Practice in Motion: Part I

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Disclaimer: Participants must always be aware of the hazards of using limited knowledge in integrating new techniques or procedures into their practice. Only sound evidence-based dentistry should be used in patient therapy.

Introduction

This continuing education course is designed to educate dental professionals about efficient sitting positions and movements that assist with minimizing occupational pain and/or injury. As part of this course, we will examine why many practitioners need to change how they sit, discuss common postures/habits that contribute to lifelong pain and the consequences of not changing.

Please note this is Part I of a two-part series. *Practice in Motion: Part II - 6 Components of Posture* will discuss the 6 components of posture and how to recognize structurally stable positions when providing care.

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Conflict of Interest Disclosure Statement

- Jacquelyn Dylla reports no conflicts of interest associated with this course.
- Jane Forrest has done consulting work for P&G.

Course Contents

Overview

Dental professionals are exposed to several occupational risk factors that can lead to musculoskeletal disorders (MSDs). Biomechanical and physiological changes due to prolonged static postures, such as sitting, can lead to MSDs resulting in reduced work time or a career ending disability. Although literature of 60 years continues to cite this occupational problem through 2010, the scientific knowledge in biomechanics, kinesiology and occupational health has not been adequately translated into dental or dental hygiene practice. Suggestions to "find a neutral sitting position," "maintain a neutral posture," "keep the back straight" or "keeping the head fairly straight," may be ambiguous and attempts to assume such positions may result in further discomfort or injury.

This course is designed to educate dental professionals about efficient sitting positions and movements that assist with minimizing occupational pain and/or injury. As part of this course, we will examine why many practitioners need to change how they sit, discuss common postures/habits that contribute to lifelong pain and the consequences of not changing. A review of the anatomy and the various pathologies associated with static positioning and poor posture will be presented. Proper alignment for postural control will be reviewed through video clip demonstrations, as will a sampling of stretches and strengthening routines that target various body regions. Many of these can be incorporated into daily practice routines during frequent short breaks to minimize stress to pain sensitive tissues.

Learning Objectives

Upon completion of this course, the dental professional should be able to:

- Discuss the national scope and severity of musculoskeletal pain and disorders (MSDs).
- Identify risk factors that contribute to MSDs.
- Discuss the effects that prolonged static positioning can have on the spine and surrounding soft tissues.
- Explain and demonstrate structurally stable sitting positions and movement strategies to minimize injury and improve postural control.

Introduction: National Scope and Severity of MSDs

Musculoskeletal disorders (MSDs) are often chronic, painful and disfiguring. While rarely fatal, MSDs affect the quality of life by preventing individuals from enjoying a healthy and active lifestyle. In addition to personal consequences, these diseases represent an economic loss and social burden for society.

Low back pain (LBP) is currently the most prevalent and costly orthopedic problem in society. In fact, it's predicted that 80% of adults will experience LBP in their lives[1] and 34% who experience LBP will have recurrent episodes.[2] While the financial cost of treating low back pain looms in the billions, the cost of declining attendance on productivity in the work-place should not be overlooked either. For example, Americans spend at least $50 billion each year on LBP.

Likewise, LBP is the most common cause of job related disability and the leading contributor to missed work.[3,4] Considering these astounding statistics, we must ask if this topic garners

interest from any prominent organization positioned to assist with investigating this wide reaching and costly problem. The answer is yes.

The National Institute on Occupational Safety and Health, NIOSH, is part of the Centers for Disease Control and Prevention (CDC) and is the federal research agency established to help assure safe and healthful working conditions. The NIOSH research agenda (NORA) recognizes the extent of MSDs as a societal problem, and identifies the need for research on factors such as posture, movement, and force within the context of temporal factors (duration and frequency).[5] Furthermore, prevention of back and other musculoskeletal injuries in the health care sector are recognized as important priority areas, with one of its specific strategic goals targeted at reducing back and shoulder disorders due to patient handling and/or working in awkward postures.[6]

Capturing data unique to any of the dental professions poses a challenge. First, NORA does not specifically reflect data on the majority of the dental workforce, since national statistics on the self-employed, which includes most dentists, are not gathered by the Bureau of Labor Statistics (BLS) of the U.S. Department of Labor.[7] However, injuries or illness reported for private and service-providing industries include *worker motion or position*, injuries involving *the shoulder*, and injuries from *repetitive motion*.[8] These injuries or illnesses parallel findings from the dental literature. Second, the professional organizations are equally remiss in not collecting data. Both the American Dental Association (ADA) and American Dental Hygiene Association (ADHA) do not collect specific data on MSDs experienced by dentists or dental hygienists. Consequently, there is limited knowledge on the full scope of the problem since current national data are not available on the majority of the dental workforce. What is known has been gathered from multiple small studies conducted among different populations, involving a focus on different body sites and using a variety of survey instruments. Yet, given these limitations, there is consistency in identifying several occupational risk factors that can lead to MSDs in dental professionals. These include the prevalence of MSDs and their distribution among the different body areas, and by the type of practitioner who sustains the injury.[9] For example, approximately 60% of both dentists and dental hygienists report lower back pain;[10,11] whereas, there is a greater difference reported by these two groups related to hand/wrist pain with a prevalence as great as 69% for dental hygienists and only 54% for dentists.[11,12]

The statistics clearly support the multifarious costs and prevalence of MSDs in and outside the dental profession. However, the solutions to these problems must be linked to our understanding of anatomy, the movement-related sciences, and risk factors that contribute to MSDs. The next section will provide a review of the risk factors and their associated impact on the musculoskeletal and nervous systems.

Risk Factors that Contribute to MSDs

The dental professional is exposed to a multitude of risk factors that can contribute to MSDs. The primary factors include: repetition, force, mechanical stresses, posture, vibration, cold temperature and extrinsic stress. Of these, posture is one of the most frequently cited risk factors in dentistry.[13-15]

Postural stress occurs with strained sitting positions, such as those associated with bending/slouching, head tilting, torso twisting, tipping shoulders, and raising elbows outside the normal range of motion.[14] These risk factors may work alone or in concert with one another to compound the problem and/or further expose one's own vulnerability earlier than later. The obvious risk factors include sitting, compounded by prolonged sitting, and awkward positioning. The following briefly captures what researchers have found concerning these risk factors.

Sitting

While there is a very low level of muscle activity during sitting as compared to dynamic activities, there is a 35-40% increase in intra-discal pressure as compared to standing[16] making pain an inevitable experience for those who engage in prolonged static sitting.

