

WORK PAIN FREE !

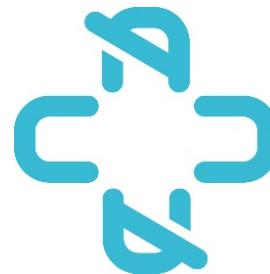
Pay attention to your work posture at the dental office

Rose-Ange Proteau, ergonomist



ACDQ

Professional development
2019/2020



ASSOCIATION DES
CHIRURGIENS DENTISTES
DU QUÉBEC

Rose-Ange Proteau, ergonomist, self-employed

- ❖ Recently retired from l'ASSTSAS
- ❖ Advisor at ASSTSAS from 1989 - 2018 : 29 years
- ❖ Advisor for dental clinics : 22 years
- ❖ Author of the French *Guide de Prevention des troubles musculo-saquelettiques (TMS) en clinique dentaire, 2002, 2007 (276 p.). (in the process of revision)*
- ❖ Author English Guide *Prevention of Work-Related Musculoskeletal Disorders (MSDs) in Dental Clinics, 2009, (excerpts from French Guide (109 p.))*
- ❖ Basic training : nursing

Please note

- The following slides are the exclusive property of ASSTSAS
- ASSTSAS allows its use in the exclusive framework of professional development course of ACDQ, 2019-2020



Objectives

At the end of this training session, you will:

- Understand the origin of muscular pain related to working methods
- Know solutions on how to reduce them:
 - Working methods
 - Equipment
 - Environment



Objectives

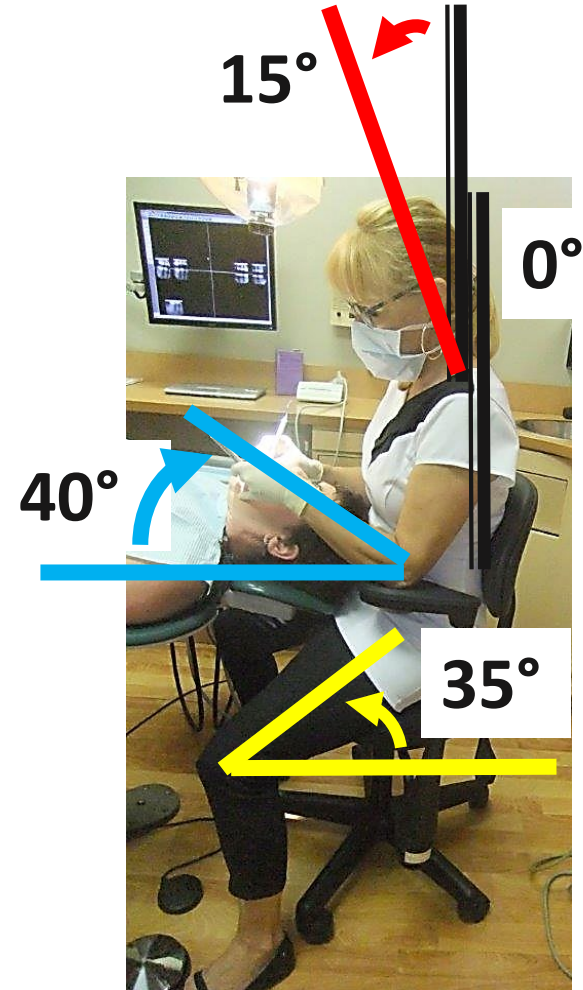
- Examine current work postures
 - Equipment
 - Working methods
- Understand the effects of risky movements and postures on tendons and muscles
 - Vertebral joints
 - Upper extremities
- Explore solutions
 - Equipment
 - Working methods



TIME TRAVEL (1997 - 2019)

Bending angles of the neck can be ↘ from 45° to 15°

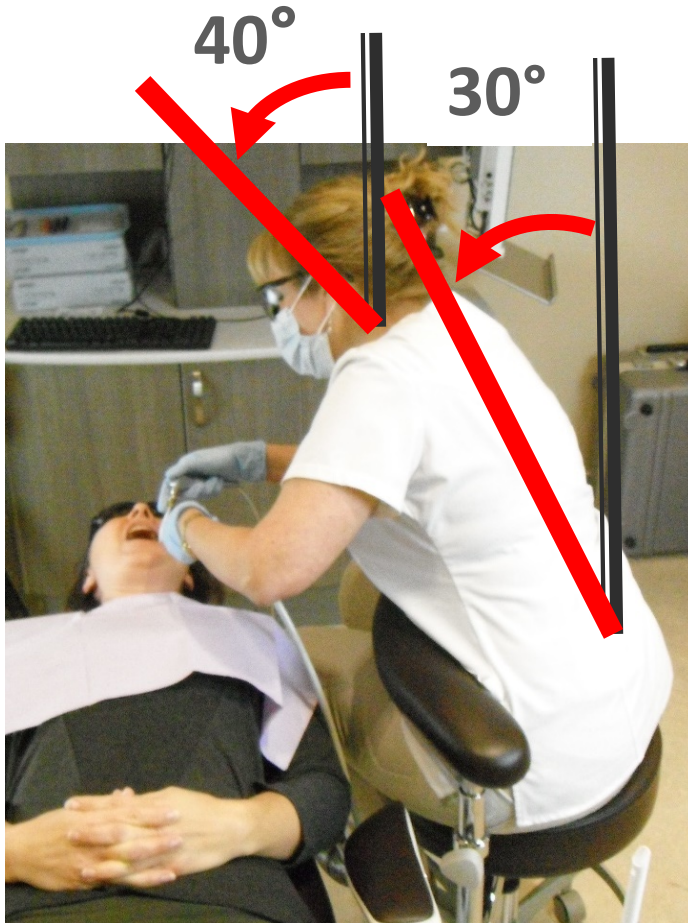
Bending angles of the back can be ↘ from 15° to 0°



TIME TRAVEL (1997 - 2019)

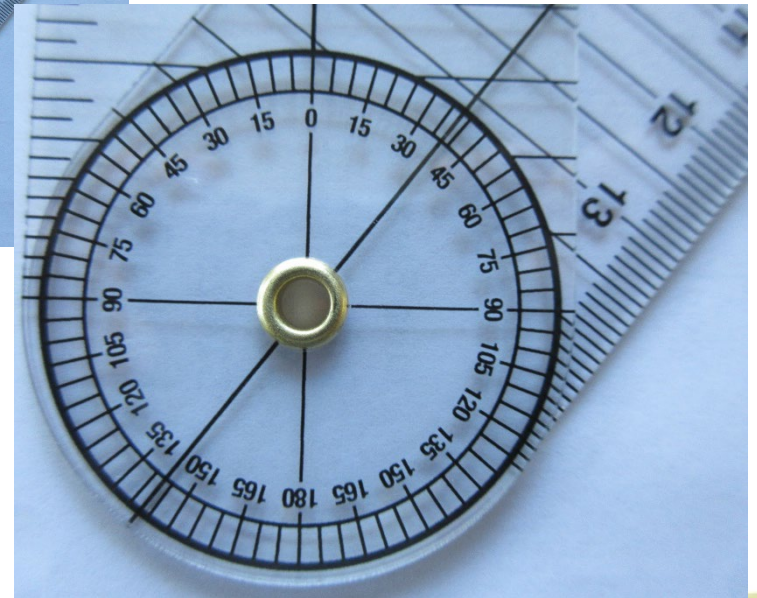
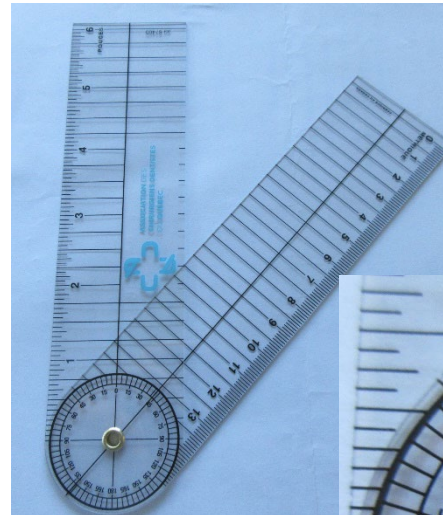
Dental assistant

the flexions of the neck can \searrow from 40° to 15° ,
the flexions of the lower back can \searrow from 30° to 0°



EXERCISE

Learn to measure work postures of different parts of the body (neck, lower back, shoulder and forearm)



The ACDQ provides each of you with a protractor.
We will practice!

Evaluation survey of this training

- Take only 2 minutes to complete.
- Please do it before the end of the day.
- https://fr.surveymonkey.com/r/_CPP2019-2020
 - Click on the right button of your mouse
 - Click on the Hyperlink



Summary

1st part : PROBLEMS

Slide

- | | |
|---|-----|
| 1. Status of the situation | 16 |
| 2. Risks factors for musculoskeletal disorders (MSDs) in dental clinics | 68 |
| 3. Risky postures for the neck and back of the dentist and dental hygienist | 87 |
| 4. Risky postures for the dental assistants | 99 |
| 5. Risks factors of MSDs to the lower back | 114 |
| 6. Risks factors of MSDs to the shoulders | 130 |
| 7. Risks factors of MSDs to the hips | 141 |



Summary

Slide

2nd part : SOLUTIONS

146

8. Notions of eye-task ergonomics	148
9. Solutions - Methods	190
10. Risks factors of MSDs to elbows, wrists and hands	251
11. Solutions for MSDs to elbows, wrists and hands	296
12. Solutions - Equipment	340
13. Solutions - Environment	435
14. Solutions – Organisational and psychosocial factors	473
15. Muscles recovery techniques	477
16. Synthesis of solutions	482
Conclusion	492
References	505



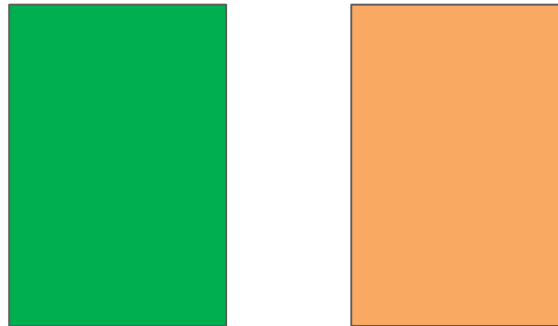
My challenge...

- Present problems and solutions for 3 types of work (dentist, dental hygienist and dental assistant) and that it will be interesting for all
- To tackle the problems encountered at the neck, upper and lower back, shoulders
- To tackle the problems encountered at the elbows, wrist and hands



Your participation

- You will find 2 colored cards in your package that will be used during the presentation
- Keep them and use them at **appropriate time**



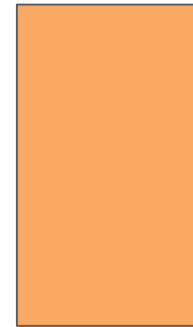
Poll 1

Did you download today's presentation?

