Ergonomics in Endodontics: Evidence-based Strategies to Prevent Pain & Extend Your Career

Belgian Endodontic Society
May 25, 2012
Brussels, Belgium

Presented by

Bethany Valachi, PT, MS, CEAS
Physical Therapist/Dental Ergonomic Consultant
Author, “Practice Dentistry Pain-free”

info@posturedontics.com

©2012 Posturedontics® All Rights Reserved

The information provided in this handout or at any consulting seminar regarding the Posturedontics Program is not intended to be a substitute for diagnosis or treatment of specific medical problems. In no event shall Posturedontics, its agents, members, employees or authorized representatives be liable for any injury arising from or related to the use of the Posturedontics Program.
The Problem
- Brief history of dental ergonomics
- Impact of CTDs

Cumulative Trauma Disorder (CTD) Definition
Work-related pain or injury to the musculoskeletal system resulting from microtrauma which accumulates at a rate faster than the body can repair it.

Signs & Symptoms of Cumulative Trauma Disorders (CTDs)
- Decreased strength & Range of motion
- Pain, stiffness, swelling or inflammation
- Numbness or tingling in hands or feet
- Shooting or stabbing pain in arms/legs

Contributing Risk Factors in Dentistry

Microtrauma resulting from Prolonged, Static Postures
1.
2.
3.
4.

Safe Postural Working Range (SPWR)
1) Head posture: 0 – 20 degrees
2) Forward arm reach: 0-25 degrees (≥ 15 degrees requires armrests)
3) Forearms parallel to floor, or angled upward 10 degrees
4) Hip angle 105 – 125 degrees

1A. Traditional Stool Adjustment
1) Adjust backrest height so the convex portion aligns with low back curve
2) Move backrest away from the back
3) Sit all the way back on the seat
4) Place 3 fingerwidths behind the knee. If the closest finger touches the seat, the seatpan is too deep for you.
5) Tilt seat forward 5-10 degrees, or use a saddle-style seat for best hip angle
6) Adjust height till thighs slope slightly downward
7) Adjust backrest forward to snugly nestle in low back curve (opt)
8) Adjust armrest height
1B. Saddle Stool Adjustment

- Adjust seat flat for most users. For users with hyper-lordosis (excessive curvature of the low back), tilt the seat slightly backward. For users with flattened lordosis (no low back curve), tilt the seat slightly forward.
- Adjust the height till the thighs slope downward at a 45 degree angle.
- Adjust armrest height

2. Operator Positioning

- For most procedures, move into the 11-12:00 position. Periodontic procedures may at times require utilizing a different clock position.
- Position delivery system within easy reach elbow height.

3A. Patient Positioning for Microscope users: (maxillary)

- Recline the patient to supine position
- Adjust the double-articulating headrest to angle up into the occiput. The occlusal plane of the upper arch should be about vertical (perpendicular to the floor).
- If using flat headrest, ask the patient to scoot to end of headrest and position with contoured dental cervical pillow so large end is under the neck and chin is elevated.
- Adjust the height of the patient chair so forearms are level or sloping 10 degrees upward.
- Rotate the head slightly (if needed) to view the treatment area.

3B. Patient Positioning for Microscope users: (mandibular)

- Recline the patient to semi-supine position (backrest angled 20 degrees above horizontal)
- Adjust the double-articulating headrest forward so chin tilts downward or position with contoured dental cushion –large end behind the head.
- Occlusal plane of lower arch should be 10 degrees angled forward (toward patient’s feet) from vertical when working on the lower posteriors. For lower anteriors, angled 20-30 degrees forward.
- Adjust the height of the patient chair.
- Rotate the patient’s head slightly (if needed) to view treatment area.

4. Microscope and mirror placement

- Microscope should be angled vertically downward for most procedures. Severely tilting the microscope compromises operator posture.
- In relation to the microscope, the mirror should be angled 45 degrees toward the operator for maxillary arch (easier) or 45 degrees away for mandibular arch.
- Identify finger fulcrums to enable relaxation of hand/arm

5. Assistant Scope Adjustment

LOW BACK PAIN
Primary Risk Factors for Low Back Pain in Dentistry
The impact of the pelvic position on the low back curve

<table>
<thead>
<tr>
<th>Passive sitting</th>
<th>Active sitting</th>
<th>Balanced sitting</th>
</tr>
</thead>
</table>

Strategies to prevent low back pain & maintain the low back curve
1. Hip angle and stool adjustment
2. Saddle-type stools - benefits
3. Move patient to end of headrest
4. Change feet position frequently
5. Operator weight
6. Rheostat position

Operator Pivot Exercise
- Scoot all the way back
- Lift chest up, stretch through abdomen
- Slight curve in low back
- Assume operator position of arms
- Exhale, pull navel to spine
- Slowly, pivot forward from the HIPS. Slowly return.

