Dental Ergonomics 1:

Objectives: the student will:
- Become familiar with the field of Ergonomics
- Learn the common occupational injuries associated with Dentistry
- Define work-related musculoskeletal disorders (WMSDs) and be aware of the scope of the problem
- Identify risk factors and stressful individual behaviors in dentistry which lead to injuries
- Learn how to apply preventive strategies, including good posture and positioning
What is Ergonomics?

- Derived from the Greek...“ergos” meaning work and “nomos” the study of...literally the study of work.
- Ergonomics is the study of work including the tasks, the technology and the environment, in relation to human capabilities.
- In essence, it is fitting the job to the worker instead of vice versa.
- Ergonomics is a way to work smarter—not harder—by designing tools, equipment, work areas and tasks to fit the individual worker.
- Leads to improved productivity, reduced injuries, and greater worker satisfaction.
Ergonomic Design Goals

- Improve job process by eliminating unnecessary tasks, steps & effort
- Reduce potential for overexertion injury
- Minimize mental/physical fatigue potential
- Leverage workers’ skills/knowledge of their jobs to re-design work to increase their satisfaction, comfort, morale and fulfillment
Consequences of Poor Design

- Discomfort → Chronic Pain
- Accidents → Injuries
- Fatigue → Increased Errors
- Work-Related Musculoskeletal Disorders (WMSDs)
  - Low back pain**most common**
  - Tendonitis
  - Epicondylitis
  - Bursitis
  - Carpal tunnel syndrome( CTS)
  - Tumors
OSHA Ergonomics Standard  2004

Program-oriented approach - elements:

Management leadership (Dean, Dept. Chairs)
• Employee participation (Students)
• Hazard identification (Faculty)
• Job hazard analysis and control
• Training (This Course, FSDC sessions)
• Medical management
• Program evaluation

• Applicable to manufacturing and manual handling operations; workplaces where WMSDs are reported, including dental offices
WMSDs in Dentistry
WMSDs: Definition

- Work-Related Musculoskeletal Disorders (WMSDs): disorders of muscles, nerves, ligaments, tendons, joints, cartilage, and/or spinal discs (examples: Carpal Tunnel Syndrome)
  - Gradual chronic development rather than acute episode
  - Work-related
  - Also known as Cumulative Trauma Disorders (CTDs) or Repetitive Motion Injuries (RMIs)
WMSDs in Dentistry

Reasons for Early Retirement Among Dentists

- **Musculoskeletal Disorders (29.5%)**
- Cardiovascular Disease (21.2%)
- Neurotic Symptoms (16.5%)
- Tumors (7.6%)
- Diseases of the Nervous System (6.1%)
- Also—eyestrain and hearing loss (handpiece noise)

Source: Burke et al., 1997
Work Related Musculoskeletal Disorders in Dental Care Providers

- A review of the literature clearly identifies various anatomical sites affected in DCPs including:
  - neck
  - shoulders
  - upper extremities (elbows, hands, wrists and fingers)
  - back
WMSD Symptoms Among Dentists

% Reporting

Body Part

Source: Finsen et al., 1998
What Factors Contribute to WMSDs?

- Repetitive motions (e.g., scaling, polishing)
- Excessive Force (e.g. tooth extraction)
What Factors Contribute to WMSDs?

♦ Static neck, back, and shoulder postures
What Factors Contribute to WMSDs?

- Grasping small instruments for prolonged periods
What Factors Contribute to WMSDs?

♦ Prolonged use of vibrating hand tools
Ergonomics in Dentistry

Magnification Systems

**Goal:** Improve neck posture; Provide clearer vision

Consider:

- Working distance
- Depth of field
- Declination angle
- Convergence angle
- Magnification factor
- Lighting needs
Ergonomics in Dentistry

Operator Chair

Goal: Promote mobility and patient access; accommodate different body sizes

Look for:
- Stability (5 legged base w/casters)
- Adjustable lumbar support
- Seat height adjustment
- Adjustable foot rests
- Adjustable, wrap-around body support or arm supports
- Seamless upholstery
Ergonomics in Dentistry

Patient Chair

Goal: Promote patient comfort; maximize patient access

Look for:
- Stability
- Pivoting or drop-down arm rests (for patient ingress/egress)
- Supplemental wrist/forearm support (for operator)
- Articulating head rests
- Hands-free or preset operation
Ergonomics in Dentistry

**Posture/Positioning**

- **Goal**: Avoid static and/or awkward postures

**Potential Strategies:**

- Position patient back far enough so that their mouth is at the operator’s elbow. Elbows are elevated no more than 30 degrees.