YES



NO



1ST PART: PROBLEMS

NECK AND UPPER BACK,
LOWER BACK, SHOULDERS AND HIPS



1. STATUS OF THE SITUATION



1. Status of the situation

1997 : STARTING POINT FOR REFLECTION



Terminal field work in ergonomics, master level, at the *Université du Québec à Montréal (UQAM)*

Dental hygienist with tendonitis on the right shoulder and neck pain

- Tendinitis recognized by CNESST
- Absent for 10 months - 2 unsuccessful attempts to return to work
- Studies carried out on her 2 hygienist colleagues
- Observations and testing of solutions
 - 1 day / week for 10 weeks
- New equipment tested with the collaboration of readaptation professional from CNESST for the financing



22 years of practice to help dentists, hygienists and dental assistants, with MSDs

- Since 1997, about 80 assessments done
 - 80 % dental hygienists
 - 20 % dental assistants and dentists
- Purpose of interventions
 - Continue the work
 - Resume work after a period of absence
- Evaluation
 - For almost all types of MSDs
 - Of almost all parts of the body



Dentists, hygienists and dental assistants seen by the ergonomist

- With and without absence from work
- History of mild to severe pain varying from one to 10 years
- Majority are over 30 years of age
- Numerous types of therapy used (*physiotherapy, osteopathy, chiropractic, acupuncture, etc.*)
- Significant disruption in their day to day activities
- History of recurrence after their return to work
- Inability to return to work or change in career

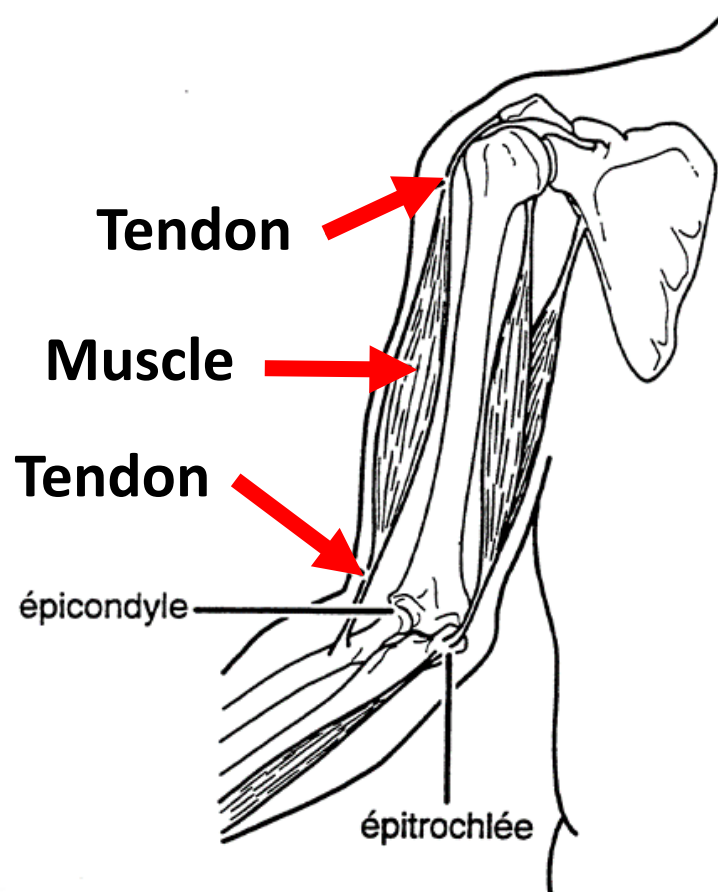


1. Status of the situation

MUSCULOSKELETAL DISORDERS (MSDs) DEFINITION



Muscular and joint pains are MSDs



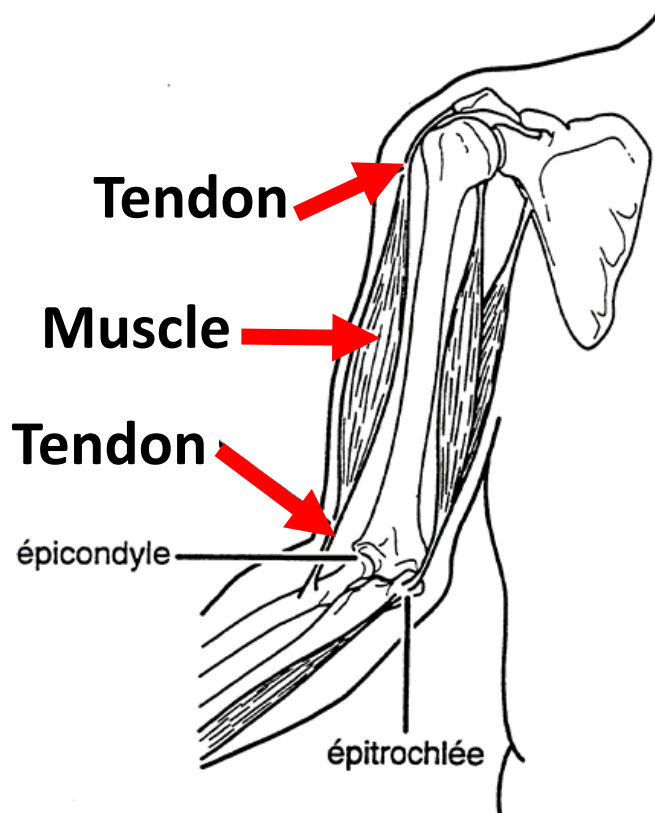
Muscles are attached to bones by tendons

- Musculo (muscles)
- Skeletal (related to the skeleton - bone)
- Disorders

= MSDs

Or also named WRMSDs
(Work-Related MSDs)

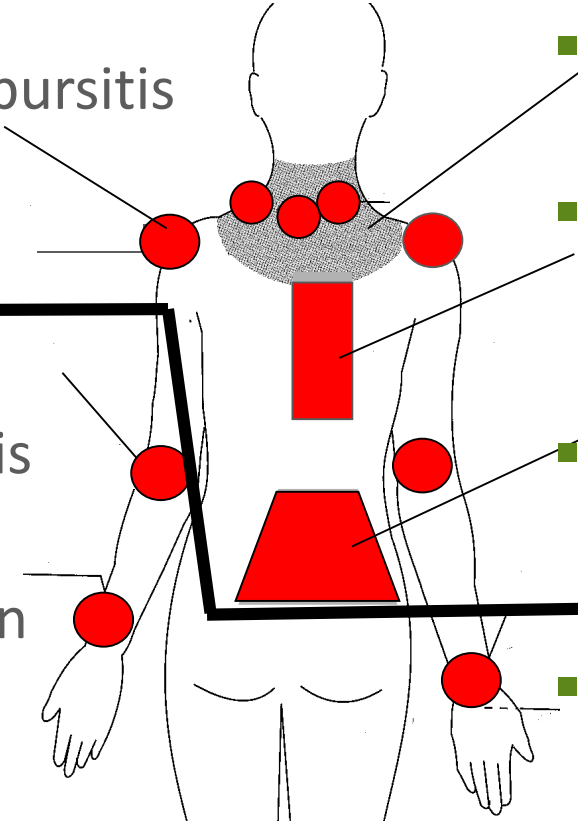
Tendinosis and tendonitis



- **Tendinosis:**
degenerative phenomenon of the tendon, cause of the vulnerability (often painless at the shoulder)
- **Tendonitis:**
when tendons are inflamed

Diagnosis of MSDs by regions and causes

Often caused by **static postures**

- 
- Tendonitis et bursitis (shoulders)
 - Neck pain
 - Pain in the upper back
 - Epicondylitis
 - Wrist tendinitis
 - Tenosynovitis of De Quervain
 - Lower back pain
 - Carpal tunnel syndrome

Usually caused by **repetitive gestures**

Most frequent side affected by MSDs:
Dominant side* : caused by the handling of instruments
Other side : caused by the holding of mirror and suction

- ❖ Tendonitis Right or Left shoulder
- ❖ Pain in Left pectoral region
- ❖ Neck pain
- ❖ Upper and/or lower back pain

****Dominant side:***

- *Right for right-handed*
- *Left for left-handed*



Most frequent MSDs caused by maintaining static postures (neck, shoulders, back)

- Tendon
 - Tendinitis of the **supraspinatus in the shoulder**
- Muscle
 - Functional pathology of the **upper trapezius** (upper back)
- Joints of **cervical and lumbar vertebrae**
 - Minor Intervertebral Disruption (DIM)
 - Herniated disc







Appearance of MSDs

- Appearance
 - Sudden
 - Progressive: wear
 - Both of them
- Pain = alarm signal
- Symptoms
 - Inflammation
 - Loss of mobility
 - Numbness
- Discomfort \Rightarrow exertion \Rightarrow **pain** \Rightarrow **pathology**



Progression of symptoms of MSDs

Initially	■ If continued exposure	MSDs
■ Discomfort		■ Pain
■ Associated with some activities		■ Occurs even at rest
■ Disappears quickly after work		■ Persists outside of working hours
■ Complete recovery		■ Residual damages



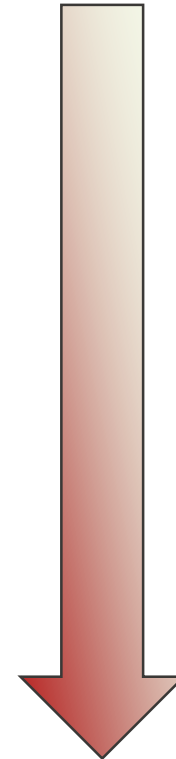
Progression according to the time of disappearance

After a night rest

After a week-end

On holidays

Permanently



Activities causing pain in dental care

Seemingly harmless working positions



Seemingly harmless small gestures



Repeated many times /day



Over the course of months and years



Work-Related Musculoskeletal Disorders (W-R MSDs)



1. Status of the situation

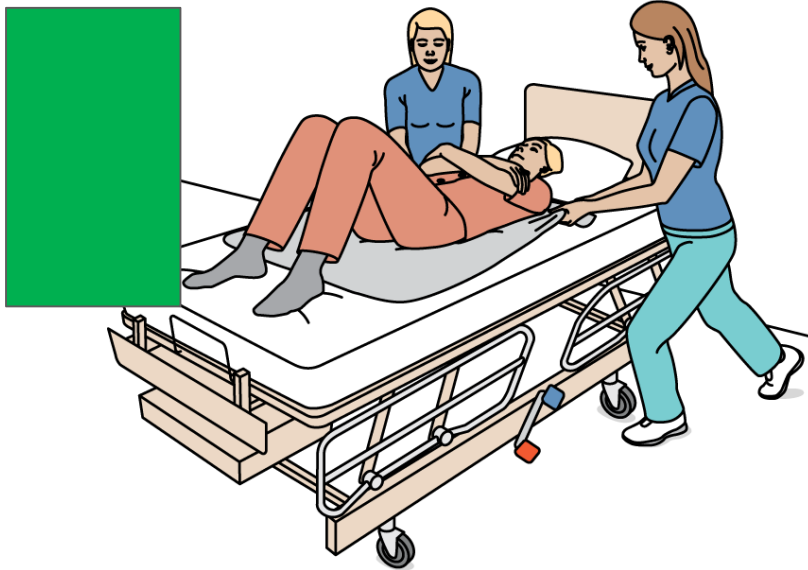
FREQUENCY OF MSDs AT THE DENTAL OFFICE



Poll 2

In which categories of work are absences in CNESST the longest?

Health care workers
moving patients



Dental hygienists
and dental assistants

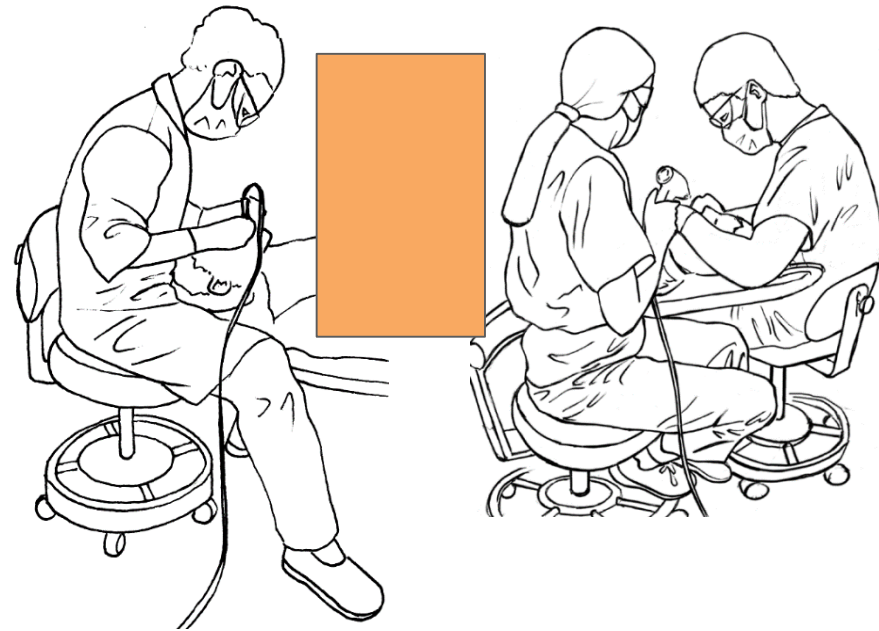


Illustration from the
PDSB training © ASSTSAS

Poll 2 - Answer

Average days compensated by the CNESST for MSDs

Health care
workers in 2014

57 days

Hygienists and
dental assistants

- 2001-2005 : 233 days
- 2013-2015 : 148 days
- 2005-2015 : 85 days/injury
➤ 37 %



Injuries compensated / CNESST in dental clinics (data 2013 - 2015)

Body area	% injuries	Average work absence / injury (days)	Average compensation costs
Cervical area	6 %	239	33 158 \$
Shoulders	24 %	227	26 349 \$
Wrists	21 %	183	21 108 \$
Elbows	10 %	204	26 181 \$
Lumbar area	16 %	145	11 908 \$
Sub-total MSDs	77 %	148	nd

Causes of long-term disabilities for dentists in 2000*

Back and MSDs	39 %
Psychological problems (eg depression)	12 %
Heart and stroke (cerebrovascular accident)	13 %
Cancer	10 %
Pregnancies	9 %
Accidents	3 %
Other diseases	12 %

**Can. Dental Service Plan inc.*

Data from other provinces in Canada (except Québec), 2000

Prevent is to:

- **Identify**
work situations at risk
- **Correct**
work situations at risk
- **Control**
the situation



Employer's obligations according to “*Occupational Health and Safety Act*”

- ❖ See that the establishments under his authority are so equipped and laid out to ensure the protection of the worker (art. 51.1)
- ❖ Ensure that the organization of the work and the working procedures and techniques do not adversely affect the safety or health of the worker (art. 51.3)
- ❖ Supply safety equipment and see that it is kept in good condition (art. 51.7)



What is ergonomomy ?