Prolonged Sitting

The inactivity associated with sitting may cause fatigue as well as injury. Inactivity can cause a build up of metabolites that can contribute to

disc degeneration and disc herniation in both the cervical and lumbar spines. Additionally, in sitting, the lack of motion statically loads muscle, ligament, and joint tissue (passive tissue forces), which can accelerate disc degeneration and increase the risk of herniation.[17]

Awkward Positioning
Cervical flexion during prolonged positioning can cause an increase in disc pressure and an increase in muscular tension. Correspondingly, there is an increase in tension on the spinal cord, brain stem, and the nerve roots.[18] Keep in mind that the position of the thoracic spine drives the position of the head. If the thoracic spine is more flexed, the result is an increase in lower cervical flexion potentially causing both pain and pathology.[19]

Additionally, in the slouched position, there is backward rotation of the pelvis causing flexion of the spine with resultant widening of the lumbar intervertebral discs and strain on the lumbar ligaments.[20] Other less obvious risk factors dental professionals may encounter that can lead to MSDs include:

a. Fatigue
b. Altered Spinal Curves (even when not in awkward positions)
c. Lack of upper extremity support (intrinsic or extrinsic)
d. Poor level of fitness (flexibility, strength and endurance)
e. Lack of adjustable equipment
f. Poor lighting/vision
g. Environmental stress: The stress of the dental environment also plays a role in triggering physical abnormalities that contribute to pain. Marras et al demonstrated that increased environmental stress while sitting actually caused an increase in compression and shear in the lumbar spine[21] with pain as on obvious outcome.

Be reasonably *au fait* with these risk factors. Familiarity and understanding are the first steps in reducing the risks of MSDs. The remainder of this course directs the reader to understand their body's apposite anatomy and potentials for pathology, and suggests positions and movements to minimize the impact of MSDs. Recommendations of fitness activities for maintaining the health specifically related to dental professionals is covered in *Practice in Motion: Part II - 6 Components of Posture*.

Review of Pertinent Anatomy and Pathology

In order to understand what is happening in your body, the following text and media will provide essential principles of pertinent anatomy and associated pathologies of the spine, describe anatomically descript sitting positions, introduce the 6 components of a structurally stable sitting posture with suggested movement strategies, present stretching and mobilization techniques essential for dental professionals, and finally prescribe exercises that target the primary muscles supporting the foundation of a structurally stable sitting posture and a healthy spine.

First: The Spinal Column

A normal structurally stable spine sports 3 natural curves: the cervical lordosis, the thoracic kyphosis, and the lumbar lordosis (Figure 1). Each curve measures approximately 30-40 degrees. These curves provide the spine with structural stability making the strong vertebral bodies the weight bearing structures

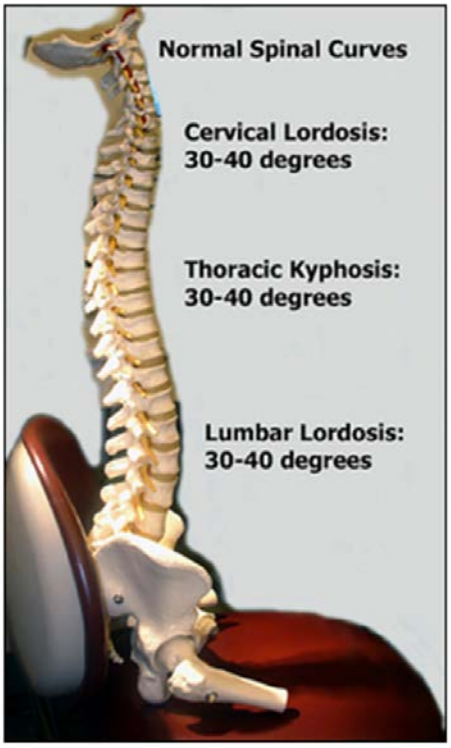


Figure 1. Normal Spinal Curves.

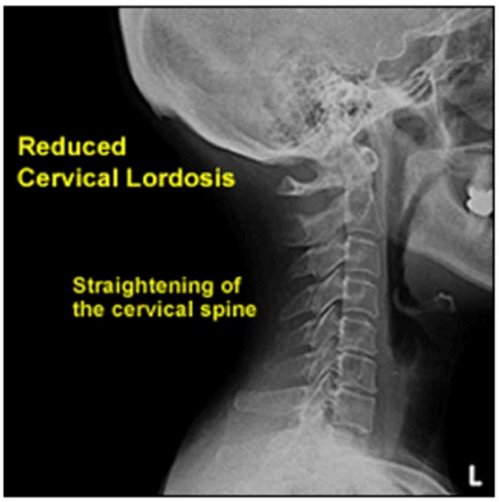


Figure 2. Reduced Cervical Lordosis.

of the spine. Without these curves, or a spine with significantly less or more curve, pain-sensitive tissues become the weight-bearing structures and over time lead to pain and possible pathology (Figure 2).

Additionally, the spinal column contains many parts and spaces. First, let's look at what composes a spinal segment. A spinal segment is made up of 2 vertebral bodies with an intervertebral disc in between (Figure 3). The disc provides shock absorption, nutrition to the vertebral endplates, and occupies a space between the 2 vertebrae that maintain the patency of the intervertebral foramen (Figure 4).

The patency of the foramen is crucial as the nerve root exits the spinal cord and comes out the intervertebral foramen. Any compromise or stenosis of this foramen may cause sensory and/or motor impairments in the target tissues supplied by the peripheral nerve (Figure 5). Later we will discuss further the common pathologies associated with dysfunctional or degenerative spinal segments. A facet joint is made from 2 facets, one facet from the superior vertebrae and the second from the inferior vertebrae. These two facets articulate together to form the joint (Figure 6).

This joint is what is commonly referred to with the term degenerative joint disease. Finally, the spinal canal is the space occupied by the spinal cord. The nerve roots branch off the spinal

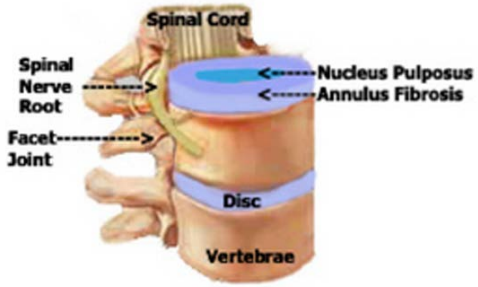


Figure 3. Spinal Segment.

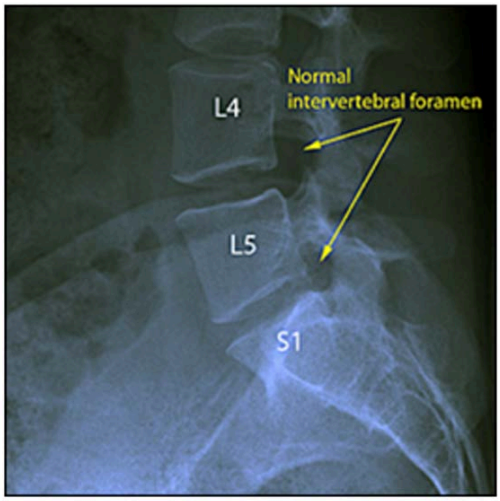


Figure 4. Intervertebral Foramen.

