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Change Degrees and Add Years to Your Practice

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Abstract
In Recent Years, The Centre For Disease Control And Prevention Office Of Health And Safety Has Identified Repetitive Motion Injuries As A Factor In Employee Injuries. These Injuries Are Caused By Excessive And Repeated Physical Stress On The Musculoskeletal System - The Hands, Wrists Elbow, Shoulders, Neck, And Back. All Of These Injuries Can Impact Dentist And Assistant. As Most Dental Offices Today Place Increased Use Of Computers Also, It Is Important That The Backup Office Staff Learns Proper Equipment Placement And Proper Body Positioning For The Use Of These Equipment To Prevent Musculoskeletal Injuries. Ergonomics Is The Study Of Physical Relationship Between People And Their Environment. The Practice Of Ergonomics Involves Arranging The Environment In A Healthier Way. It Involves The Anatomic, Physiologic, Mechanical Principles Affecting The Efficient Use Of One's Energy. When Ergonomics Is Applied Appropriately In The Work Environment, Visual And Musculoskeletal Discomfort And Fatigue Are Reduced Significantly. In This Paper Emphasis Is Laid On Principles Of Ergonomics That Help To Reduce Stress And Eliminate Many Potential Injuries And Disorders Associated With Overuse Of Muscles, Bad Posture And Repeated Tasks. This Is Accomplished By Designing Tasks, Work Space, Computer Station, Lighting And Other Equipment To Complies With The Physical Capabilities And Limitations Of The Dental Office's Staff.

Keywords:*Ergonomics, Musculoskeletal Disorder, Dental Office, Work Place*

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I. Introduction

A healthy person is one of the most important components of a successful profession. Dentistsoftenmaintainunnaturalposturewhiledealingwithpatientsformanyhourscontinuously.Theuseofawkwardpo sturesisperhapsthegreatestriskfactorforthoseinthedentalfield.Researchershave confirmed the presence of awkward postures specifically of the neck, back, shoulders,hand and wrist for dental professionals. Awkward postures are often adopted due to improperseating, improper patient positioning and poor work techniques.

Common awkward posturesindentalpracticeincludeelbowandwristflexionandthumbhyperextension,whichhavebeen shown to stressneurovascularstructuresandligaments.

Kupcinskas& Petrauskas[1] (2003) in their study stated that although 88% of dentists report good or excellent health,somestudiesshowthatoneoutoftendentistsreportofhavingpoorgeneralhealthandthreeout of ten dentists report having poor physical state[2]. Researchers have foundsymptomsofdiscomfortindentalworkersthatoccurinthewrists/hands(69.5%),neck(68.5%), upper back (67.4%), low back (56.8%) and shoulders (60.0%). Anton[3] (2002)found that93%of dentistsstated,theyhadatleastonejob-relatedache,pain,ordiscomfortinthe period of 12 months prior to the survey. Dentists sometimes experience illnesses that candamagetheircareerorimpairthepractice.

These problems can be avoided by increasing awareness of postures used during work,redesigning the workstation to promote neutral positions, examining the impact of instrumentuseonupperextremity,andfollowinghealthyworkpracticestoreducethestressofdentalworkon thepractitioner'sbody[4].

Recently, "Ergonomics" has become a popular term. In Greek, "Ergo," means work and,"Nomos,"isanappliedscienceconcernedwithdesigningproductsandproceduresformaximum efficiency and safety[5]. It is also a study of the relationship among the personnel,equipmentandenvironmentintheworkarea.Properergonomicdesignisnecessarytopreventrepetitive strain injuries, which can develop over time and can lead to long-term disability.Ergonomicsisconcernedwiththeefficiencyofpersonsintheirworkingenvironment.Ittakesaccountoftheworker'scapabilitiesandlimitationstoensurethattask,equipment,informationandtheenvironmentsuiteachworker.

The aim of this paper is to spread awareness among dental health care professionals regardingthehealthproblemstheyfaceandhowtopreventtheseposturesrelatedproblemswiththehelpofliteraturesupport.