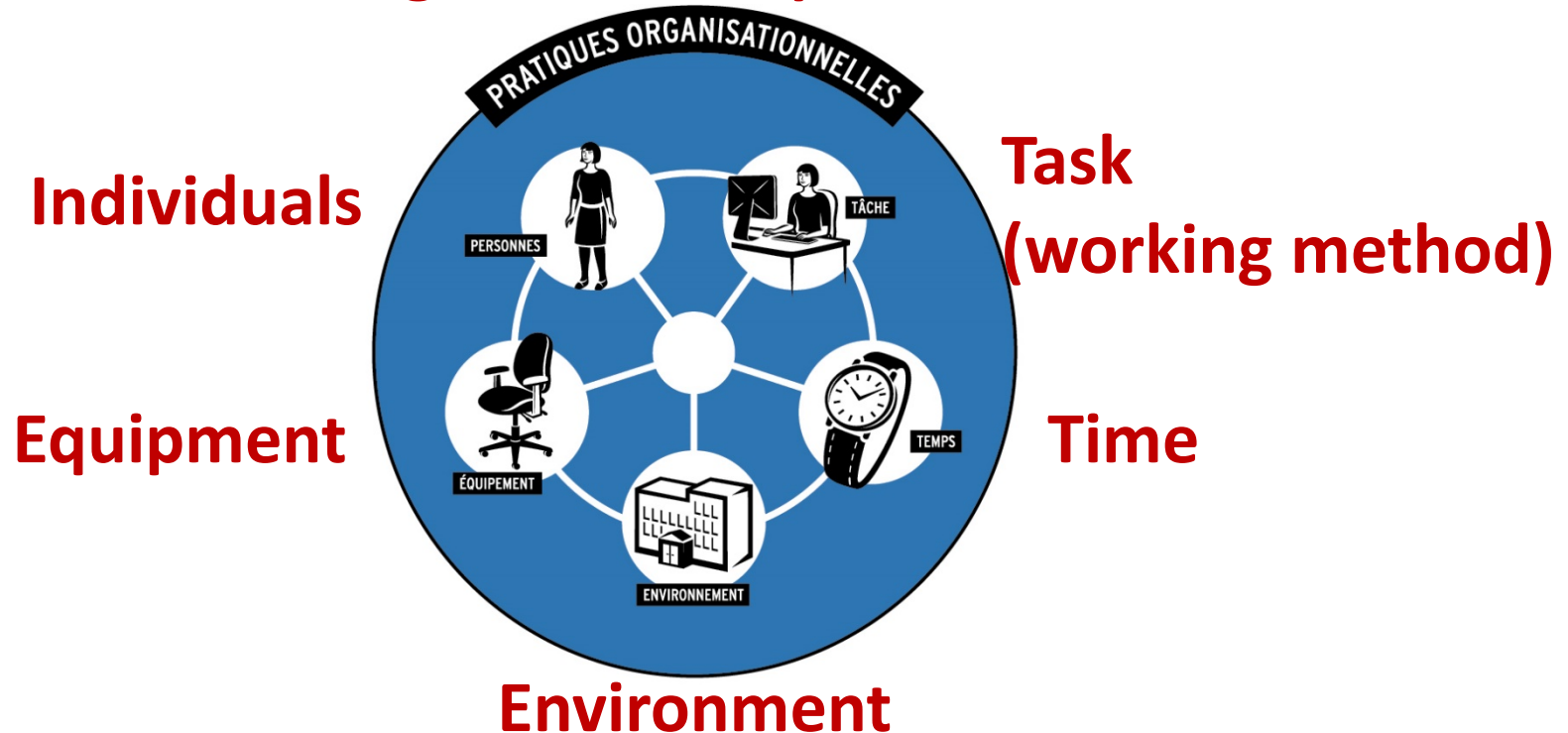
- Ergon (work)
- nomos (laws)

- Study of the components and interactions at work



Ergonomics considers all aspects of work and their relationships with each other *

Organizational practices



*ASSTSAS model

An ounce of prevention is worth a pound of cure

« Brush your teeth ... »

+

« Use dental floss ... »

=

Small gestures of prevention
to be done everyday

Same principles are applicable
in prevention of MSDs



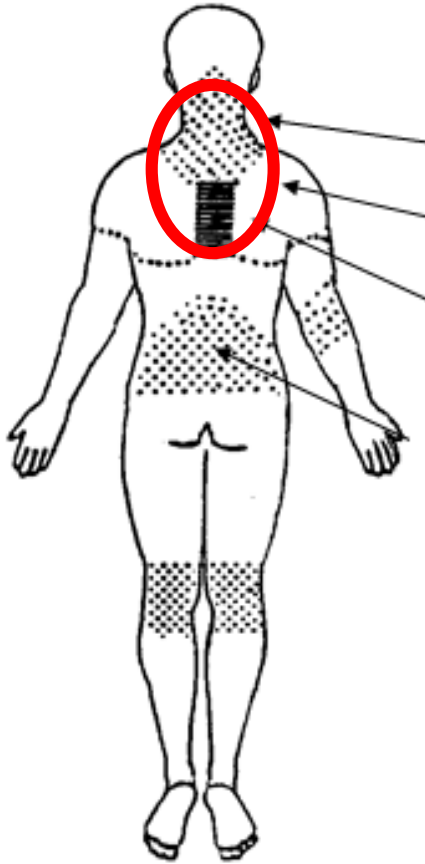
Testimony of a young dentist with 4 years of practice

*« Me, I have no problem,
I go to the chiro every week »*

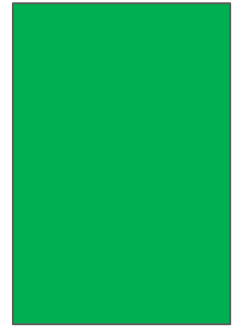


Poll 3 Question 1/2

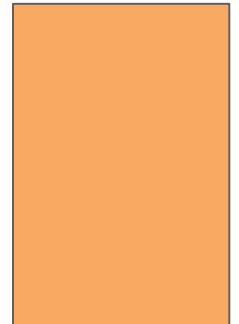
In the **past 12 months**, at the level of the **neck** and **upper back**, have you experienced



✓ Discomfort, pain

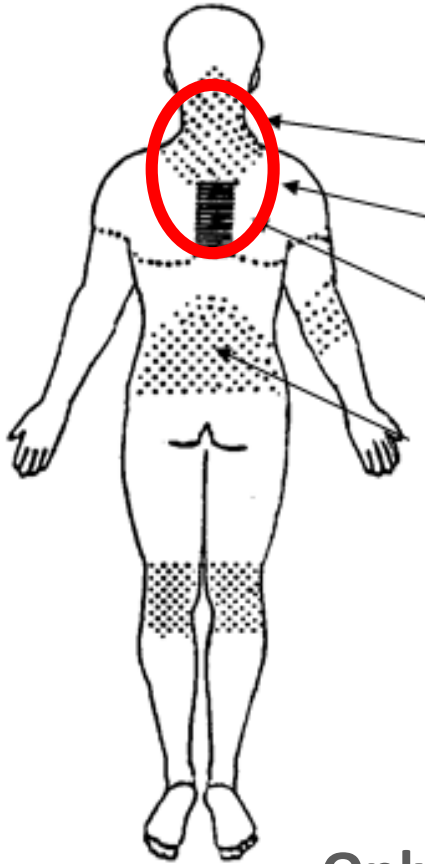


✓ “Serious pain” that “interfered with your usual activities”
(“serious and disturbing”)



Poll 3 - Question 2/2

If you lift the **orange card** for “serious” pain at the **neck** and **upper back** that “interfered with your usual activities”, indicate how often



✓ Never

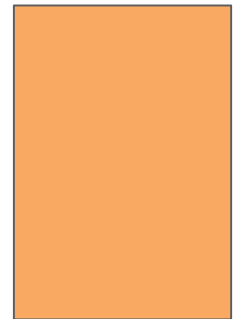
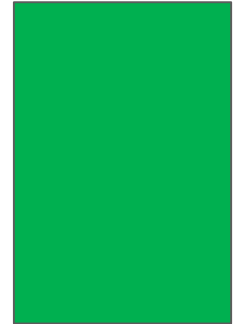
✓ Sometimes

✓ Quite often

✓ All the time

OR

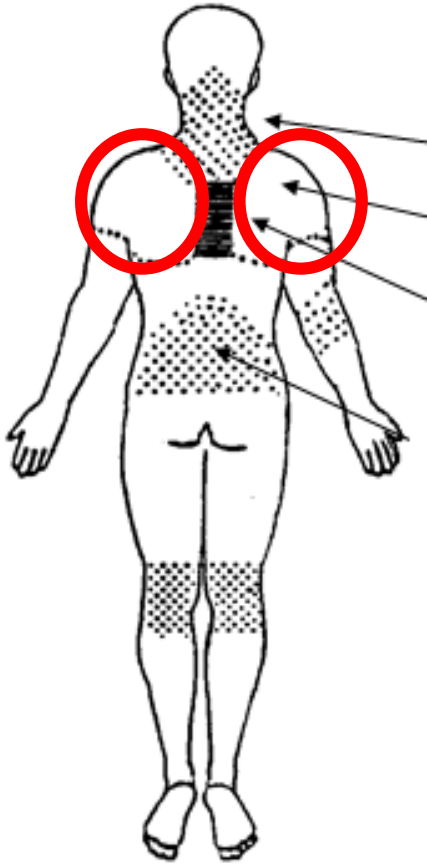
✓ If you received treatments?



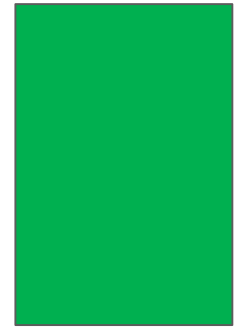
Only those 3 answers are selected for calculation and comparison of frequencies

Poll 3

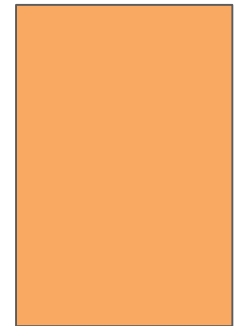
During the **past 12 months**, at the level of the **shoulders**, have you experienced



✓ Discomfort, pain

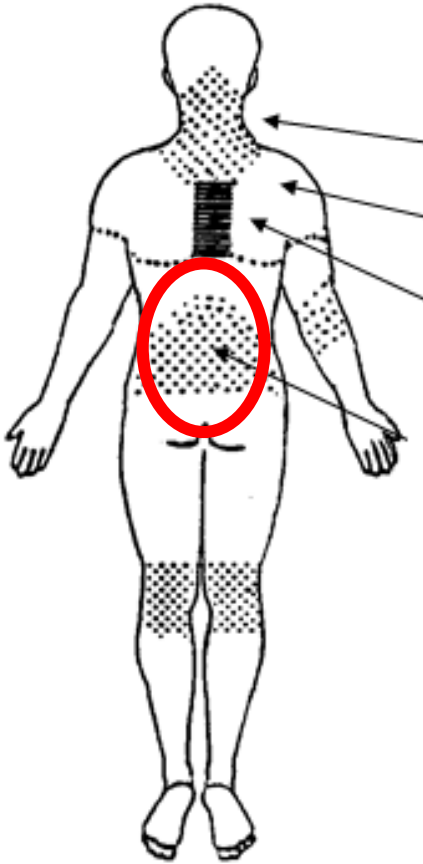


✓ Serious pain that interfered with your usual activities

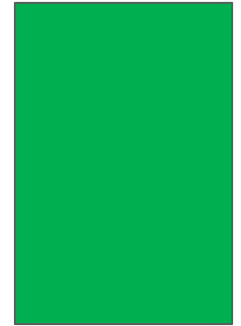


Poll 3

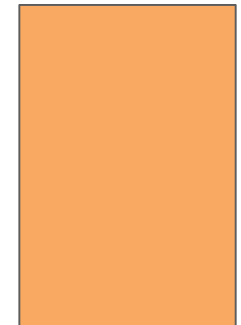
During the **past 12 months**, at the level of the **lower back**, have you experienced:



