those who fall, 20% to 30% suffer moderate to severe injuries that makes it hard for them to get around or live independently, and increase their risk of early death.
- By 2020, the annual direct and indirect cost of fall injuries is expected to reach \$54.9 billion (in 2007 dollars).
- More than 90% of hip fractures occur as a result of falls, with most of these fractures occurring in persons over 70 years of age.
- Risk factors for falls in the elderly include increasing age, medication, cognitive impairments and sensory deficits
- On average, the hospitalization cost for a fall injury is \$17,500.
- Hospitalization costs accounted for 44% of direct medical costs for hip fractures.
- Approximately 75% of deaths due to falls in the U.S. occur in the 14% of the population who are 65 years of age and older.
- After 75 years of age, the rates increase markedly
- Incidence rates for falls in nursing homes and hospitals (about 1.6 falls per bed annually).
- Older adults are hospitalized for fall related injuries five times more often than they are for injuries from other causes.
- Medicare costs per fall averaged between \$9113 and \$13,507.
- People age 72 and older, average health care cost for a fall injury total \$19,440.
- 2 of the most common concerns facing older adults is reduction in function causing considerable morbidity and mortality.
- Falls and instability precipitate premature nursing home admissions.
- Accidents are the 5th leading cause of death in older adults, and falls account for 2/3rd of these accidental deaths.
- Those who experience non-fatal falls can suffer injuries, have difficulty getting around and have a reduced quality of life.
- About 5% of adults 65 and older live in nursing homes, but nursing home residents account for about 20% of deaths from falls in this age group.
- Each year, a typical nursing home with 100 beds reports 100 to 200 falls. Many falls go unreported.
- Patients often fall more than once. The average is 2.6 falls per person per year.
- About 35% of fall injuries occur among residents who cannot walk.
- About 1,800 people living in nursing homes die each year from fall-related injuries.
- About 10% to 20% of nursing home falls cause serious injuries; 2% to 6% cause fractures.

## Falls in Nursing Homes

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## Pain

- More than 50% of US nursing home residents have substantial cognitive impairment or dementia
- Since assessment of pain is an important step towards the treatment of pain, there is a need for manageable, valid and reliable tools to assess pain in elderly w/dementia
- Dementia causes serious and unique barriers to pain assessment and can be characterized by memory loss, personality changes and loss of other functions
- A substantial proportion of elderly people living in institutions are unable to understand and answer even simple yes/no questions, and therefore cannot self-report pain

## Osteoporosis

- A disease that causes bones to become thin and weak, often resulting in fractures (broken bones).
- The most common breaks are in the hip, spine or wrist.
- Osteoporosis is called a silent disease because many people do not even know they have thin bones until one breaks.
- Commonly affects older adults, postmenopausal women and persons of Caucasian or Asian descent.
- If you have a physical disability, you are at higher risk for osteoporosis than other people.
- After age 25, most people no longer build bone mass.
- Is a systemic skeletal disease characterized by low bone mass, deterioration of bone tissue, increase in bone fragility, susceptibility to fracture.
- 10 million people in the U.S., 80% of whom are women, have osteoporosis, another 18 million (83% women) have low bone mass.
- Osteoporosis is a major cause of morbidity and death in older persons.
- Clinical complications include fractures, most commonly vertebral, hip, and forearm; disability, deformity, and chronic pain.
- Women who are > the estimated lifetime risk for osteoporotic fracture is 54%.
- Prevalence of vertebral fractures is similar for men and women. Approximately 4% of patients older than 50 years of age who experience a hip fracture will die while in the hospital, and 24% will die within 1 year of experiencing hip fracture.
- Osteoporotic fractures cost an estimated \$13.8 billion, U.S. in 1995.
- Several reasons for the increased risk for broken bones with age including: the loss of bone, the reduced quality of bone and the increased risk of falling associated with age.

## Alzheimer's Disease (AD)

- 4.5 million people are diagnosed in the U.S.
- 15 million to be diagnosed by the year 2050.
- 231,900 number of NH residents with Alzheimer's.
- 15.5% of NH residents with Alzheimer's.
- Direct and indirect costs, approx. \$100 billion in the U.S.
- AD predicted to affect 1 in 85 people globally by 2050.
- In 2006, there were 26.6 million AD sufferers worldwide.
- Dementia costs worldwide have been calculated at \$160 billion.

## Parkinson's

- Combined direct and indirect costs of Parkinson's is estimated to be nearly 25 billion per year in the U.S.
- 1 million people live with Parkinson's disease in the U.S.
- 60,000 are diagnosed with Parkinson's disease each year
- 10 million people worldwide are living with Parkinson's
- 4% people w/ Parkinson's are diagnosed before the age of 50
- Men are 1 ½ times more likely to have Parkinson's than women
- Medication costs averages \$2500 per year

## Stroke (CVA)

- 3rd leading cause of death in the US, only heart disease and cancer killed more people.
- 137,000 people in the U.S. died of stroke in 2006, accounting for nearly 1 in every 17 deaths.
- Someone in the U.S. has a stroke every 40 seconds.
- Every three to four minutes, someone dies of stroke.
- Stroke is a leading cause of serious long-term disability.
- Males have slightly higher age-adjusted stroke rates than females.
- Blacks have a very high stroke mortality rate.
- In 1997 over 1,000,000 patients were discharged from the hospital with a diagnosis of stroke.
- Institutional care is required by 20-30% after discharge
- Approximately \$6,000 per hospitalization that is 6 billion dollars in hospitalization costs alone.
- In 2009, stroke cost the U.S. \$68.9 billion. This total includes the cost of health care services, medications, and missed days of work.

### % of U.S. adults with stroke risk factors

Risk Factor	%
Inactivity	39.5
Obesity	33.9
High Blood Pressure	30.5
Cigarette Smoking	20.8
High Cholesterol	15.6
Diabetes	10.1