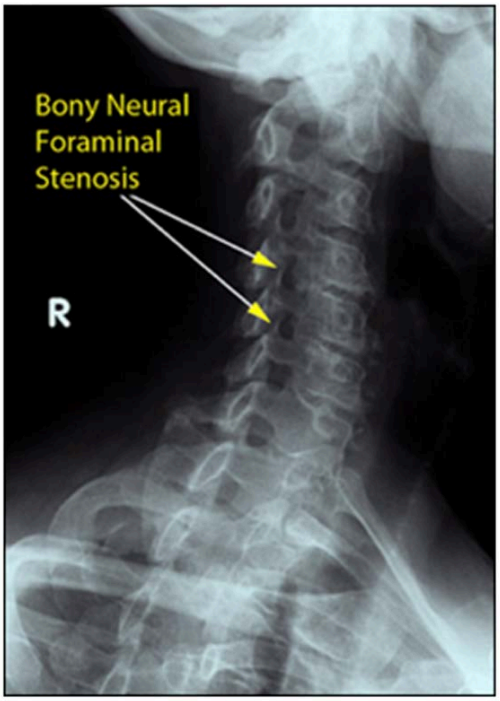


Figure 5. Stenosis.

Figure 6. Facet Joint.

cord and exit out to the periphery through the intervertebral foramen.

Second: The Intervertebral Discs

Normal discs (Figure 7) serve as shock absorbers for the spine, occupy space between vertebrae (intervertebral disc space) (Figure 8) that keep the holes (intervertebral foramen) (Figure 4) where the nerve roots exit open, and provide nutrition to the vertebral body above and the vertebral body below it. So all efforts should be aimed at preserving this shock absorber. Disc degeneration can result from many factors. A few of these include prolonged altered spinal curves/posture, trauma, age, genetics, and pathologies that can progress due to repetitive and improper body mechanics during common activities that include sitting, lifting, and bending with rotation. These motions are commonly repeated during normal activities that may be conducted at work or home.

Pathological consequences emerge from prolonged repetitive positioning in biomechanically unsound positions. We will now pictorially review a few of those degenerative conditions (Figure 9) that typically can be seen at various stages of a dental professionals career.

In our 20s, 30s, and 40s, the disc's water content is the highest producing a normal disc signal on a magnetic resonance image (MRI) (Figure 7). This high water content also increases our vulnerability for a disc injury. During this stage of life, the development of disc pathology can be seen to include disc bulges, disc herniations and disc extrusions. These generally develop from excessive prolonged lumbar flexion. Now let's look at the progression that can occur with disc lesions. In the early stages of disc injury, the outer wall of the disc bulges various amounts

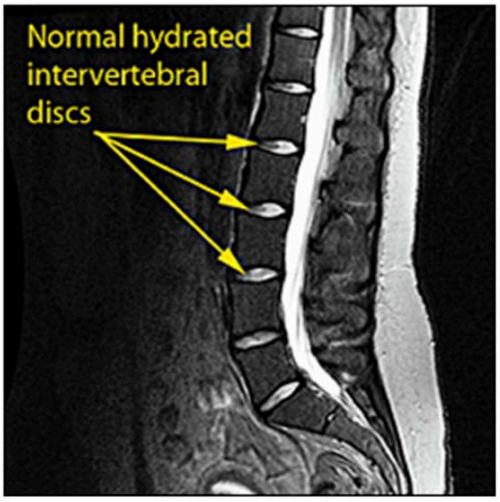


Figure 7. Normal Discs.

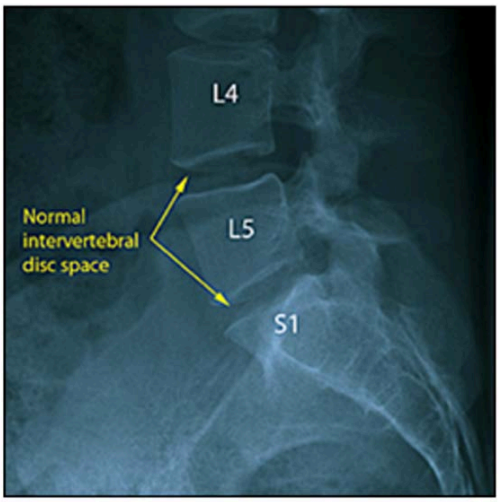


Figure 8. Intervertebral Disc Space.

possibly putting pressure on a nearby nerve root (Figure 10).

A more severe form of a disc bulge is a disc herniation (Figure 11) followed by a disc extrusion (Figure 12). The outer layer of the disc actually fractures allowing the gelatinous content of the disc to extrude outside of the disc. This nuclear material then sits outside the disc, possibly on the nerve root itself, and can block part of the foramen where the nerve root exits.

Into our 50s and beyond the disc will lose water content causing the disc height to shrink. This loss of water from the disc, otherwise known as disc desiccation (Figure 13), causes

Figure 9. Degenerative Conditions.

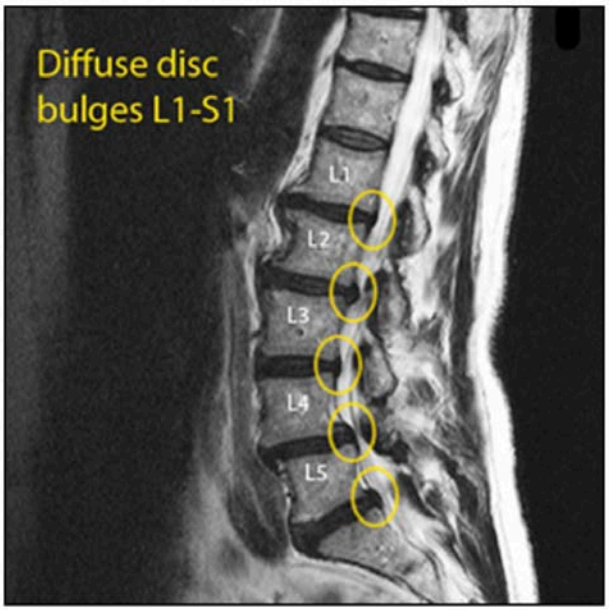


Figure 10. Diffuse Disc Bulges.