✓ Discomfort, pain

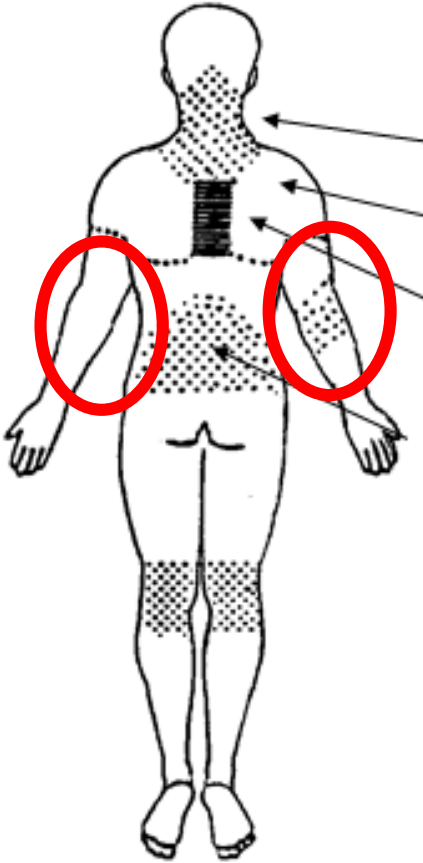


✓ Serious pain that interfered with your usual activities

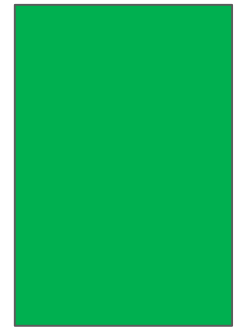


Poll 3

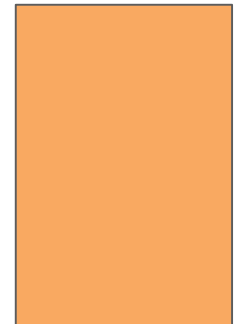
During the **past 12 months**, at the level of **your elbows**, have you experienced:



✓ Discomfort, pain

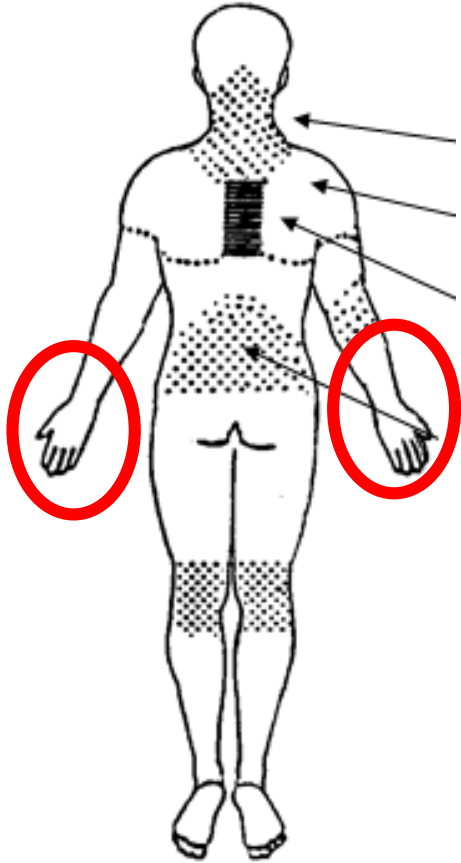


✓ Serious pain that interfered with your usual activities

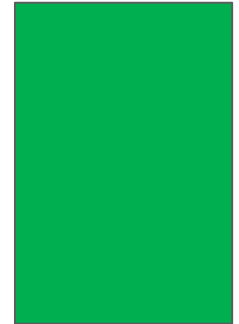


Poll 3

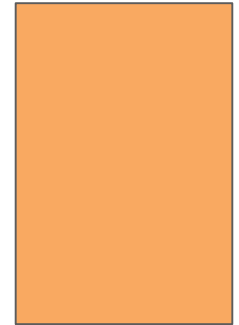
During the **past 12 months**, at the level of **your wrists and/or hands**, have you experienced:



✓ Discomfort, pain

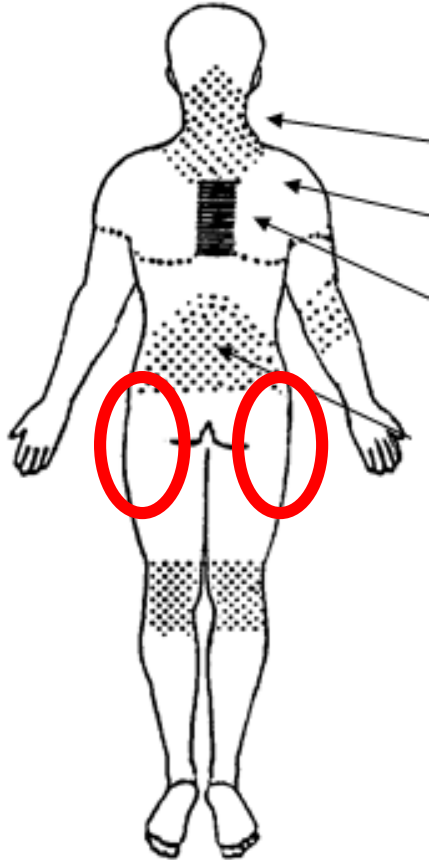


✓ Serious pain that interfered with your usual activities



Poll 3

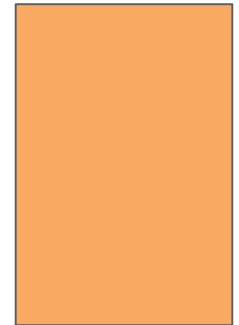
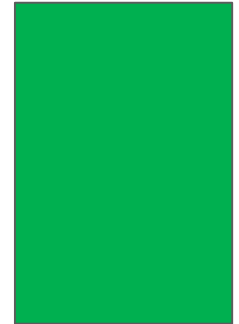
During the **past 12 months**, at the level of **your hips**, have you experienced:



✓ Discomfort, pain

✓ Serious pain that interfered with your usual activities

↓
“serious and disturbing pain”



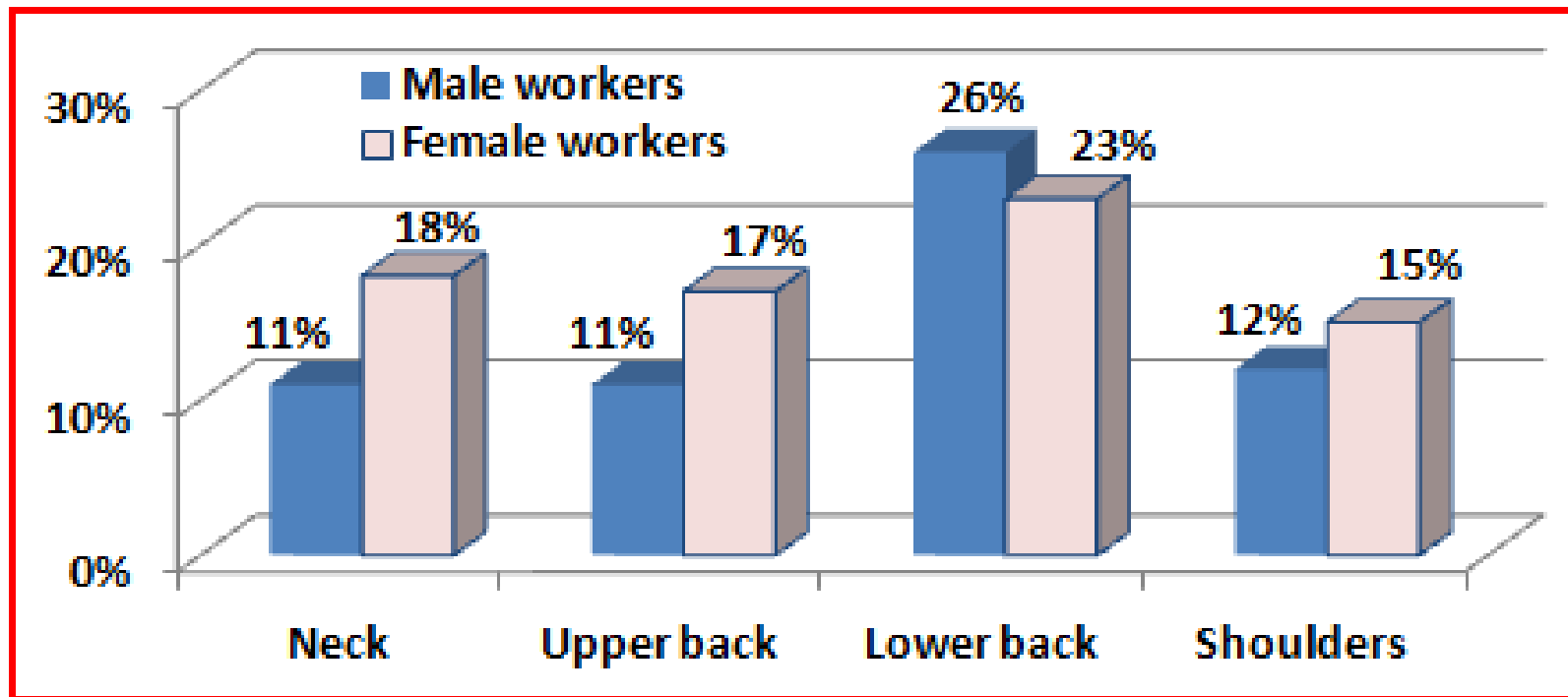
ALL respondents to the self-answered MDSs screening questionnaire in dental clinics. ACDQ Professional development courses, 2003-2004 (n = 644)

	Number	Average age
Male dentists	258	46
Female dentists	201	38
Hygienists	108	32
Dental assistants	77	37

Higher frequency of “*serious*” and “*disturbing pain*” than of other female workers in Quebec

- Self-answered standardize questionnaire, developed from Nordic questionnaire (Kuorinka)
- In 1998, same questionnaire was used by the *Institut de la statistique du Québec* for the *Enquête Sociale et de santé du Québec (ESSQ-1998)*
- Respondants in the province of Quebec who worked more than 15 hours/week:
 - 1 500 women
 - 1 900 men
- Are considered “positives” for serious and disturbing pain of frequencies of
 - “quite often” or
 - “all the time”

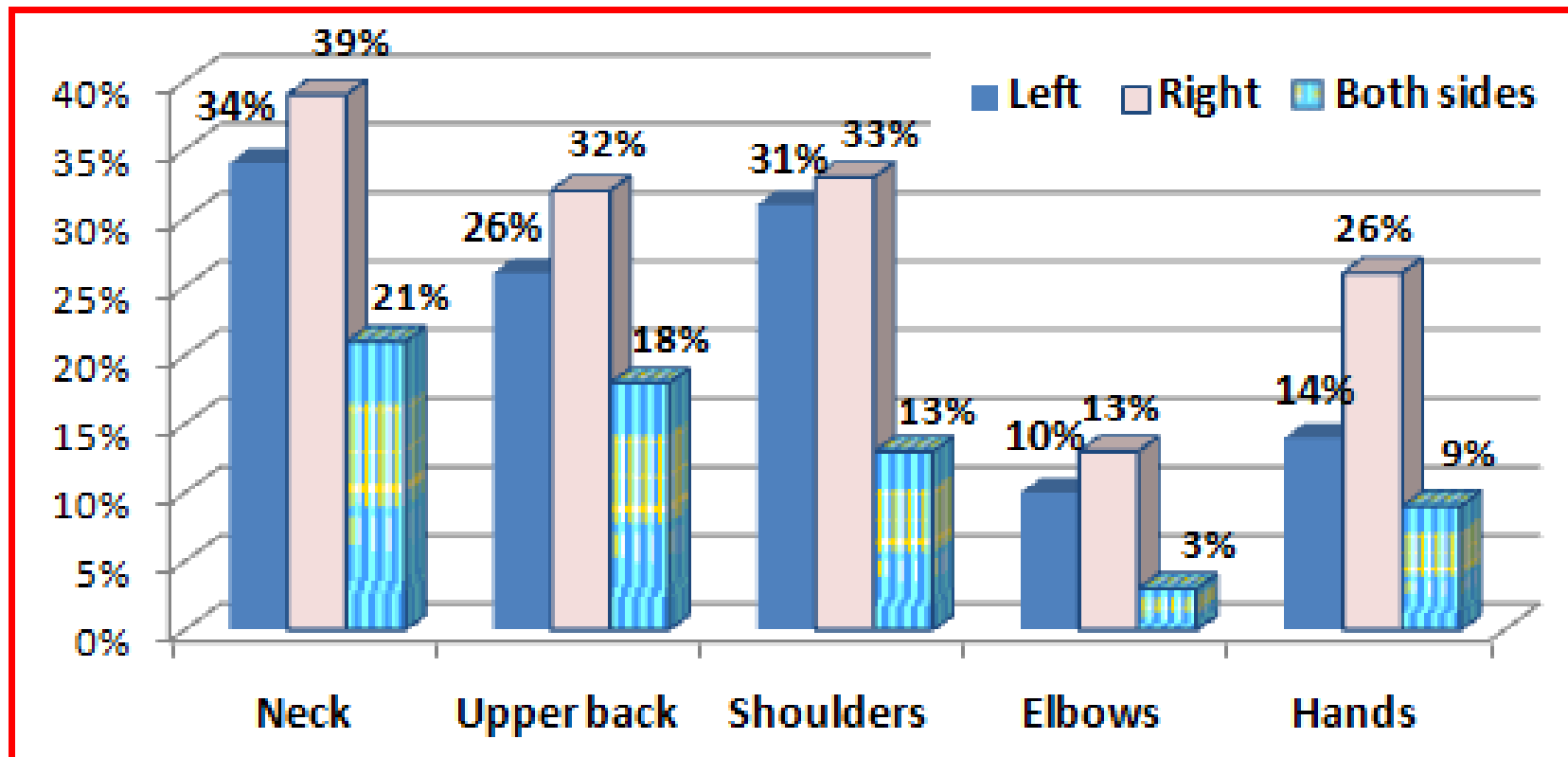
Frequency of serious and disturbing pain, « quite often » or « all the time », for Quebec workers of 15 years and older (1 500 women and 1 900men)