II. Musculoskeletaldisorders(MSD`s)

MSDs are injuries and disorders of the musculoskeletal system. The musculoskeletal systemincludes muscles, tendons, tendon sheaths, nerves, bursa, blood vessels, joints/spinal discs,andligaments.MSDsmaybecausedoraggravatedbythepresenceofoneoranycombinationof the following risk factors: repetition, awkward or static postures, high forces, and contactstress. Whenthesefactorsexistsimultaneously, theriskofdevelopingMSDissignificantly increased. Conditions can vary from mild recurrent symptoms to severe andincapacitating.

Factorsinwork-relatedmusculoskeletalinjuries

- ✓ Repetitivemovements
- ✓ Awkwardpositions
- ✓ Remaininginonepositionforextendedperiodsoftime
- ✓ Poorposture
- ✓ Poorposturalmusclestrength
- ✓ Poorflexibility
- ✓ Stress
- ✓ Infrequentbreaks
- ✓ Inappropriateselectionanduseofdentalstoolsandmagnificationaids
- ✓ Poorlydesignedequipmentworkstation
- ✓ Improperworkhabits
- ✓ Genetics
- ✓ Medicalconditions
- ✓ Poorfitnesslevel
- ✓ Physical/mentalstress
- ✓ Lackofrest/recovery
- ✓ Poornutrition
- ✓ Environmentalfactors

SymptomsofMusculoskeletaldisorders (MSDs):

- ✓ Excessivefatigueintheshouldersandneck
- ✓ Tingling,burning,orotherpaininarms
- ✓ Weakgrip,crampingofhands

- ✓ Numbnessinfingersandhands
- ✓ Clumsinessanddroppingofobjects
- ✓ Hypersensitivity inhandsandfingers

Signs ofMSDs

- ✓ Decreasedrangeof motion
- ✓ Lossofnormalsensation
- ✓ Decreasedgripstrength
- ✓ Lossofnormalmovement
- ✓ Lossofco-ordination

***Off-the-JobactivitiesthatcancontributetoMSDs*:**

- ✓ Homecomputeruse
- ✓ Repetitiveactivitiesusingthefingers
- ✓ Sportsactivities
- ✓ Prolonged/awkwardposturesathome
- ✓ Useofhouseholdtools
- ✓ Activitiesinvolvingrepeatedheavylifting,
- ✓ bending,twisting,orreaching

AwkwardPostures

Posture is a term used for the position of various parts of the body during an activity. Whilespecific procedures place the clinician at increased risk for finger and hand injuries, poorposture is a risk factor with all procedures. This is compounded by the requirement to remainin one position for significantlengths of time while performing procedures. Abnormal and prolonged static posture (forward head, loss of cervical lordosis, shoulder protraction, and thoracic kyphosis)—being held for >4 to 30 seconds is often needed in daily clinical interventions to gain better visibility for excellent hand dexterity and optimal eye-hand coordination. In female dentists, inclinations and movements of the head for a mean duration of 13 to 17 minutes of work have been recorded whereby the head was shown to be tilted forward during half of the time ≥39° and during 10% of the time ≥49°[6]. Stress and time demands can add their toll,withcliniciansbecomingunawareof poor bodyposition and posture

Prolonged Static Postures (PSPs): When the human body is subjected repeatedly to PSPs, itcaninitiateaseriesofeventsthatmayresultinpain,injuryoracareer-ending MSD.

Muscle Ischemia/Necrosis and Imbalances: During treatment, operators strive to maintain aneutral,balancedpostureandfindthemselvesinsustainedawkwardpostures.Thisoftenleadstostressedandshortened muscleswhichcanbecomeischemicandpainful,exertingasymmetricalforcesthatcancausemisalignmentofthespinalc olumn(AlWazzanetal,2001).*Hypomobile Joints*: During periods of PSPs or when joints are restricted due to musclecontractions, synovialfluidproductionisreducedandjointhypomobilitymayresult.