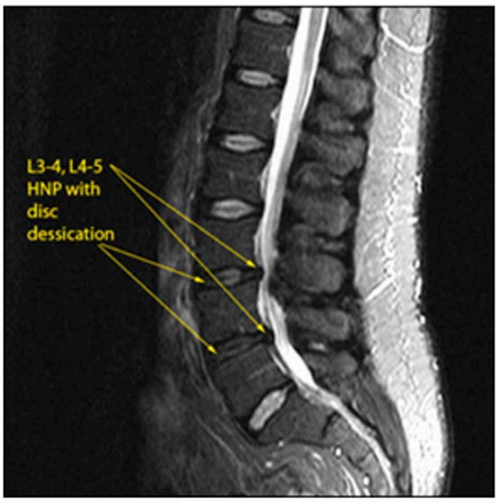


Figure 11. Disc Herniation.

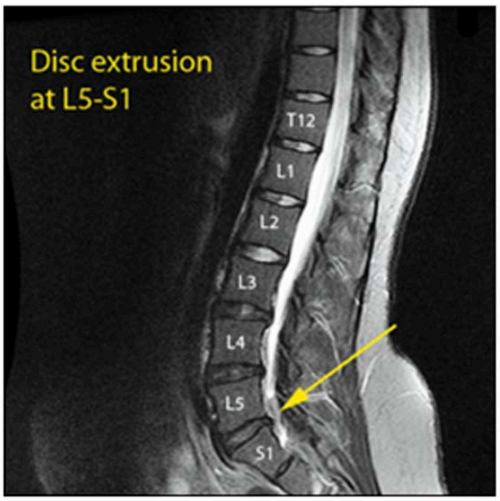


Figure 12. Disc Extrusion.

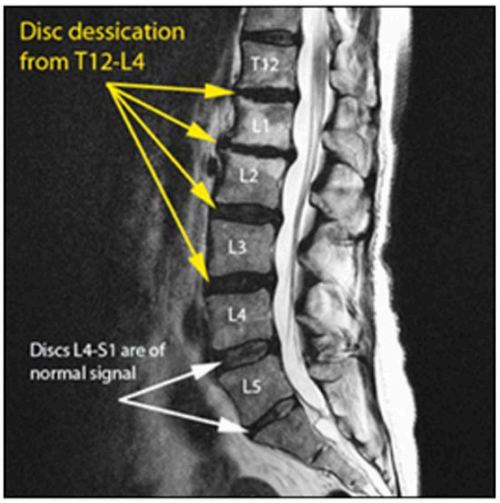


Figure 13. Disc Desiccation.

the disc to become thin. This thin disc no longer provides adequate shock absorption causing more friction and shearing, creating degenerative changes in the vertebral bodies above and below it with the formation of osteophytes. This can be called osteophytosis (Figure 14).

This growth of bone additionally limits the joints in the spine from moving thus further contributing to arthritis. Now, review pictorially the degenerative disc disease progression and the associated pathologies that may result from thin or thinning discs: degenerative joint disease (Figure 15), degenerative disc disease (Figure 16), stenosis of the intervertebral foramen (Figure 5), and osteophyte formation (Figure 14) on the vertebral bodies or in the intervertebral foramen.

Third: The Lumbar Stabilizing Muscles

Besides the bony support offered by the skeletal system, the muscular system plays an essential role in support of the spine during both static and dynamic postures. Awareness of the principal muscles to target when training for postural support and injury prevention is key. The crucial two categories of lumbar stabilizing muscles include the primary and secondary stabilizers.

The ***primary stabilizers*** of the lumbar spine from posterior to anterior are the multifidi (MF) (Figure 17) and the transverse abdominis (TA) (Figure 18) respectively.

The MF and the TA work together providing stabilization to the spine. When the TA fires, the MF fires. The multifidi connect 1-3 vertebral bodies and function to control motion between the vertebrae such as anterior-posterior gliding of the vertebral bodies. Anteriorly, the TA wraps around the trunk and attaches to the spine via the lateral raphe or lumbar dorsal fascia. When contracted, it increases the intra-abdominal pressure causing the spine to become a more rigid structure resistant to damaging forces such as flexion, rotation, or shearing. Think of a fire hose without water running through it. The hose is supple without rigidity representing the spinal column without activation of the transverse abdominis. Now, run water through the fire hose and it becomes a rigid structure

Figure 14. Osteophytosis.

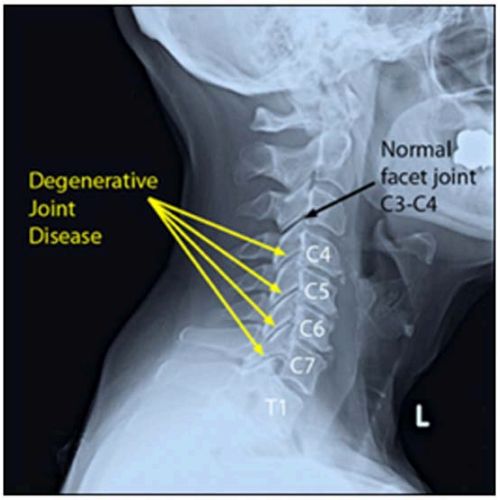


Figure 15. Degenerative Joint Disease.

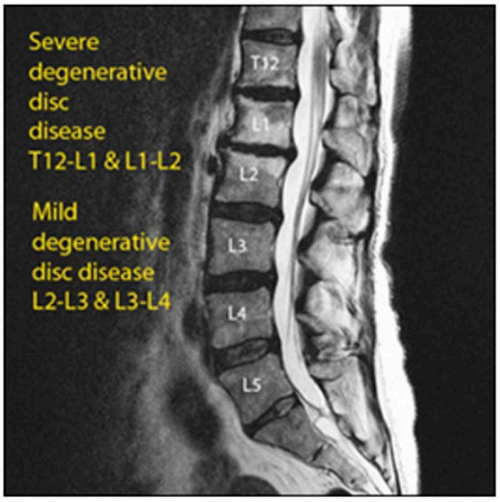


Figure 16. Degenerative Disc Disease.

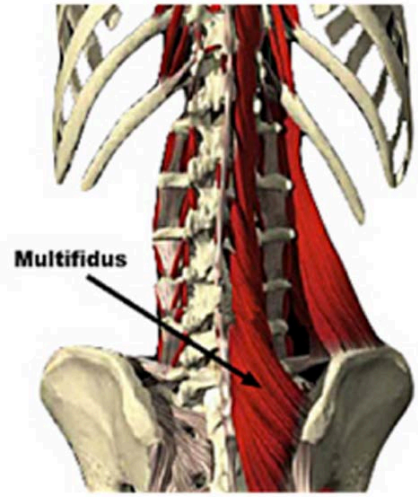


Figure 17. Multifidi (MF).