Except for lower back, female workers have higher frequencies, but less than 20%, for most body regions (QSHS- 1998)

Arcand et al, *Institut de la statistique du Québec*, 2001, p. 532, 545

% having serious and disturbing pains, according to side of the body affected, “quite often” or “all the time”
ALL: dentists, hygienists and assistants (n = 686)



1/3

1/3

1/3

1/10

1/4

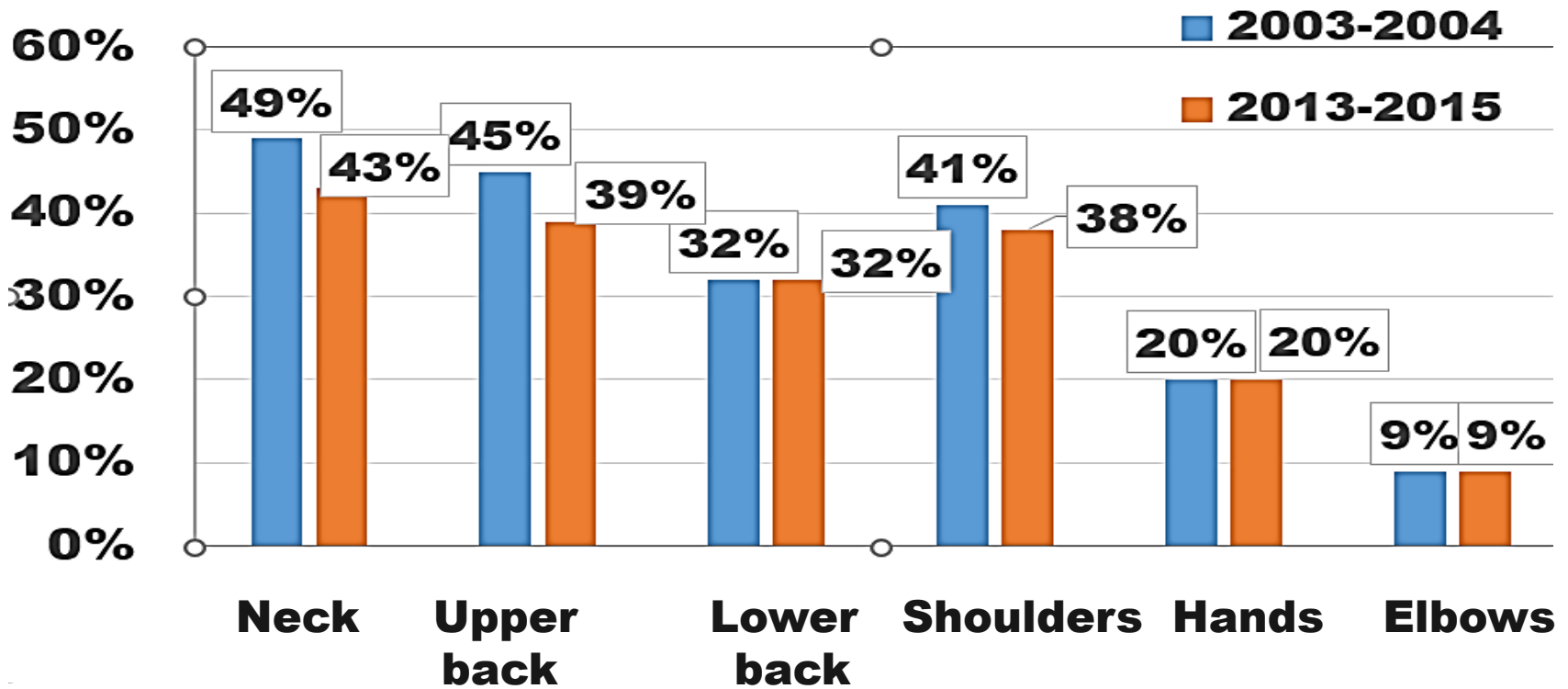
ALL have almost as much serious and disturbing pain on the **left side** (90% right-handed) as on the **right side**

- Left arm holds mirror, cheek or suction
- Left arm more static than the right arm because little change of instruments
- 1 in 5 have pain on both sides



HYGIENISTS having serious and disturbing pains "quite often" or "all the time"

Comparative 2003-2004* et 2013-2015



*Proteau, 2005, p. 14-20

ASSISTANTS having serious and disturbing pains "quite often " or "all the time" (Respondants : 2012, n = 52 , 2003-2004, n = 77)

2012 (International dental day (*Journées dentaires*))

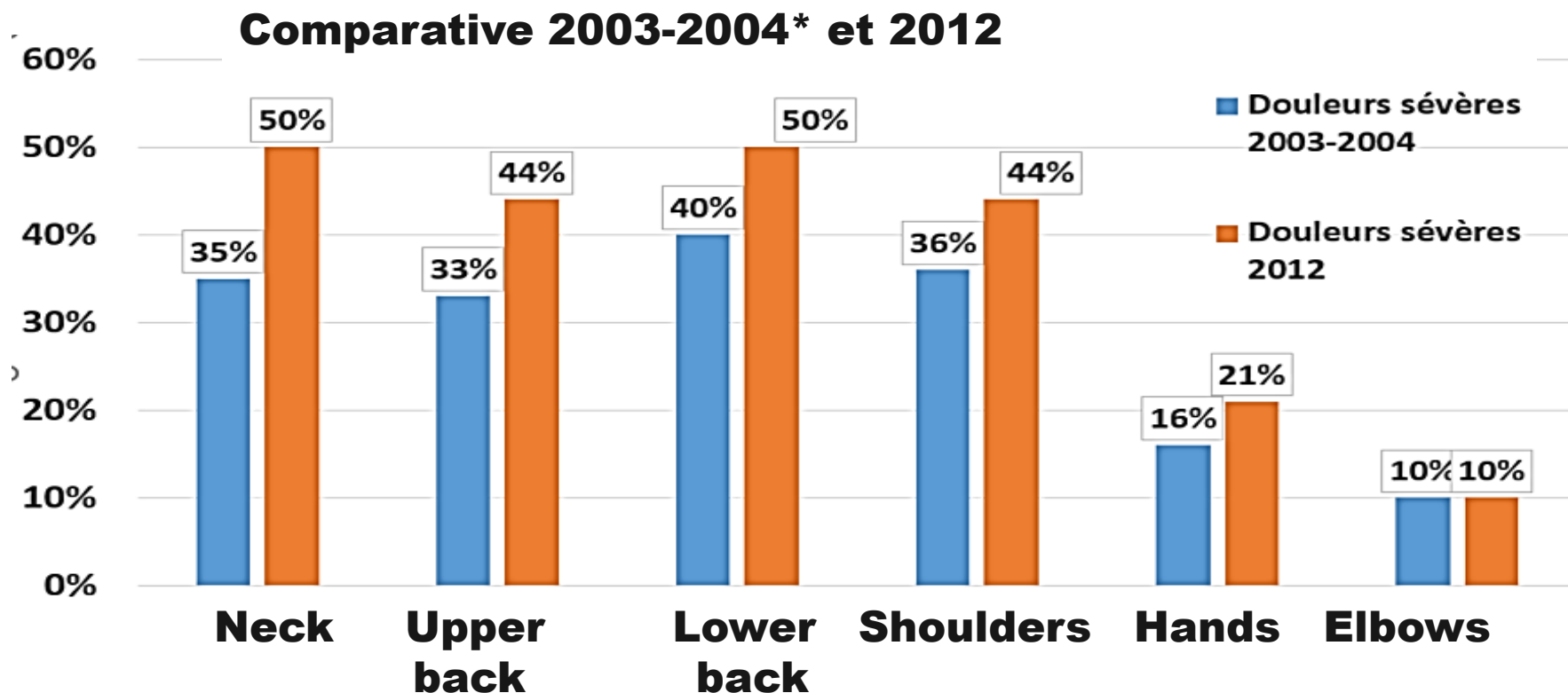
- Average age: 37 (min 19, max 57)
- Average years of expérience : 11 (min. 1, max. 32)
- Right-handed : 80 %

2003 – 2004 (ACDQ Professional development courses)



DENTAL ASSISTANTS

% having serious and disturbing pains
"quite often" or "all the time"»



2004 (n =77) et 2012 (n= 52)

*Proteau, 2005, p. 14-20

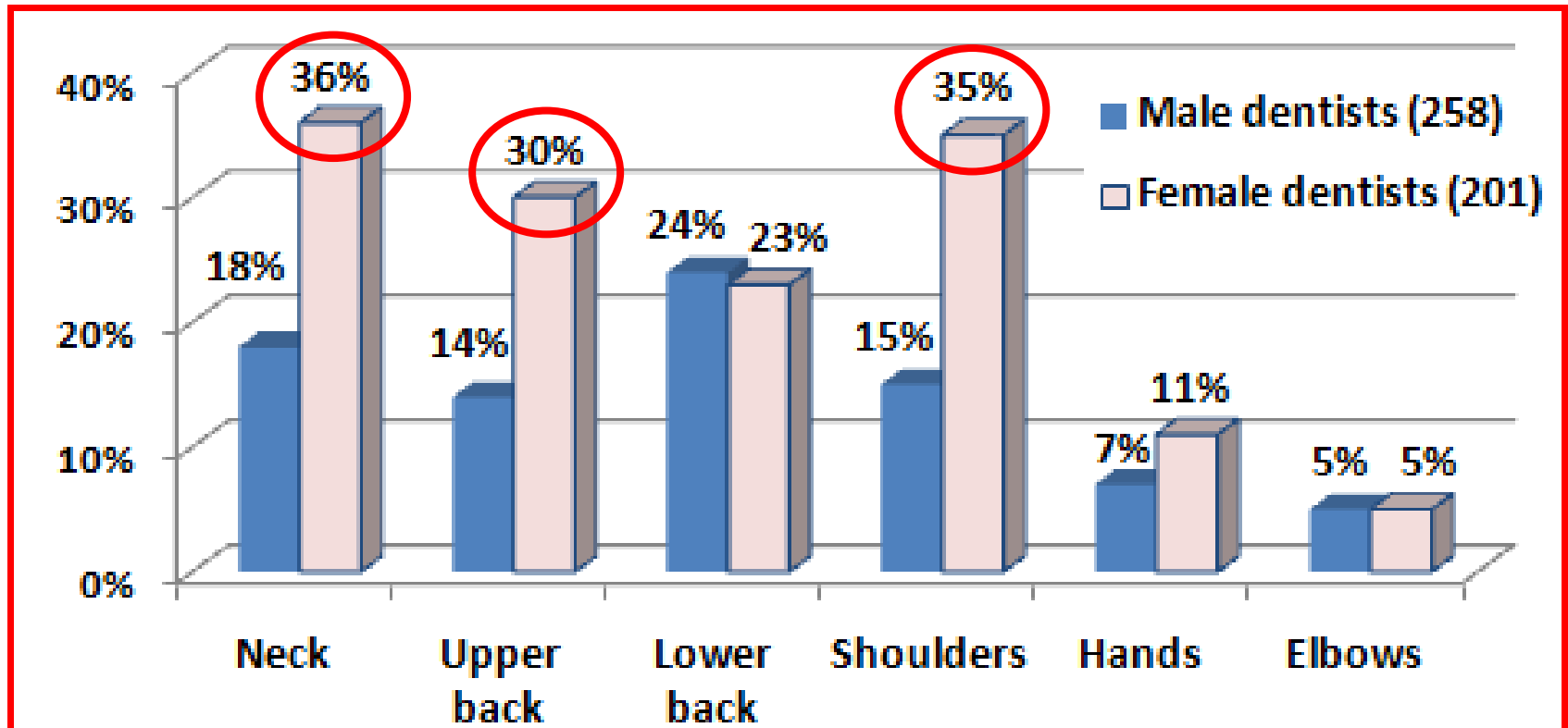
ASSISTANTS have the highest frequency of serious and disturbing lower back pain "quite often" or "all the time"» (40%)