SpinalDiscHerniationandDegeneration:Inunsupportedsitting,pressureinthelumbarspinaldiscs increases. During forward flexion and rotation, the pressure increases further and makesthespine&discvulnerableto injury[7].

*NeckandShoulderInjury:*Repetitiveneckmovementsandcontinuousarmandhandmovements affecting the neck and shoulder demonstrate significant associations with neckMSDs.

Carpal-Tunnel Syndrome (CTS): It has been associated with both repetitive work and forcefulwork. Symptoms can appear from any activity causing prolonged and increased pressure(passiveor active)inthecarpalcanal[8].

Low Back Pain: Low back discomfort has been associated with dental work in numerousstudies.

Psychosocial Factors: Dentists with work related MSDs show a significant tendency to bemore dissatisfied at work. They are burdened by anxiety, poor psychosomatic health and thusfeellessconfident with their future[8].

SomeElementsofanImproperWorkstationSetup[9]:

- ✓ Dentist'sorpatient'schairistoohigh/low.
- ✓ Dentist'schairhasnolumbar,thoracic,orarm support.
- ✓ Instrumenttableisnotpositionedproperly.
- ✓ Lighting isinadequateforthetask.
- ✓ Edgesoftables/worksurfacesaresharp/uncomfortable.

- ✓ Workenvironmentisdampandcold.

ApplicationofErgonomics

Ergonomic improvements in seating, instrumentation, magnification, lighting, and glove usehave offered a proactive measure for ensuring a proper balance between job requirements andworkercapabilities.

Seating/Dentalstool

Perhaps the most important equipment purchase made by dental professionals, is the seat.Proper seating is a complex subject about which there is much misunderstanding. Researchfindingsindicatethatdentistswhosit80to100%ofthedayareatanincreasedriskof

developing low back pain[10]. Prolonged sitting in a poorly designed chairwith inadequate lumbar support or adjustability has been found to be a contributing factor tomuscularfatigueandlowbackpain[11].

Studies have shown that the seat moves almost every minute throughout a typical treatmentsession, as the clinician is continually adjusting his position to improve visual access andaccommodate patient movement. As a result, the support base itself must be capable ofsustainingtherepeated stress.

Criteriaofidealseat:

- ✓ A seat should be constructed of a rigid cast frame that will not distort with time anduse.
- ✓ This rigid base must accommodate five casters to prevent rearward tipping, howeverthebaseshouldnotbeaswideasthatof an officechair.
- ✓ The compact base ensures that the wheels do not interfere with the feet, foot controls,orpatientchair[12].
- ✓ Theseatpanshouldbewideenoughtoallowforsomeshiftingandmovement.Twenty-five percent wider than the total breadth of the buttocks is considered adequate for themajorityof people.
- ✓ The front edge of the seat should taper off and away from the legs so as not to impedecirculationandnervesupplytotheleg.
- ✓ Theseatshouldalsobeheightadjustable.Whenthefeetarerestingflatonthefloortheanglebetweenspineandthighsshouldbe90 ºto 110 º.
- ✓ An angle less than 90º flattens the lumbar curve of the spine and an angle greater than110ºgivesthefeelinglikeyou areslippingofftheseat.
- ✓ Variations in footwear (high heeled shoes to flats) should have the clinician alteringtheirseatheightday today depending onwhattheyarewearing.

Researchers recommend that a shorter clinician should have a seat adjustment range from 16 to 21inches,whiletallerindividuals shouldhavearangeof21to26inches.Inanidealsituation,aclinicianshouldbeabletofunctionfromaheightrangewhereth eirthighsareparallelwiththefloorandlegsareinfully supported position[12].