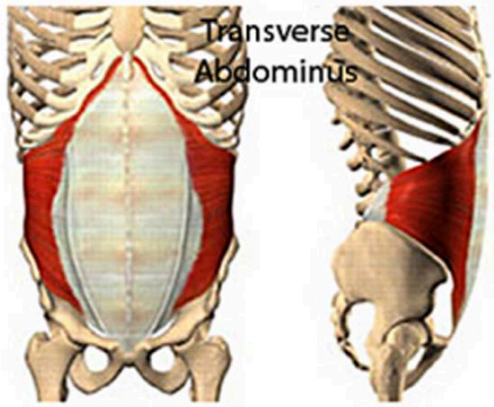


Figure 18. Transverse Abdominis (TA).

impervious to bending or twisting forces. The act of turning on the water is similar to activating the TA muscle resulting in an increase in water pressure within the hose and an increase in intra-abdominal pressure surrounding the spinal column making it also a rigid structure capable of resisting damaging forces. The combination of these two muscles form a protective corset within the body to protect the spine and hence the name, the ***primary stabilizers***.

The ***secondary stabilizers*** are additional muscles that are important to protecting the spinal column. These are recognized as secondary stabilizers as they do not directly connect to the spinal column itself. The secondary stabilizers include the internal obliques (Figure 19), external obliques (Figure 20), gluteus maximus (Figure 21), and the gluteus medius (Figure 22).

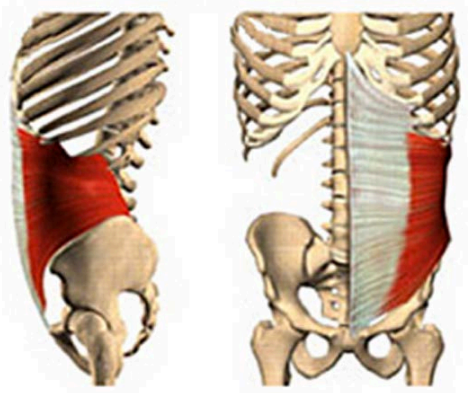


Figure 19. Internal Obliques.

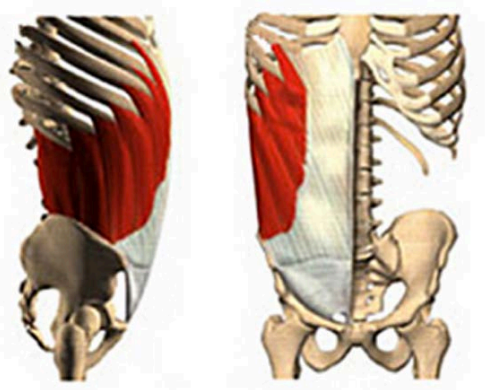


Figure 20. External Obliques.

Without strong hips supporting the base of the spine, a healthy spine cannot exist. The hips should be emphasized and used in all standing or bending activities to minimize compression, shear, and rotational forces to the spine itself.

Postures and Pathology

The review of the musculoskeletal system provided pivotal information to now grasp the significance of varied postures and their influence on pathology. Let's next examine the neutral spine position, slouched sitting, and excessive lumbar lordosis.

Neutral Spine Position

First, neutral spine is a biomechanically sound position in which the least amount of stress is placed on pain sensitive tissue. The weight of the body is absorbed by the weight bearing structures of the spine, which are the vertebral bodies. The vertebral bodies are designed to support and sustain large amounts of force. When proper spinal curves in a balanced

Figure 21. Gluteus Maximus.

Figure 22. Gluteus Maximus.

Figure 23. Balanced Posture.

posture (Figure 23) are present, the spine is actually stronger than when the curves are reduced or excessive. Neutral spine is a term that appears frequently in the literature, but to the dental professional the term may not be clearly defined or offer clear instruction.

A healthy back has three natural curves; a slight forward curve in the neck (cervical curve), a slight backward curve in the upper back (thoracic curve), and a slight forward curve in the low back (lumbar curve). Good posture actually means keeping these three curves in balanced alignment. If the lumbar curve is reversed, the thoracic curve will increase and the head will translate forward creating a forward head alignment. With each inch that the head translates forward out of alignment, the weight of the head increases creating more demand on the cervical muscles and causing abnormal forces to pain sensitive tissue in the cervical spine joints, discs, and ligaments (Figure 24).

As previously mentioned, the cervical, thoracic and lumbar curves each measure approximately 30-40 degrees. Variations exist in age groups, but these values offer spinal stability. When the curves are in alignment, the joints are held in an optimal position to allow an equal distribution

Video 1. Finding a Neutral Spine Position.
Click on image to view video online.

of force through the entire structure minimizing stress to pain sensitive tissue. The spine in a neutral position feels stable when vertically loaded. Here is an audio file to help in finding your neutral spine position.

Slouched Sitting

Second, in the wake of appreciating the neutral spine alignment, let's examine exactly what transpires in the slouched sitting position. Slouched sitting (Figure 25) is a common flawed posture used by many, not just dental

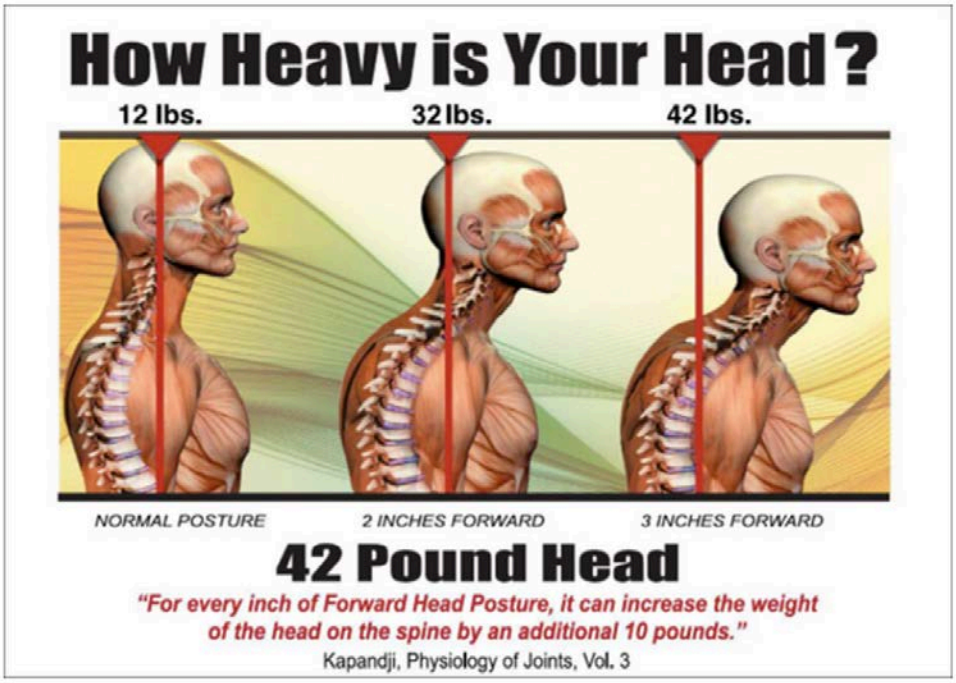


Figure 24. Forward Head Posture.