They are **twisted in the neck and back** for long periods of time if they have no space to place their legs under the backrest of the patient's chair

DENTISTS

% having frequent serious and disrupting pains
(n = 258 men and 201 women)

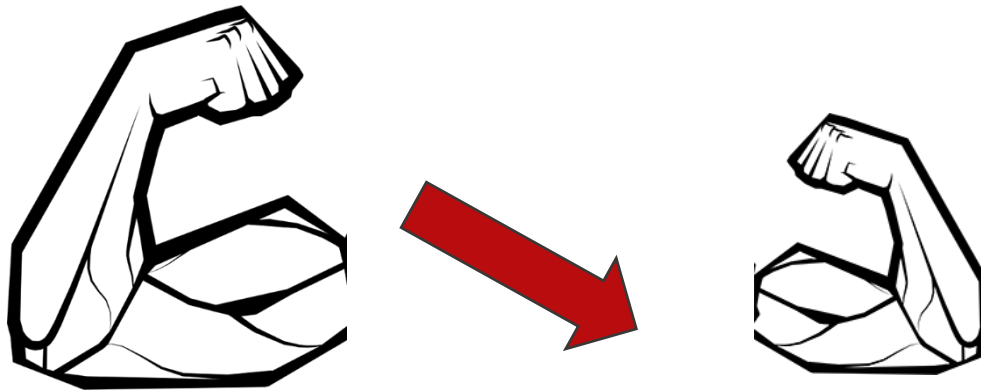


For the same job, female dentists have 2 times more pain

*Proteau, 2005, p. 14-20

Why do female dentists have more pain?

- In a woman, the average muscle strength of the trunk and upper limb muscles varies **between 1/2 and 2/3 of that of a man**



- So women are more vulnerable to static contractions of trunk and upper limb muscles



Measurement of muscular activity by electromyography (EMG)



Maximum effort tests for each muscle evaluated



- Surface electrodes are placed on the muscles to be evaluated
- The activity of each muscle is measured while working
- Before or after, each person makes maximum efforts for each muscle assessed



The efforts for each muscle are calculated based on the percentage of Maximum Voluntary Contraction (%MVC)

EMG value measured
during work

$$\%MVC = \frac{\text{EMG value measured during work}}{\text{EMG value measured during maximum effort tests}} \times 100$$

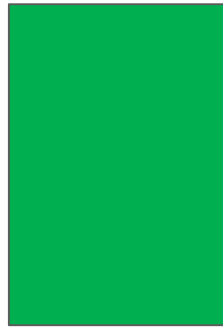
EMG value measured
during maximum effort tests



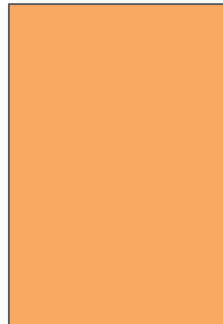
Poll 4

What is the safe value of percentage of Maximum Voluntary Contraction (%MVC) for static muscle contractions?

■ 5 %



■ 10 %



Poll 4 – Answer

Safe thresholds of % of muscle use (%MVC) in static posture <5%*

> 5 %*	<ul style="list-style-type: none">↘ Circulation of blood in the muscles↘ Oxygen in the muscle↗ Lactic acid and waste
> 10 %	<p>Lack of oxygen in the muscles Accumulation of waste</p>

- With a lower maximum force (2/3) than that of men, the 10% threshold is more easily reached by women

*Bjorksten et Jonsson, 1977, p. 23-27

Results of research with EMG, muscular contractions of trapezius superior of 10 hygienists, in real work

- EMG measurements of left and right upper trapezius (upper back) during 72 cleaning treatments
- Without elbow support, they work at **10% of their maximum strength**
- With mobile elbow supports, they work near **5% of their maximum force**

5% of maximum muscle strength
=
safe value



Decrease in muscle strength with age

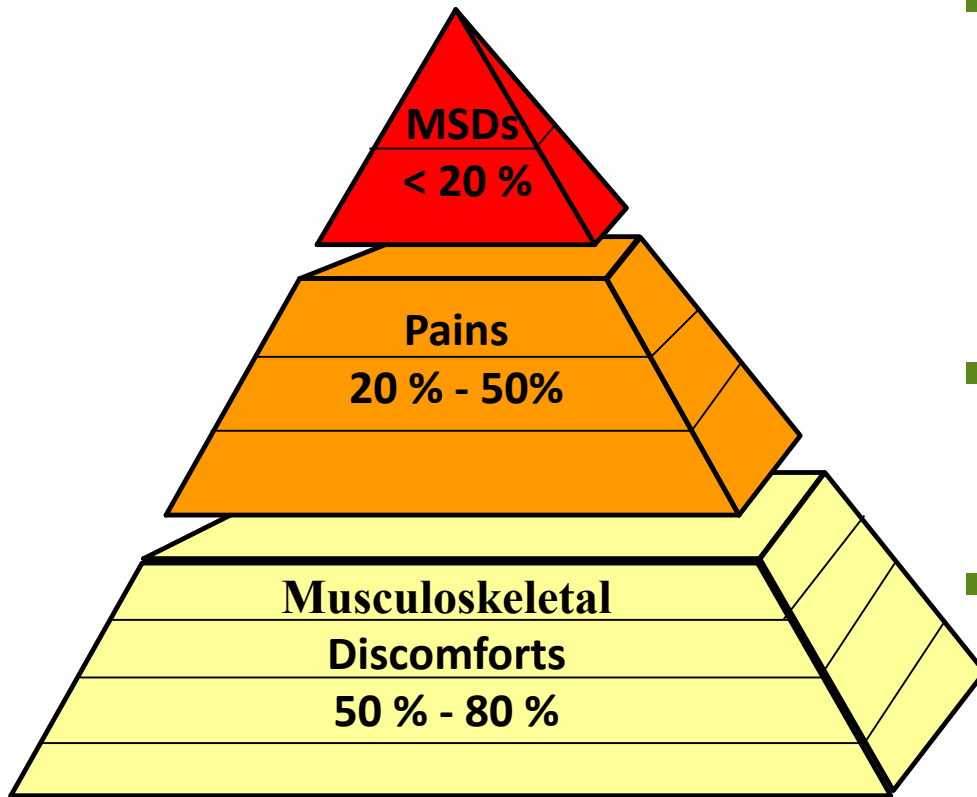
Between 40 and 65 years

↘ Volume and number of muscle fibers

↘ 25% of muscular strength



Pyramid of the evolution of pain in the absence of prevention

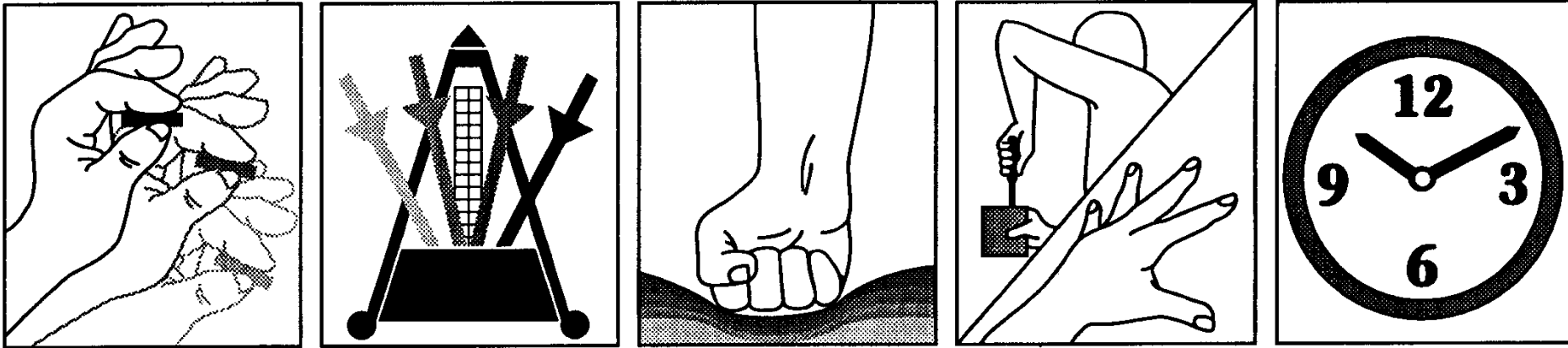


- **At the top** of the pyramid, percentage of workers affected by MSDs (*tip of a iceberg*)
- **In the middle**, discomfort have developed into pain
- **At the base**, discomforts affecting a large number of people but does not keep them from working

2. RISK FACTORS FOR MUSCULOSKELETAL DISORDERS (MSDs)



Strain combinations



Repetition + Tempo + Force + Awkward positions + Inadequate rest

+ Static loading + Local pressure (contact stress)

The influence of each one of these factors depends on their frequency, intensity and how long they are present



How to evaluate risk factors ?

**Risk
factors**

X

- **Duration**
- **Intensity**
- **Frequency**

=

**Physical
demand**

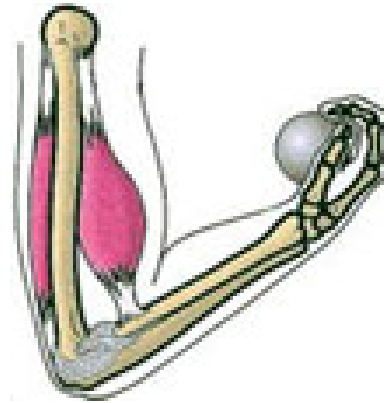


Poll 5

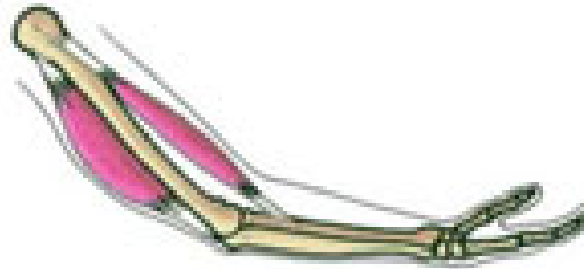
The movements are made thanks to the contraction of the muscles.

When does the blood nourish the muscle?