Periodic Stretches – *Take frequent breaks & stretch*

How to Stretch Safely
- Move into and out of a stretch slowly.
- Breathe in and exhale slowly as you increase the stretch to a point of mild tension or discomfort.
- Hold stretch for 2-4 breathing cycles.
- Try stretch toward both sides to determine tightest side. Stretch toward the tightest side during the workday. Perform stretches in both directions at home and on weekends.
- Do NOT stretch in a painful range. Discontinue stretching if pain increases following stretching.

Delivery Systems
- Rear Delivery
- Side Delivery
- Over-the-patient (aka trans-thoracic) Delivery - not recommended for microscope users when positioned over patient’s chest. Compromises operator posture by reaching around the microscope.

Patient Chair Features
- Small, thin headrest
- Narrow upper back
- Swivel feature
- Base location/size
- Adjust up/down
- Low-profile armrest

©2012 Posturedontics®, LLC · Portland, OR 97225 · 503.291.5121 · www.posturedontics.com · 3
Traditional Operator Stool Features
Cylinder height (short, med or tall)
Adjustable backrest – should not extend above the lower edge of shoulder blade. 8-10 “ high backrest is very adequate to provide lumbar support.
Textured seat material – place a square of rubber shelving material on seat if worn smooth
Tilting seat pan – tilted from 5-15 degrees forward
Lumbar support – should be contoured to fit the shape of the low back
Armrests (recommended for microscope users)

Passive/Active Stool Features (BQ Ergonomics)
Places pelvis in the most neutral position to optimize posture
Adjustable-resistance to correct posture in passive sitting and facilitate active sitting.
Improved circulation in legs
Allows closest positioning to the patient
Available with armrests

POSITIONING WITH THE DENTAL NURSE
Proper Assisting Posture
• Thighs angled toward head of patient, or (better) interlocking knees with doctor
• Asst. tray should extend over assistant’s lap. If located behind asst, they should stand or face patient with tilting seat pan.
• Assistant should consider standing for up to half of treatment time, if possible

TENSION NECK SYNDROME
Symptoms include pain and tenderness in the neck and trapezius muscles, between the shoulder blades, and often accompanied by painful muscle spasms or trigger points.

Risk Factors for Neck Pain in Dentistry

Strategies to prevent Neck Pain
• Magnification
• Target muscle imbalances with specific neck and shoulder girdle endurance exercises
• Armrests
  - Telescoping (2D) armrests received best reviews by general dentists
  - Other styles include floating (3D), adjustable fixed, moveable elbowrests and swivel armrests
MAGNIFICATION SYSTEMS

- Through-the-lens (TTL) loupes (pantoscopic tilt frame)

- Flip-up loupes (vertical slide adjustment)

Ergonomic criteria for selecting loupes
1) Working Distance
   Distance from eye to working surface.

2) Declination Angle
   The angle at which the scope is inclined downward toward the work area.

3) Frame Size
   Affects where scope is placed in relation to pupil.

- Microscopes

  Selection Criteria
  - Angle-adjusted (inclinable or tiltable) binoculars (these compensate for vertical movement of microscope, moving from anterior to posterior of mouth)
  - Objective lens. Range from 200--300 mm. This should be custom-fit to the operator. Individuals with longer torsos or over 6’ tall may require a longer working distance. Longer objective lens also creates more space to pass instruments, handpieces, etc…
  - 5-step (‘stair’) changer – to easily move from larger working field to very fine detail.

Ergonomic Modifications to Microscopes
1) Ergonomic vertical extenders: Longer objective lens, vertical spacers, flat binocular extender

2) Ergonomic horizontal extenders: The greatest ergonomic problem among microscope users. Not many manufacturers’ microscopes have sufficient horizontal length without retrofitting with an extender. Forward head postures are a common result of poor horizontal extension on a microscope.

3) Add a co-observation tube for the assistant to follow procedures.

- Procedure Scope
Attaining Optimal Head Posture with Loupes
1. With loupes on and head erect, focus on an object straight in front of you.
2. Without tilting the head, roll the eyeballs downward to look through the loupes.
3. Bring the chin in and rotate downward just until the oral cavity comes into view.

Headmounted Lighting
Best way to prevent shadowing. Ultra-lightweight models now on the market, .4 grams.

SHOULDER DISORDERS
- **Rotator Cuff Impingement**
  Symptoms include pain with overhead reaching, lifting, dressing or sleeping on the affected arm.