- Adjust patient chair when accessing different quadrants.

- Turn the patient’s head as needed

- Alternate between standing and sitting—frequent rest breaks every 20-30 mins.

- On-site stretching exercises
**Ergonomics in Dentistry**

**Work Practices**

**Goal:** Maintain neutral posture, reduce force requirements

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**Potential Strategies:**

- Ensure instruments are sharpened, well-maintained
- Use automatic handpieces instead of manual instruments where possible
- Use full-arm strokes rather than wrist strokes
Ergonomics in Dentistry

Scheduling

Goal: Provide sufficient recovery time for staff to avoid chronic muscular fatigue

Potential Strategies:

♦ Increase treatment time for more difficult patients
♦ Alternate heavy and light calculus patients within a flexible scheduling system
♦ Vary procedures within the same appointment
♦ Shorten patient’s recall interval
ERGONOMICS 1 SUMMARY

- Good ergonomic design of tools, processes and furniture DOES improve personnel comfort, health, morale, productivity and readiness.
- Students and faculty working as part of a team to improve posture & positioning and maintain good work habits.
- It’s critical to seek prompt medical aid for symptoms of ergonomic stress / WMSDs, CTDs.
Dental and Dental Hygiene
Student Observation

Observational study findings*:

- Students seen reaching for instruments (too far from their seated locations)
- Students frequently bend and twist upper torso
- Students contort their bodies in order to get closer to the treatment site

* these were findings from a study done almost 20 years ago (George et al, 1987)...how true are they today ??
Simulation Lab – Twisting torso
Simulation Lab – Using pincer grip
Simulation Lab – Back not flush against back of chair/stool
Simulation Lab – Twisted torso
Simulation Lab - Static flexed neck position
Simulation Lab – Too close to patient’s face
Simulation Lab - Static flexed neck position
Simulation Lab – Hunched shoulders; static neck position
Simulation Lab – Using pincer grip and vibrating instrument
Simulation Lab – Using pincer grip and gloves may be too large
Simulation Lab – Neck bent; right shoulder raised
Simulation Lab – Hair is in patient’s mouth !!!!
Patient Position

- **Supine**
  - Chair nearly parallel to the floor
  - Heels slightly higher than nose

- **Patient’s Head**
  - Even with end of headrest
  - Mandibular work - chin DOWN
  - Maxillary work - chin UP
  - Change patient’s head position for: good visibility, access to teeth & treatment area
Clinician Position...

- Clinician should have:
  - Back against the seat back
  - Entire backside on seat
  - Feet flat on the floor
  - Thighs parallel with the floor & hips slightly higher than knees
  - Shoulders relaxed & parallel with floor
  - Eyes directed downward
Clinician Position

Clinician should have:

- Eyes directed downward. Neck flexion 10-20° max.
- ~14-16 inches distance between patient’s mouth & clinician’s eyes (use loupes)
- Elbows close to sides
- Patient’s mouth at elbow height
- Shoulders/forearms relaxed & parallel to floor
- Knees spread apart--Hip angle slight greater than 90°. Feet flat on ground.
Neutral Seated Posture
Clock Positions

Instrumentation of the various treatment areas may be accomplished from one of four basic clinician positions. The four basic clinician positions are usually identified in relation to a 12-hour clock face:

1. the 8 o’clock position, to the front of the patient’s head,
2. the 9 o’clock position, to the side of the patient’s head,
3. the 10 to 11 o’clock position, to the back of the patient’s head, or
4. the 12 o’clock position, directly behind the patient’s head.

The four clock positions are described in detail on pages 28 and 29.
Clinician Position (‘clock’)

The 8 o’clock position

The 10 - 11 o’clock position

The 9 o’clock position

The 12 o’clock position
The 8 o’clock Position (Front Position)
The 9 o’clock Position (Side Position)
The 10 o’clock position
The 12 o’clock position

1. Head turned slightly toward the clinician
2. Chin-up position
Visibility: Light position (mandible)

- For the Mandible:
  - Light must not be obstructed by operator’s head or hands
  - Light shines directly above the patient’s head with chin down position
  - Beam is nearly perpendicular to floor, angled 10 degrees down
Visibility: Light position (maxillary)

For the Maxilla:

- Light must not be obstructed by operator’s head or hands.
- Light shines into patient’s mouth at an angle in front of the patient with chin up position.
- Beam is more parallel to floor or 10 degrees upward.
What do you think of this?
Shoulder too high?
How’s this positioning?
Typodont Intimacy?
Good working position?
Practice makes perfect!