- During the contraction

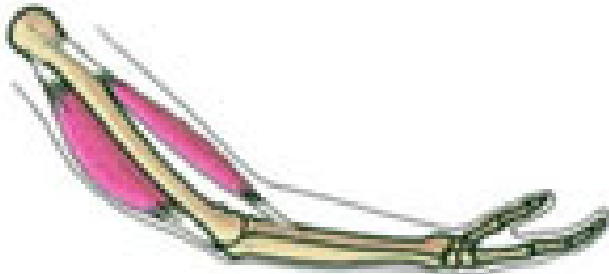
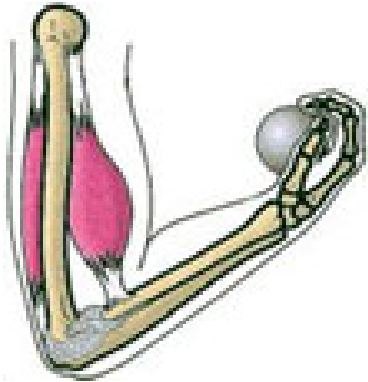


- During the relaxation



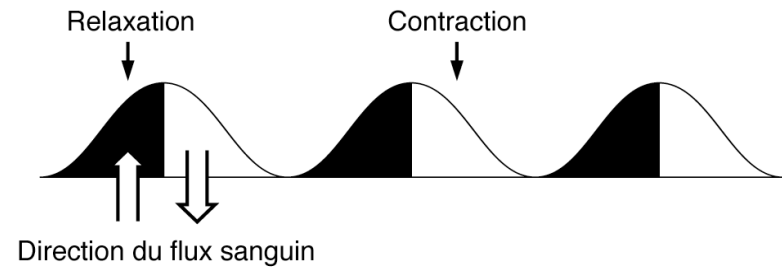
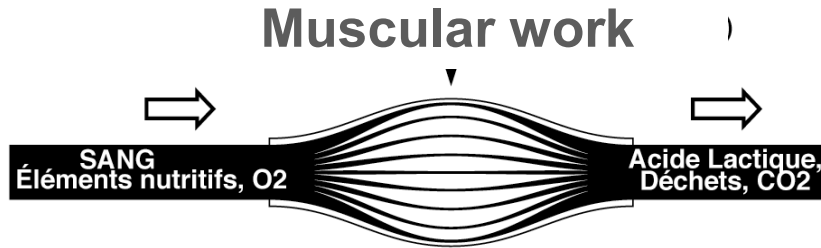
Poll 5 - Answer

The blood feeds the muscles mainly during active movements



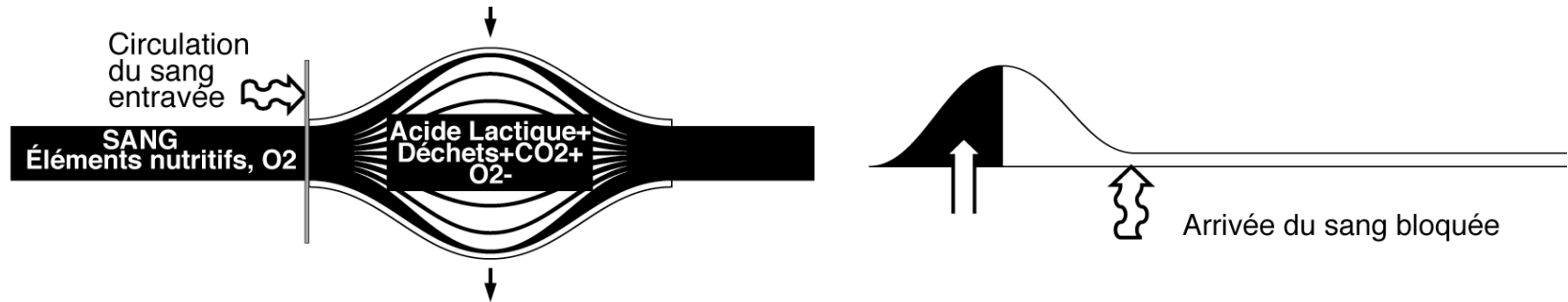
- More during the relaxation
- But it is especially when there is **alternation between**
 - Contraction
 - Relaxation (rest)

Dynamic effort: blood circulation



- The blood comes in with the nutrients and oxygen
- Blood leaves with waste and carbon dioxide (CO₂)
- **The alternation** between contraction and rest acts as a pump that promotes the entry and exit of blood from the muscle

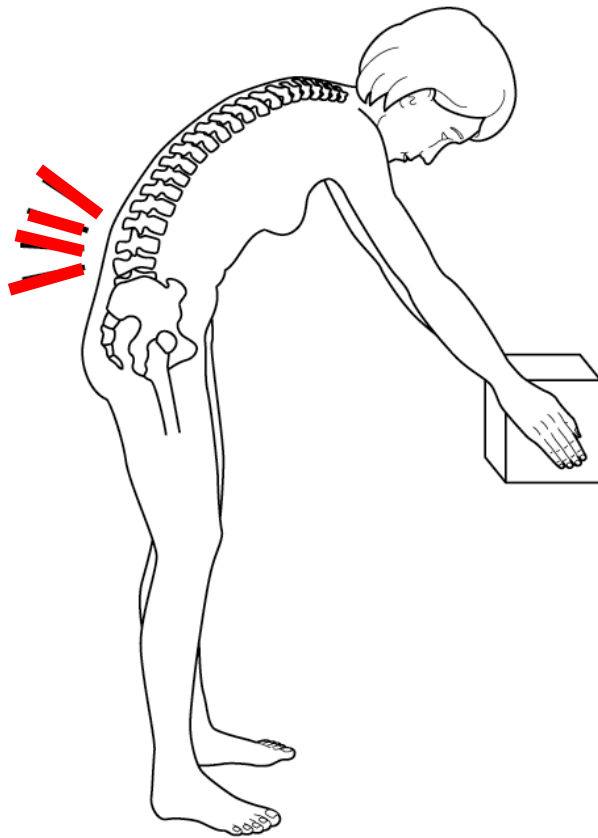
Sustained posture = "Static" muscular efforts



- The entry of blood into the muscle is blocked in part or totally
 - ➔ oxygen in the blood
 - ➔ lactic acid and other waste that accumulates
- Consequences
 - Feeling tired, difficulty moving, pain
 - ➔ concentration lactic acid ➔ risks of calcifications

Poll 6

What is the percentage of each part of the body weight?



- **Head**

9%

18%

- **2 arms**

11%

22%

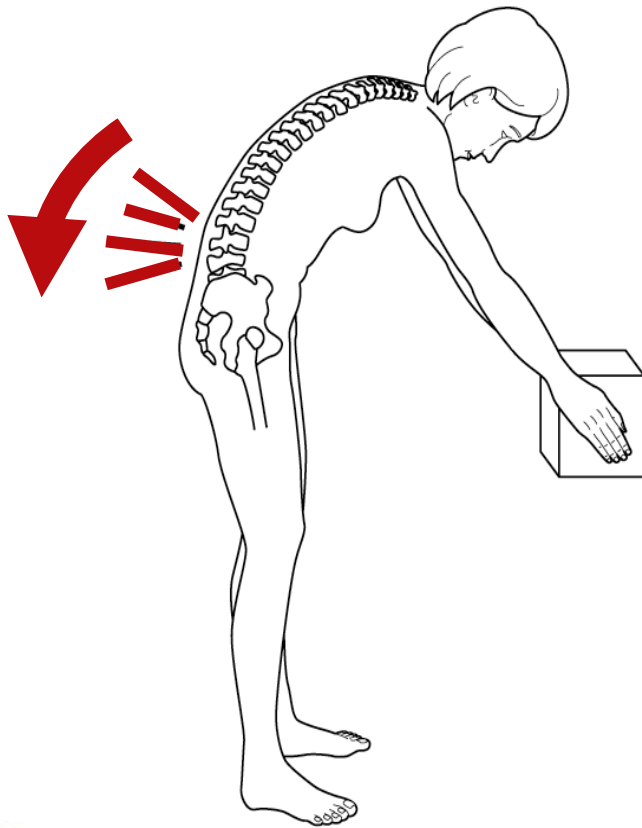
- **Trunk**

45%

55%

Poll 6 - Answer

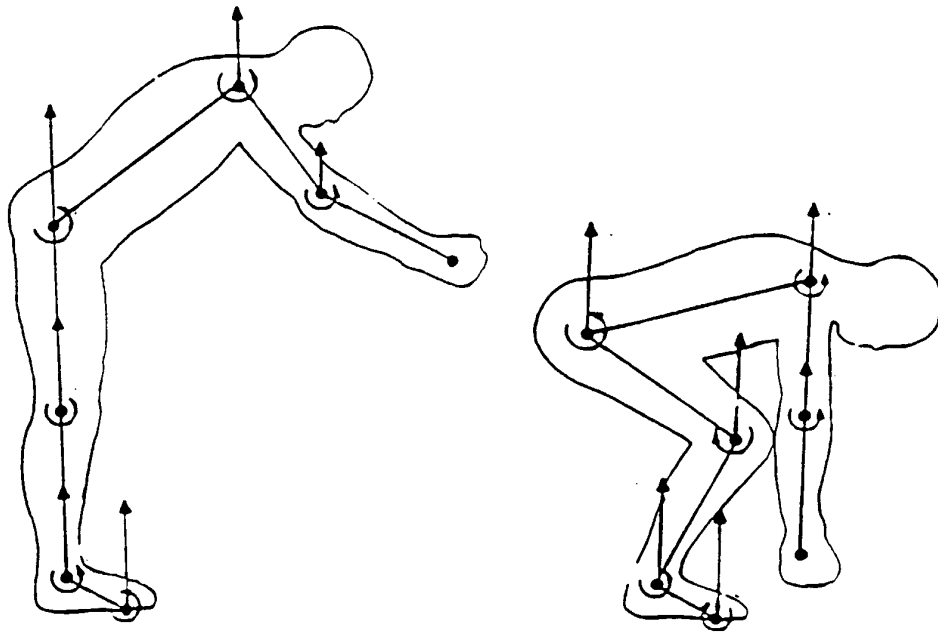
Lower back contracts to keep the trunk tilted forward



- Head 9 %
- 2 arms 11 %
- Trunk 46 %

Body weight above waist =
at least **50 % of total weight**

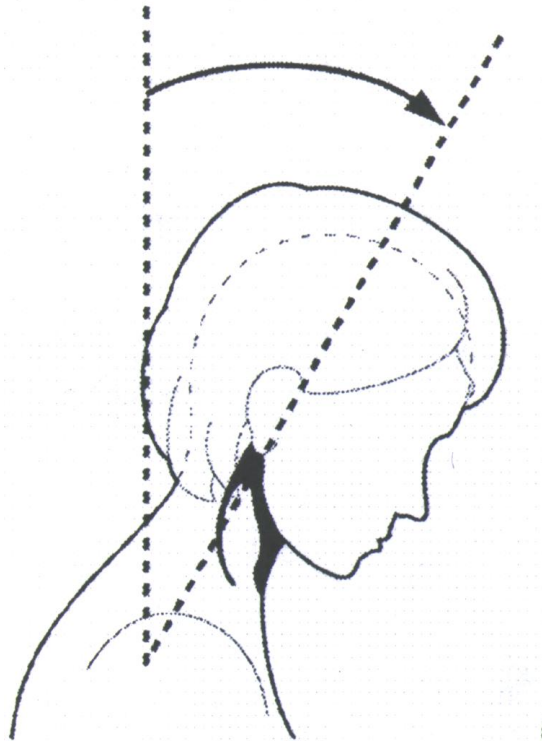
Forces of muscles to counter gravity in the joints



Muscles and tendons
of each segment
must pull in opposite
direction of the gravity
that draws its weight
to the ground

Poll 7

When my head is leaning forward, at what angle of flexion are the muscles of my neck and upper back starting to be contracted?



14°



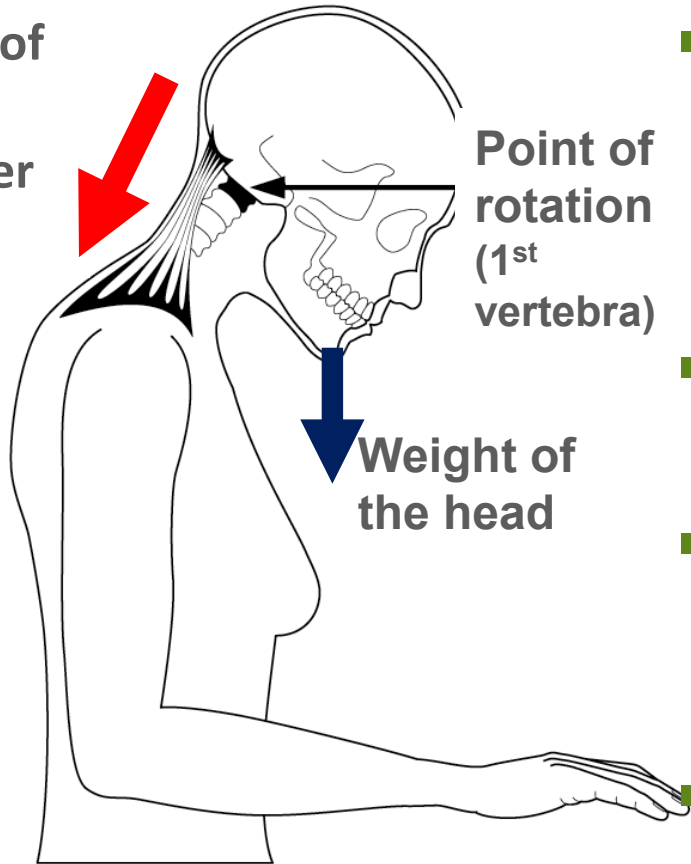
30°



Poll 7 - Answer

Point of rotation of the head

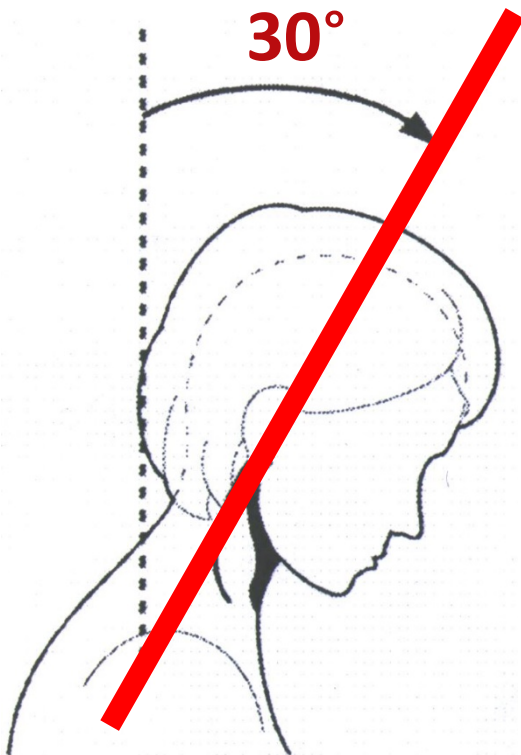
Muscles of the neck and upper back



- When my head tilts, the muscles in my neck and upper back are contracted from a 14° angle
- The point of rotation is the 1st cervical vertebra
- The weight of the head (9% of the body) causes it to be pulled downward
- The muscles at the back of the neck contract to retain the head