Figure 25. Slouched Sitting.

professionals. Starting from the bottom up, the pelvis is usually rotated posteriorly (Figure 26).

This posterior rotation affects several structures. It is impossible to maintain lumbar lordosis with a posteriorly rotated pelvis. Therefore, this reversal of the lumbar lordosis triggers abnormal forces to many tissues. Immediately, it causes the lumbar spine to flex causing widening of the lumbar intervertebral discs and strain on the lumbar ligaments. The paraspinal muscles

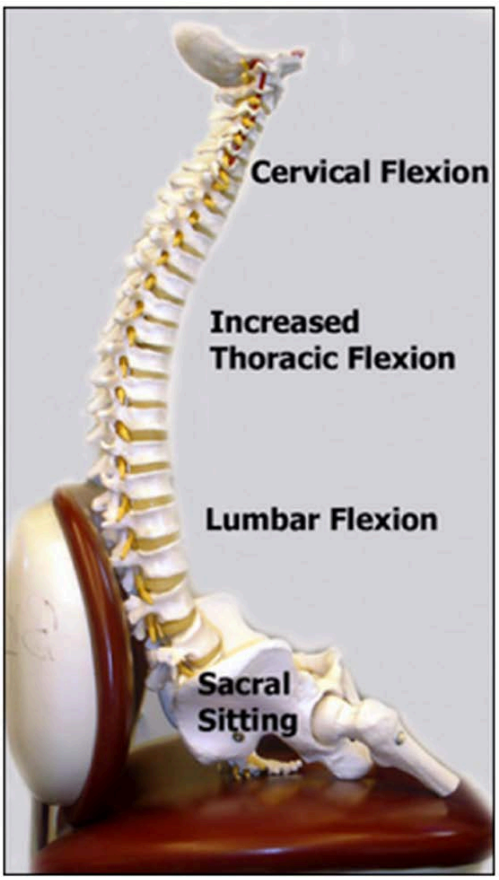


Figure 26. Posterior Rotation.

running along side the spine are elongated and many times rendered inactive due to the elongation. The length/tension curve is no longer ideal for these muscles and they become less electrically active on electromyography (EMG). The deep primary stabilizers, the multifidi, function to assist with extension and rotation. However, during over-flexion of the lumbar spine, these primary stabilizers also become close to electrically silent.

Next, distractive and straining forces are placed on the interspinous ligaments, and the posterior longitudinal ligaments of the lumbar spine. Daily repetitive strain to these ligaments over time can result in one experiencing a generalized lower backache that is often felt across both sides of the lumbar spine. Overtime with the muscles and ligaments strained, the next structures to bear the flexion forces are the intervertebral discs. As stated before, these discs serve important functions such as shock absorption and the provision of nutrition to the vertebral bodies above and below the disc via the vertebral endplates.

The discs also occupy space between two vertebrae to keep the intervertebral foramen patent so the nerve roots can pass from the spine cord out to the periphery. Remember, during slouched sitting, the lumbar spine is in flexion causing distractive forces across the disc and thus weakening the outer layer of the disc called the annulus fibrosis. Over time as repetitive and sustained slouched sitting occurs, more weakening of the disc occurs making us vulnerable to further injuring our discs with simple movements performed independent of sitting, such as bending to tie our shoes or putting on our pants.

Once injured, discs do not easily heal and can start to degenerate. During this degenerative process, not only is the annulus fibrosis weaker, but the inner core, the nucleus pulposis, migrates posteriorly further pushing on the weakened walls of the annulus. In many circumstances, the nucleus causes bulging, herniation, or extrusion. The nuclear content full of water for shock absorption now resides outside of the disc never to be useful in the role of providing shock absorption. Further injury and/or degeneration sets off a cascade of events that over time can lead to neural foraminal stenosis (Figure 27), central canal stenosis (Figure 28), degenerative disc disease, degenerative joint disease (facet disease) and nerve entrapment. At this point, many are familiar with the term “sciatica” which can result from any one of these conditions or others.

Besides affecting the lumbar spine, a posteriorly rotated pelvis in slouched sitting effects all the portions of the spine and not just the lumbar region. Slouched sitting additionally causes the thoracic spine to flex, the head then must also move forward to offset the posterior movement of the pelvis.

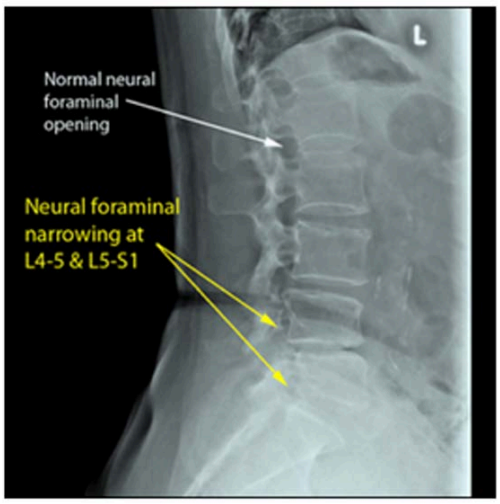


Figure 27. Neural Foraminal Stenosis.

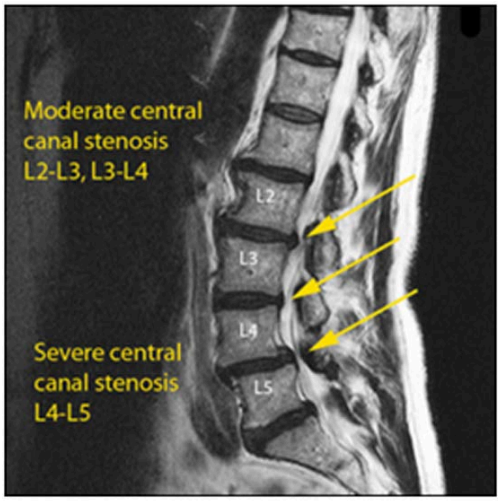
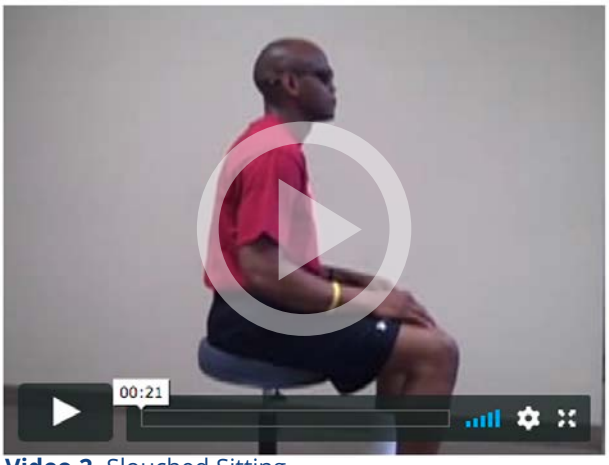
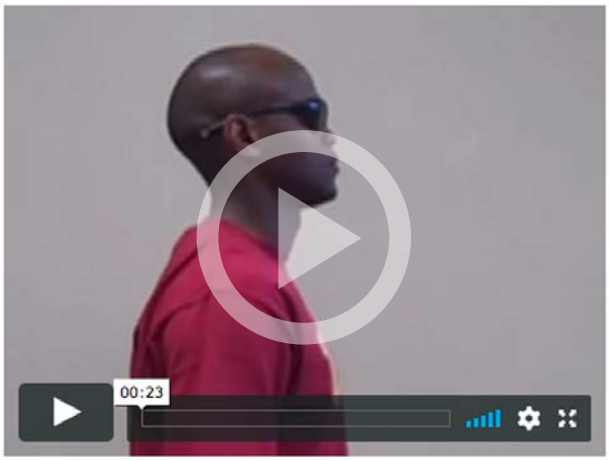