Risk factors for Rotator Cuff Impingement

- **Trapezius Myalgia**
  Symptoms include pain, spasms, tenderness or trigger points in the upper trapezius muscles, frequently on the side of the operator’s mirror or retracting hand.

Risk factors for Trapezius Myalgia

Postural awareness for shoulder pain
Neutral shoulder posture: Arms relaxed, elbows close to body and at the occlusal plane.

Strategies to prevent shoulder pain

CARPAL TUNNEL SYNDROME
Symptoms include pain, numbness, weakness and/or tingling into the hands and first 3 ½ fingers.

Risk Factors for CTS
Postural Awareness for CTS
- Maintain neutral wrist position.
- Avoid excessive flexion combined with ulnar deviation of wrists.

Prevention Strategies for CTS
- Reposition handpiece in hand
- Extractions: Physics Forceps
- Instrument handle size
- Alternate handgrips. Consider non-dominant hand usage.
- Fitted gloves
- Hose drag
- Stretching most effective intervention!!

Syndromes/conditions that mimic carpal tunnel syndrome
- Thoracic outlet syndrome
- Cervical radiculopathy
- Trigger points
- Poorly fitted gloves

OA of the CMC Thumb Joint
  Symptoms: Pain at the base of the thumb

Lateral Epicondylitis
  Symptoms: Pain on the lateral side of the elbow

FITNESS OUTSIDE THE OPERATORY

AEROBIC EXERCISE
- Rhythmic movement delivers oxygen and nutrients to muscles
- Improves circulation
- Improves healing & recovery time for muscles
- Controls weight & reduces stress

Considerations for selecting an aerobic activity
- Symmetrical movement.
- Walking, cross-country skiing, Nordic Track, elliptical, running, rowing. (Pick one you enjoy)
- Perform 3-5X week for minimum of 30 minutes.
- Know your target heart rate.
TARGET HEART RATE (THR)
Karvonen Method
- Calculate your RHR (Resting heart rate). Take this in the morning and average 3 mornings. (Ex: RHR is 63 bpm)
- Find your HRmax (Maximum Heart Rate)
  220 – your age (40)= 180
- Calculate HRreserve (Heart rate reserve)
  Subtract RHR from HRmax: 180-63=117
- Calculate upper and lower limit of Target Heart Rate:
  For High intensity Exercise, Target Heart rate will be 80% of HRreserve + RHR
  \[(117 \times 0.8) + 63 = 157\]
  For Low intensity Exercise Target Heart rate will be 60% of HRreserve + RHR

Most accurate THR considers Body Mass Index – see Certified Athletic Trainer or local university for testing
Always check with your doctor before beginning any exercise program

MUSCULAR TRAINING- POWER VS. ENDURANCE
Endurance training
- Good for targeting the postural muscles.
- Essential for preventing injuries and for maintaining optimal postures in prolonged, static postures.
- Focuses on high repetitions and low weight.

Power training
- Tends to target the more superficial mover muscles which are designed for power.
- Training focuses more on low repetitions and high weight.

MUSCULAR ENDURANCE TRAINING:
- Postural stabilization muscles
  Transverse & oblique abdominals, quadratus lumborum, erector spinae and multifidus
- Scapular stabilizing musculature
  Middle & lower trapezius, serratus anterior
- Specific rotator cuff muscles
  Infraspinatus, subscapularis, teres minor

Strengthening Guidelines
- Never perform strengthening exercises if you have pain.
- Strengthening should be done 3 times weekly. (Stretches can be performed daily)
- Always start out mildly and increase gradually.
- Exercise should not cause pain. Mild discomfort that lingers after you have stopped exercising is normal, but if you experience pain, stop the exercise.
- Pilates and/or Swiss ball – excellent for core strengthening, however generic Pilates programs should be modified for dental professionals.
- Avoid overstrengthening specific muscles that can worsen pain.
GOLF

Risk Factor #1: Improper Set-up Posture
- Pivot from the hips
- Avoid flexing spine forward
- Stretch hamstrings
- Strengthen abdominal stabilizing muscles

Risk Factor #2: Poor Trunk Rotation
- Develop good flexibility with trunk rotation, especially toward the backswing side

CYCLING

Adjustments to the bike
- Raise handlebars
- Move seat forward
- Seat level or tilted slightly downward

Important Bicycling exercises
- Chin Nods
- The Reversal

POSTURAL AWARENESS EXERCISE
- Find neutral pelvis
- Pull navel back toward your spine
- Stretch head toward ceiling
- Lift chest upward, stretching through abdomen
- Pull shoulder blades back to neutral
- Point thumbs outward, like a hitchhiker
- Relax palms at sides, without moving shoulders

Stabilize the trunk with firm abdominal contractions throughout the day.