While arm support is a controversial subject, many clinicians and experts feel that they areessentialtohealthandcomfort.Thecapabilityforhighlysupportivearmsthatfunctionthrougha wide range of motion is an option that most modern dental stools provide. If elbow rests arepresent, they should be positioned just below seated elbow height so that the shouldersarenotelevatedwhileusingtherests.Theyshouldnotimpedeaccesst o thepatientwhile

keeping their elbows at the side. Arm support may be fixed in length but should allow rapidheight adjustment and full articulation. Some researchers have found the use of elbow rests toreduceuppertrapeziusmuscleloadaswellasthefrequencyandrangeofarmabductionduringregulardentaltasks.

When selecting a dental stool, ensure it meets the above criteria and allows you to work in aneutralbodyposition.Withnumerousdesignscurrentlyavailableonthemarket,eachchairhasitsownuniqueadvantages anddisadvantages.Asaresult,itisimportanttospeakwithproductspecialistsandtrythechairunderrealworkingcondition s beforecommittingtopurchase.

PatientChair

Whenseatingapatient,optimalresultswillbeachievedwhentheiroralcavityispositionedata height equal to the seated height of the clinician's heart. Positioning the oral cavity aboveheart level will limit vantage and increase the rate of shoulder fatigue. On the other hand,positioning the oral cavity below the recommended height will result in non-neutral workingpostures including over declination of the head, forward and/or lateral bending of the torso,andinabilityofthecliniciantoaccessfreemovementintheclockpositions.

When the patient is properly positioned dentist shoulders, elbows, and wrists should be in aneutralposition, meaningthat:

- o dentistupperarmsareclosetohisbody
- o dentistelbow/forearmangleis closeto90º

- dentistwrists areinlinewiththeforearmwithnomorethan20-30ºextension

WorkingPostureandTechniques

Aneutralworkingpostureisdefinedasonewhichsupports**uncompromisedmusculoskeletalbalance** of the clinician. This consists of dynamic positioning where the clinician operates indifferent locations around the oral cavity, rather than static operation. Changing positions notonlyservestoimprovevisionandaccessintotheoralcavitybutalsoshiftsworktoothermusclegroups. By using the clinician's stool to navigate around the patient, static and awkwardposturescanbeavoided.

It is important to ensure that the clinician's access to the oral cavity is truly unimpeded. Youshould be able to move freely with your legs beneath the patient's head and headrest to avoidtwisting or forward bending of the torso. If this is not possible, you may be forced to spreadyour thighs and knees apart and lean forward or twist with the knees together on one side.Eitherofthesepositionscompromisesaneutralworkingpostureandshouldbeavoided.Asa

result,mostcliniciansattempttouseawiderangeofpositionsaroundthepatient'shead,oftenreferredto asthe"clock positions".

For right-handed clinicians, working in the range from 7 to 9 o'clock is commonly associatedwithtwistingofthetrunkandneckaswellasworkingwithanelevatedelbowpostureinorderto gain access. The mirror image (3 to 5 o'clock) is equally problematic for left-handedclinicians. In an attempt to reduce such postural deviations a conservative range from 10o'clocktoapproximately 12:30ispreferred andshown below.

SomeTipsforWorkingwithGood Posture[13]:

(1) Maintain an erect posture: by positioning chair close to the patient, one can minimizeforwardbendingorexcessiveleaningoverthe patient.Placefeetflatonthefloortopromoteaneutraloranteriortilttoyourpelvis, whichkeeps back alignedandpromotes the
natural curvaturesofback.
(2) Useanadjustablechairwithlumbar,thoracicandarmsupport:Agoodchairisessentialformaintaining good posture. A chair should have important features like, adjustable height,width, tilt, backrest, seat pan and armrests, because in most dental offices, many people ofdifferentsizesusethesameworkstation.
(3) Workclosetoyourbody:Positionthechairclosetothepatientandpositiontheinstrumenttrayclosetothechair.Thiswa y,dentistdoesnothavetooverextendhimselftoreachthepatientor instruments, putting excessive stress on back, shoulders and arms. Think of the 90° rule ofhavingelbows, hips,knees, andankles allforming90°angles.
(4) Minimizeexcessivewristmovements:Trytokeeptheminaneutralposition(palmsfacingeachother,shoulderwidth apartwithwristsstraight),whichputswristmusclesandtendonsinamuch better relationship to performthework.
(5) Avoidexcessivefingermovements:Whenonecancombinetheexcessiveforcesneededtohold the instruments with the amount of repetitions that he/she can perform each day, one cansee the tremendous toll it takes on small muscles of fingers. Retraining of shouldersandarmstopositionhandsratherthanmakingsmall,forcefulmovementswithfingers.
(6) Alternate work positions between sitting, standing and side of patient: Switching positionsallowscertainmusclestorelaxwhileshiftingthestressontoothermusclesandincreasingyourcirculation. Allow each side of your body to share the stress rather than performing the samemotioninthesamewaywhichcausescumulativetraumaintheoverusedside.
(7) Adjust the height of your chair and the patient's chair to a comfortable level: If dentistschair is too low and the patient's chair is too high, this causes elevation of shoulders and canleadtoneckproblemsandcanpinchnerves.Alternately,ifdentist'schairistoohighandthepatient's chair is too low, flexion of neck down and bend wrists back to compensate can leadtoneck andhandproblems.Rememberthe90°ruleandkeepelbowsata90°anglewithwristsstraightand shouldersrelaxed.
(8) Consider horizontal patient positioning: If workstation allows the patient to recline into ahorizontal position, it will allow a dentist to sit above the patient's head with good ergonomicpostureandhecanuseeacharmequallyinmorenaturalposition.
(9) Check the placement of the adjustable light: Position the adjustable light to avoid strain ontheneck
(10) Check the temperature in the room: Temperature of workspace should not be too coldbecausethiswilldecreasethecirculationandbloodflowofextremities.Mostoften,thedentalworkenvironmenti sdampandcold,sobecertaintowearglovesandwarmupthehandsbeforeworking.

BodyStrengtheningExercises[14]:

A. Stretchingandstrengtheningthemusclesthatsupportthebackandneckandthoseusedintheforearm, wrist, andhandwillhelpthemremainstrongand healthy.
B. Periodicstretchingthroughouttheworkday.

C. RestinghandsfrequentlyisbelievedtobeoneofthemostimportantfactorsinpreventingCTS
D. To relieve eyestrain caused by focusing intensely at one depth of vision for long periods,lookupfromthetaskandfocuseyes atadistanceforapproximately20 seconds.
E. Movetheheaddownslowlyandallowthearmsandheadtofallbetweenknees;holdfora few seconds; raise slowly by contracting the stomach muscles and rolling up, bringing theheadup last.
F. Tryheadrotationforneckstiffness.Headrotationinvolvestiltingtheheadfromrighttoleft,aswellas forwardandbackwardswithoutforcingthemotionbeyondarangeofcomfort.
G. Shoulder shrugging can be used to stretch the shoulder muscles that may be stressed fromholding oral evacuator, instruments and telephone handset. Pull the shoulders up toward theears, rollthembackwardand then forwardinacircularmotion.

III. Conclusion:

Musculoskeletaldisordersareinherentindentistry.Seriousdetrimentalphysiologicalchangesinthebodycanr esultfromtheseabnormalpostures,includingmuscleimbalances,musclenecrosis, trigger points, hypomobile joints, nerve compression, and spinal disk herniation ordegeneration. These changes often result in pain, injury particularly in the back. Preventingchronic pain in dentistry may require a paradigm shift within the profession regarding clinicalwork habits, including proper use of ergonomic equipment, frequent short stretch breaks andregular strengthening exercise. During clinical procedures, dentists should acquire a bio-mechanicallyidealpostureinwhichspinalstructuresarestressedleastandthemuscularenergyspent is minimum. By acquiring a bio-mechanically ideal posture, practicing aerobic andrelaxation exercises, dentists and auxiliary personnel can minimize or even prevent spineproblems.Inthisway,theycanincreasetheirworkingefficiencywhichinturn,willhelpthemimprovingthequalityo f dentalcaretheycanrender to theirpatients.

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