Figure 28. Central Canal Stenosis.



Video 2. Slouched Sitting.
Click on image to view video online.



Video 3. Forward Head Position.
Click on image to view video online.

Forward Head Position

The "forward head" position places the upper cervical region in extension and the lower cervical spine in flexion. How heavy is your head? Review Figure 24 again to appreciate how the weight of your head increases as it relocates past your shoulders. Not only does the weight of the head increase markedly, there are consequences to the region besides an increase in the weight of the head. See Figure 31 for the consequences described in the literature. The upper cervical extension over time can contribute to headaches, muscles spasms and tightness in the upper cervical region, and over time, possible degeneration in the articular pillars or "facet joints" of the neck. In the lower cervical region, the flexion forces place stress to the same structures as previously discussed in the lumbar spine. This is why disc herniations and degenerative conditions are mostly seen in the C4-7 regions as opposed to the lack of herniations seen in the upper cervical spine.

Excessive Lumbar Lordosis

Third, opposing excessive lumbar flexion is excessive lumbar lordosis or hyper-extension. Over correcting from a slouched sitting position has drawbacks as well. Sitting with too much lumbar lordosis places additional loading forces to structures that cannot only cause pain, but also degenerative conditions. During hyper-extension of the lumbar spine (think about the low back positions of gymnasts), there is excessive load placed on the facet joints of the back. These are not meant to be weight-bearing structures. Overtime, stress to the facet joints can cause degenerative joint disease with further progression leading to a condition called spondylolisthesis. Generally, this refers to a slippage of the superior vertebrae with respect to the inferior vertebrae. One type is an anteriolisthesis (Figure 29) where the superior vertebrae slips forward relative to the inferior one. The other is the retrolisthesis (Figure 30) where the superior vertebrae slips backward relative to the inferior one.

As excessive lordosis relates to the muscles, they may be in too shortened of a position to be effective in stabilizing the spine. Think of how ineffective it would be to perform bicep curls starting with your elbow half bent and working up. This shortened position of the muscles in a hyper-extended position is inadequate to produce the necessary forces to assist with stabilizing the spine. Additionally, in a hyper-extended lumbar position, the intervertebral foramen, the holes that the nerve roots exit into from the spinal cord, are compromised and made smaller. Therefore, any degenerative or hereditary condition present may further be exacerbated by excessive lordosis. While this position is less common in sitting, it is quite common in standing. Those who stand with excessive lordosis often hang out on the "y" ligaments in the anterior hips, have very inactive abdominal and hip musculature and thereby attain their erect position by sustained passive forces (hip ligaments and loading of the lumbar facet joints). This posture is commonly called the swayback position (Figure 32). After

Figure 29. Anteriolisthesis.

Figure 30. Retrolisthesis.

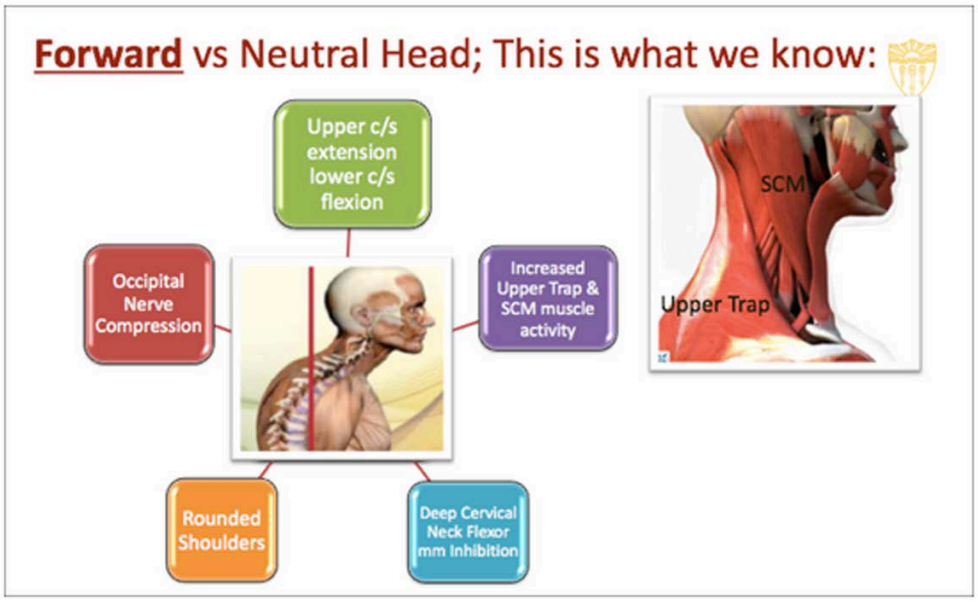


Figure 31. Consequences of the Forward Head Posture.

Figure 32. Swayback Posture.