SLEEPING POSTURES

DRIVING POSTURES
ACUTE PAIN
- Pain at rest – usually severe “7-8” range
- Swelling or heat in the area
- Sudden onset, usually lasts 3-5 days
- Restricted movement
- Early treatment EXTREMELY important during this phase

“SCRIPT”
S
C
R
I
P
T

RED FLAG SYMPTOMS
When pain may NOT be musculoskeletal in origin. Call your doctor immediately!
- If your symptoms increase with rest and during the night.
- If you cannot reproduce the pain with body movement or positioning.
- If the symptoms cover a large, non-specific area and are hard to pin-point.
- If symptoms migrate from one joint to another.
- If you have a history of serious illness, especially cancer, or if you experience sudden weight loss or fever.
- Numbness and/or muscle weakness that does not subside.
- Dizziness, nausea, blurred vision, severe headache, loss of balance, or fever.

CHRONIC PAIN
- Most common type among dental professionals
- Moderate pain “3-6” on pain scale
- Pain usually localized, and felt “on & off”
- Often the result of years of awkward, repetitive posturing
- Takes longer to recover from, requires change of habits

Treatment for Chronic Pain
1.
2.
3.
4.
5.
6.

TRIGGER POINTS
Characteristics
Trigger Point Self-Therapy
Use a tennis ball or smaller hard rubber ball against a wall, or a Backnobber device.
• Find the trigger point
• Apply deep pressure for 5 slow counts, then massage slowly across the point for 5 counts
• Alternate between deep pressure and slow massage for one minute per trigger point
• Aim at a pain level that “Hurts so good” (about 4-5 on a scale of 1-10)
• Perform a 30-60 second stretch to the affected area.
• Repeat 3-5 times/day if possible
• Too much pressure can irritate and worsen trigger point pain

Problematic trigger points among dentists & specialists
• Upper trapezius
• Levator scapulae
• Suboccipitals
• Scalenes

STRESS
Risk Factors
• Time management
• Anxious/uncooperative patients
• Malfunctioning equipment
• Technical perfection
• Team member controls
• Heavy workload

Stress Management
• Breathing Strategies
• Progressive relaxation
• Visualization
• Autogenics

QUICK TENSION-BUSTER EXERCISE
☐ Breathe in as you tense fists, bring shoulders up to ears, arch back and extend backward
☐ Exhale, placing one hand on the abdomen, and take deep abdominal breaths through your nose. Close your eyes and release tension in the shoulders, neck, arms and back.
☐ Imagine yourself covered in warm sand
☐ Continue abdominal breathing and say the word “warm” (inhale) and “heavy” (exhale)
REFERENCES


Langford M. Poor posture subjects a worker’s body to muscle imbalance, nerve compression. *Occupational Health & Safety* 1994; September:38-42


RESOURCES

Articles

Books
Valachi, B. “Practice Dentistry Pain-free: Evidence-based Strategies to Prevent Pain and Extend your Career.” Available at www.posturedontics.com
Shamus E, Shamus J. Sports Injury Prevention & Rehabilitation.
Damany S, Bellis J. It’s Not Carpal Tunnel Syndrome!

DVDs /Continuing Dental Education at www.posturedontics.com
Valachi, B. “Smart Moves in the Operatory: Chairsde Stretching” DVD kit with laminated stretching wall charts.
Valachi, B. “Smart Moves for Dental Professionals on the Ball” DVD kit with elastic exercise bands/door anchor and ball.
Valachi, B. “Neck, Back & Beyond: Preventing Pain for Peak Productivity” lecture DVD. 2 ½ hour lecture with over 100 slides interspersed throughout.

Ergonomic Microscope
Zeiss OPMI ProErgo – Excellent horizontal working distance. Quick push-button autofocus and motorized zoom enables continuous magnification that smoothly glides in/out.
Zeiss OPMI Pico – Horizontal working distance is quite short, and will usually require retrofitting with
Zeiss Angled Optics and Tube Dovetail.
Zeiss Stereo Co-observation tube – Enables the dental nurse to follow procedures.