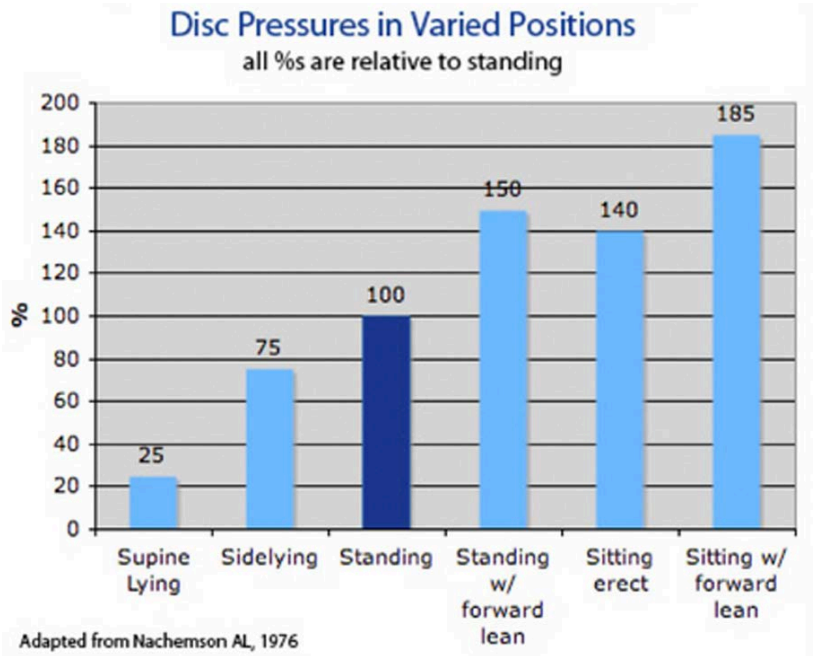
having reviewed 3 postures and their associated pathologies, let's compare the effects of posture/positioning related to intervertebral disc pressures.

Pressures Linked With Postures

Dental professionals sit during many if not all procedures. The seated posture is an inactive position. While there is a very low level of muscle activity during sitting as compared with dynamic activities, Nachemson found in sitting a 40 percent increase in intra-discal pressure as compared to standing[22] making pain inevitable for those who engage in prolonged static sitting. Even standing postures can contribute to increased disc loading, especially if there is any forward lean. In addition, inactivity can cause an accretion of metabolites that contributes to both disc degeneration and disc herniation in both the cervical and lumbar spines.[17] Table 1 shows the percentage comparison of disc pressures in the third lumbar disc in various positions.

Recognizing the effects of various positions is crucial when choosing a working posture.

Table 1. Disc Pressures in Varied Positions.



Replace the pain and fatigue from static unstable positioning with a muscular framework, a structurally stable sitting alignment, and fluid movements. In *Practice in Motion: Part II*, we ask you to consider the 6 Components of Posture and various movement strategies that can minimize stress to pain sensitive tissue.

Summary

In this course, we described relevant anatomy and postural flaws that can lead to pathology. Think about these elements, intensify your efforts, and attempt to adjust your work-habits and lifestyle accordingly. Ask yourself, "Is your spine protected or painful?" The answer to that question should guide your next step toward implementing a strategy focused on new habits. Remember, the best activity, whether it targets posture, flexibility, strengthening, or cardiovascular conditioning, *requires your participation*. Now, put your Practice in Motion!

Course Test Preview

To receive Continuing Education credit for this course, you must complete the online test. Please go to: *www.dentalcare.com/en-us/professional-education/ce-courses/ce553/start-test*

1. Which of the following is the most prevalent and costly orthopedic problem in society?
a. Neck pain
b. Shoulder pain
c. Low back pain
d. Hand/wrist pain
e. Hip pain

2. Which of the following is the most common cause of job related disability?
a. Injuries from repetitive motion
b. Injuries from falling
c. Shoulder pain
d. Low back pain
e. None of the above.

3. Which federal agency is responsible for research on safe working conditions?
a. Health Resources and Services Agency
b. Environmental Protection Agency
c. Department of Labor
d. National Institute on Occupational Safety and Health
e. Agency for Healthcare Research and Quality

4. Our knowledge of MSDs in the dental workforce is based on data from _____.
a. ADA
b. ADHA
c. NIOSH
d. Department of Labor
e. Multiple small studies

5. Which of the following is the most frequently cited risk factor in dentistry?
a. Posture
b. Mechanical stresses
c. Vibration
d. Repetition
e. Cold temperature

6. Strained sitting positions are associated with which of the following?
a. Bending/slouching
b. Head tilting
c. Torso twisting
d. Tipping shoulders
e. All of the above.

7. There is no increase in intra-discal pressure in sitting as compared to standing.
a. True
b. False

8. The inactivity associated with sitting may contribute to disc degeneration and disc herniation.

a. True
b. False

9. Which of the following statements are true?

a. The position of the thoracic spine drives the position of the head.
b. A flexed thoracic spine results is an increase in lower cervical flexion.
c. A forward rotation of the pelvis results in a widening of the lumbar intervertebral discs.
d. A and B
e. B and C

10. The spine has three curves. The proper notation of these curves is which of the following:

a. Cervical kyphosis, thoracic lordosis, and lumbo-sacral lordosis.
b. Cervical lordosis, thoracic kyphosis, and lumbar kyphosis.
c. Cervical lordosis, thoracic kyphosis, and lumbar lordosis.
d. Cervical extension, thoracic kyphosis, and lumbar extension.
e. None of the above.

11. The purpose of the intervertebral disc is to:

a. Provide shock absorption.
b. Provide nutrition to the vertebral endplates.
c. Occupy space between 2 vertebrae and block the intervertebral foreman.
d. A and B
e. A, B and C

12. Which of the following factors can result in disc degeneration?

a. Improper body mechanics
b. Trauma
c. Age
d. Genetics
e. All of the above.

13. A herniated disc is most commonly found in what age group?

a. 35-45 years of age.
b. 20-40 years of age.
c. 50-70 years of age.
d. Extremely common in all age groups.
e. A very rare occurrence for professionals who sit.

14. Osteophytosis is most commonly found in what age group?

a. 35-45 years of age.
b. 20-40 years of age.
c. 50-70 years of age.
d. Extremely common in all age groups.
e. A very rare occurrence for professionals who sit.

15. The primary lumbar spine stabilizing muscles are the:

a. Internal and external obliques
b. Multifidi and transverse abdominis
c. Multifidi and rectus abdominis
d. Gluteus maximus and medius
e. None of the above.

16. In a structurally stable sitting position, what structures are the weight-bearing structures of the spine?

a. Muscles and interspinous ligaments.
b. Facet joints and vertebral bodies.
c. Vertebral bodies.
d. Intervertebral disc and the vertebral bodies.

17. What 3 instructions can assist with finding a stable sitting alignment?

a. Sit up straight, stomach in, chest out.
b. Relax your back, tuck your chin.
c. Sit tall, shoulders down/back and hinge forward.
d. Tailbone up, shoulders down/back and stomach in.
e. Tailbone up, chest out, tuck your chin.

18. What direction must the pelvis rotate when sitting in a slouched position to assume a stable alignment?

a. Up
b. Posterior
c. Medially
d. Anterior
e. B & D

19. Disc degeneration and degenerative processes are most common at what cervical level(s)?

a. C1-C2
b. C1-C3
c. C4-C5
d. C4-C7
e. C6-T3

20. Which position results in the highest disc pressure:

a. Sitting, leaning forward without weight
b. Side lying
c. Sitting upright
d. Standing, leaning forward without weight

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