Operator Positioning
BQ Ergonomics – Ergonomic dental stools - www.bqergonomics.eu/nl/
ErgoRest articulating arm support. Multiple vendors online
Ergonomic wedge seat cushion: www.posturedontics.com

Patient Positioning Aids
Crescent Dental Products: www.crescentproducts.com (neck, lumbar, knee cushions)

Hot/Cold Packs
MediBeads Moist Heat Wraps www.painreliever.com
Icy Hot Heat Therapy (disposable) www.icyhot.com
Apollo Paks (hot or cold) www.painreliever.com

©2012 Posturedontics®, LLC · Portland, OR 97225 · 503.291.5121 · www.posturedontics.com 14
Trigger Point Tools
Backnobber self-massage tool www.posturedontics.com
Davies, C. *The Trigger Point Therapy Workbook*. www.posturedontics.com

Ergonomic Product Reviews
Unbiased reviews of operator stools, loupes, patient chairs, etc… at www.posturedontics.com

About the Speaker

Bethany Valachi, PT, MS, CEAS is a physical therapist, dental ergonomic consultant and author of the book, “*Practice Dentistry Pain-Free: Evidence-based Strategies to Prevent Pain and Extend your Career*”. She is president of Posturedontics®, a company that provides research-based dental ergonomic education and evaluates dental products. As clinical instructor of ergonomics at OHSU School of Dentistry in Portland, Oregon., she has provided expertise on dental ergonomics to faculty and students at numerous dental universities and hygiene schools, including faculty training at NYU College of Dentistry. As a certified ergonomic assessment specialist, she also consults with practicing dental professionals to improve ergonomics, work more comfortably and extend their careers with preventive strategies both in and outside the operatory.

A member of the National Speaker’s Association, Bethany lectures internationally, and was invited to speak at the 2009 *International Dental Ergonomics Congress* in Krakow, Poland. She is widely published in the *Journal of the American Dental Association (JADA)*, *Australian Dental Practice, Contemporary Oral Hygiene* and numerous other peer-reviewed dental journals. Bethany is author of the ADAA Ergonomic Home Study Course and has produced chairside stretching and home exercise videos specifically for dental professionals. She lives in Portland, Oregon with her husband, Dr. Keith Valachi, who operates a private dental practice in St. Helens, Oregon.

She welcomes visitors to her website at www.posturedontics.com, where she offers Continuing Dental Ergonomic Education courses, videos, dental ergonomic product reviews, free newsletters and articles.
Sample Chairside Stretches
from “Smart Moves in the Operatory: Chairside Stretching” DVD
All 20 Chairside Stretches available at www.posturedontics.com

The Reversal
Support wrists on hips and slowly lean backward. Do not over-extend the head. Hold 2-4 breath cycles.

The Un-Twister
Legs in tripod position, bend to your left side, resting left elbow on left knee. Stretch right arm overhead and look toward ceiling. Hold 2-4 breath cycles.

Chin Nod
Strengthens postural neck muscles. Lift chest upward, shoulders back. Nod the head, dipping the chin slightly downward. Hold 1 slow

Scalene Stretch
Anchor right hand behind your back or chair. Slowly bring left ear toward left shoulder. Hold 2-4 breath cycles.

Trapezius Stretch
Anchor right hand behind your back or chair. Slowly bring left ear toward left armpit. Hold 2-4 breath cycles.

Overhead Stretch
Sit tall, clasp hands over head. Bend trunk to one side. Hold for 2-4 breath cycles.

Thoracic Stretch
Clasp fingers together behind occiput and slowly extend the upper back. Press the elbows outward to stretch the chest. Hold 2-4 breath cycles.

Wrist Extensor Stretch
With straight elbow, point fingers downward and gently pull fingers and hand toward the body. Hold 2-4 breath cycles.

Carpal Tunnel Stretch
Turn the palm upward and hold the palm as you slowly extend the elbow until straight. Hold 2-4 breath cycles.

© 2009 Posturedontics® Do not duplicate without written permission www.posturedontics.com
SAMPLE EXERCISES for Dental Professionals*
(from the DVD, "Smart Moves for Dental Professionals on the Ball"
All 20 exercises available at www.posturedontics.com.)

Doorway Stretch
With elbows at shoulder height, lean into a doorway, stretching chest musculature. Hold stretch 20 seconds. Repeat.

Swiss Ball Reversal
Slowly extend backward over ball. Extend arms to sides or overhead, as comfortable. Hold 15-30 seconds.

Reverse Pull-downs
With tubing attached in doorway above shoulder height, squeeze shoulder blades downward and together, bringing hands back to shoulders. Repeat 15-20 times.

Shoulder External Rotation
Grasp tubing in both hands. Keeping elbows tightly pressed against sides, rotate arms outward. Slowly return to beginning position. Repeat 15-20 times.

Piriformis Stretch
Lying on back, rest left leg on ball as shown. Cross right ankle over left knee as shown and roll ball toward buttocks. A stretch should be felt in the mid-buttock on the right. Hold 20 seconds. Repeat for other side.

**Always consult your physician before beginning a new exercise program. See precautions in handout.**