Adaptation de Rodgers *et al.*, 1986, p. 125

Neck angles at risk for dentists



- Duration of postures at risk

Angles	Durations
> 15°	> 75 %

- Time assessment of postures at risk for dentists

Angles	Durations
> 15°	> 97 %
> 30°	> 82 %

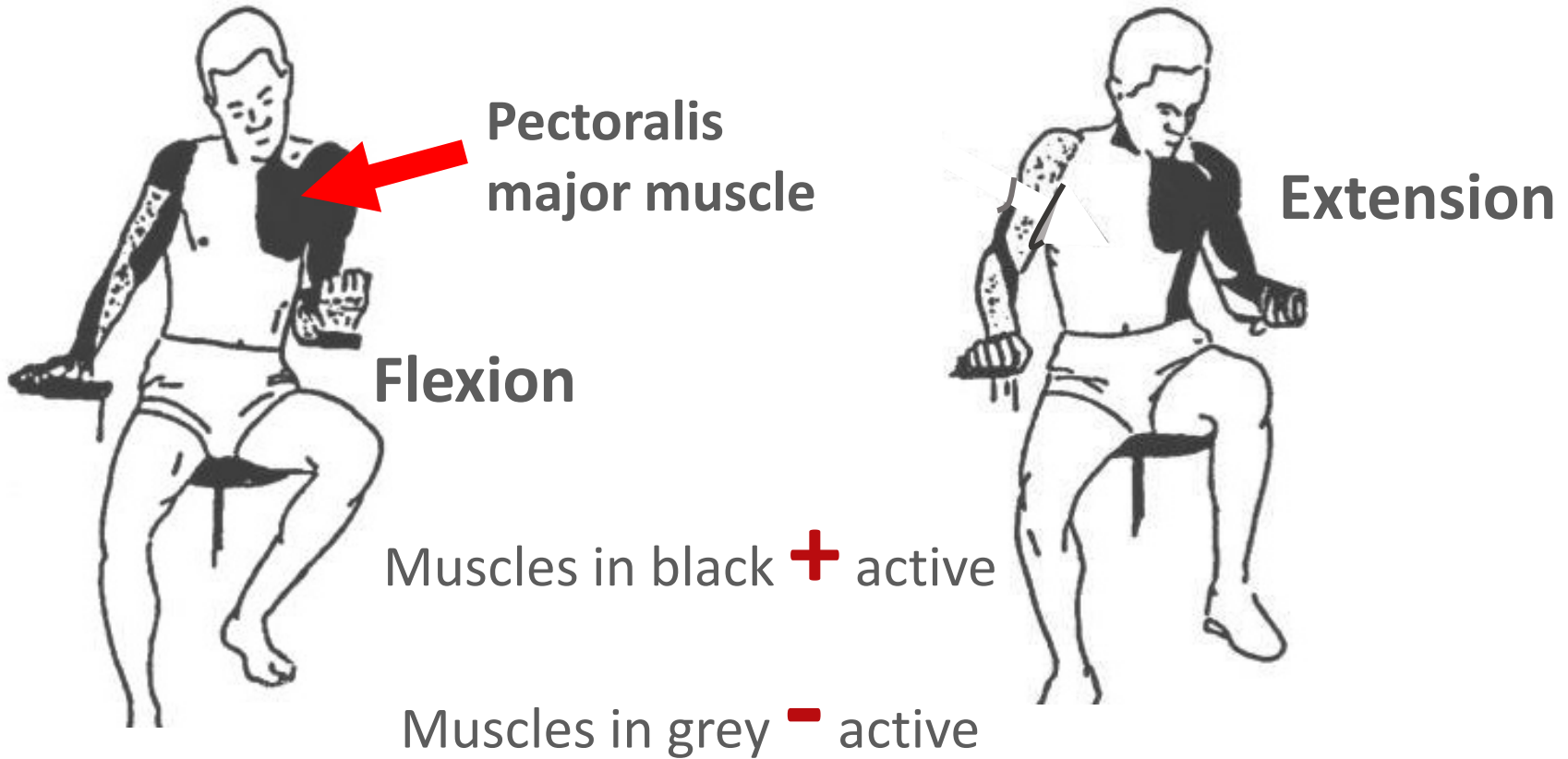


Risky postures with leaning neck and back*

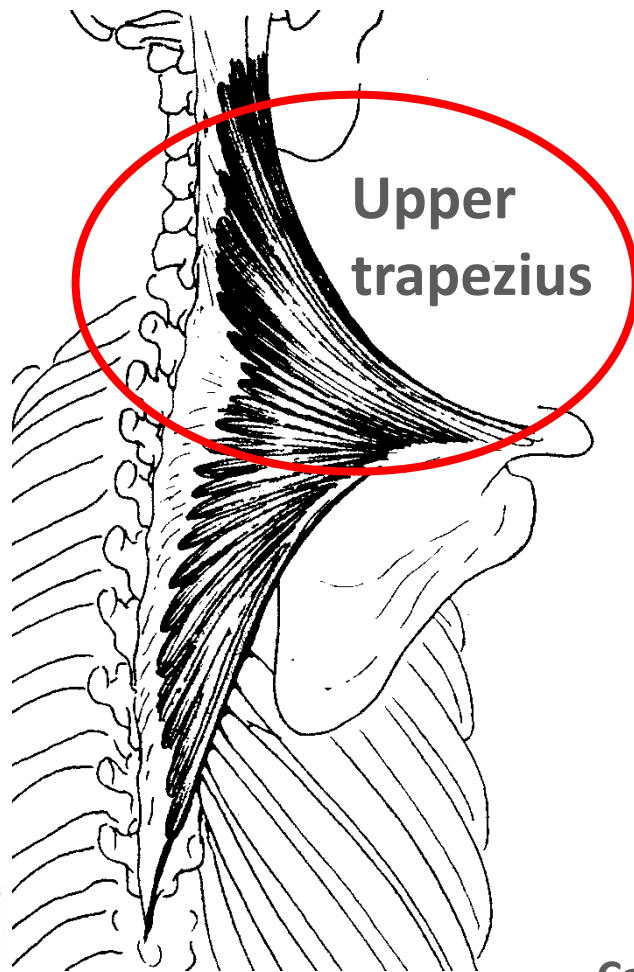


- Work with your neck or back tilted by more than 30°
- Without support or ability to vary posture
- More than 2 hours a day in total

Muscles involved when bending and extending the hand

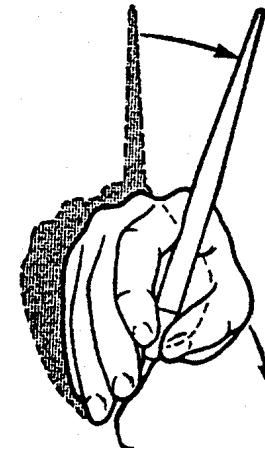
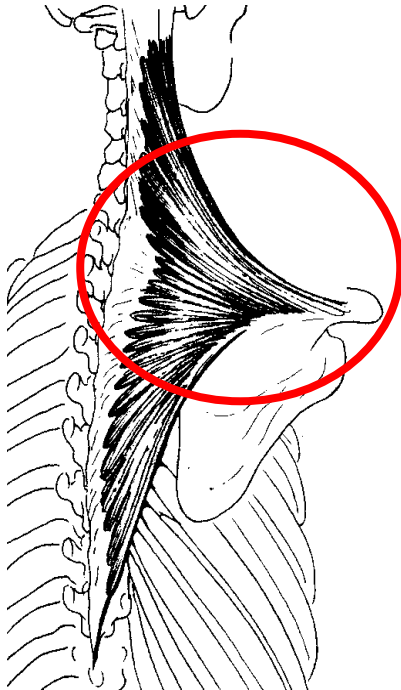


The upper trapezius supports the arm and the head (upper back)



- It stabilizes the scapular belt
- He supports both
 - The head
 - The arm on the same side

Role of the upper trapezius



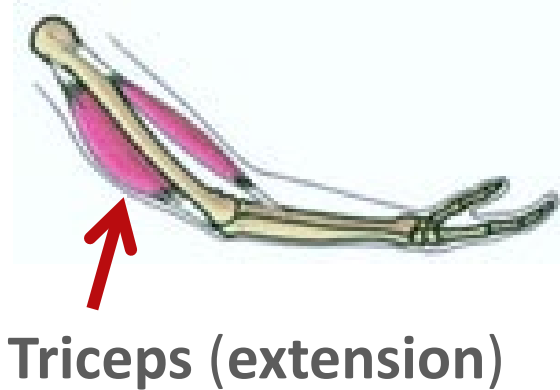
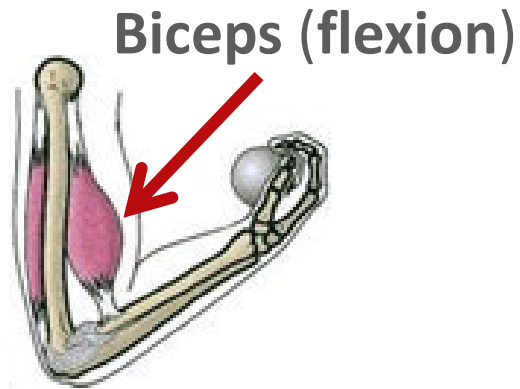
Contraction of the shoulders and upper back (upper trapezius) ensures the accuracy of hand gestures

Maintain static postures to perform a precision activity



- Postural stiffness of the muscles of the scapular girdle, contracted in order to :
 - Ensure the precision of gestures
 - Keep contact with the tooth

Co-contractions of opposite (*antagonist*) muscles during precision tasks



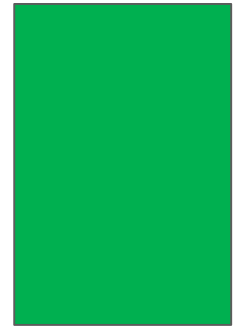
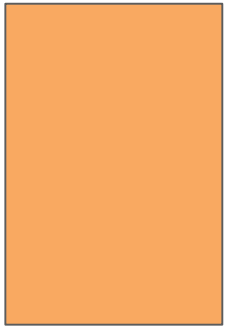
- The **biceps** contract to initiate the the movement **of flexion** of the elbow
- Almost immediately, the **triceps** (antagonists) contract to initiate a movement **of extension** and prevent too big of a flexion
- For fine movements, those small contractions are repeated during each movement

3. RISKY POSTURES FOR THE NECK AND BACK OF THE DENTIST AND THE HYGIENIST



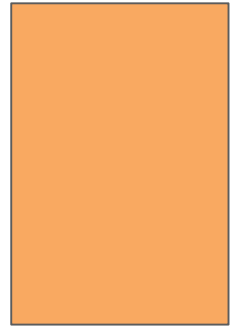
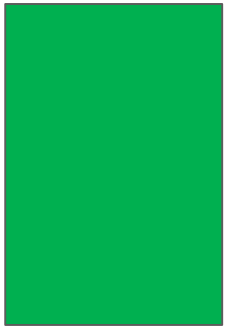
Poll 8

What position does your posture look like?



Poll 8

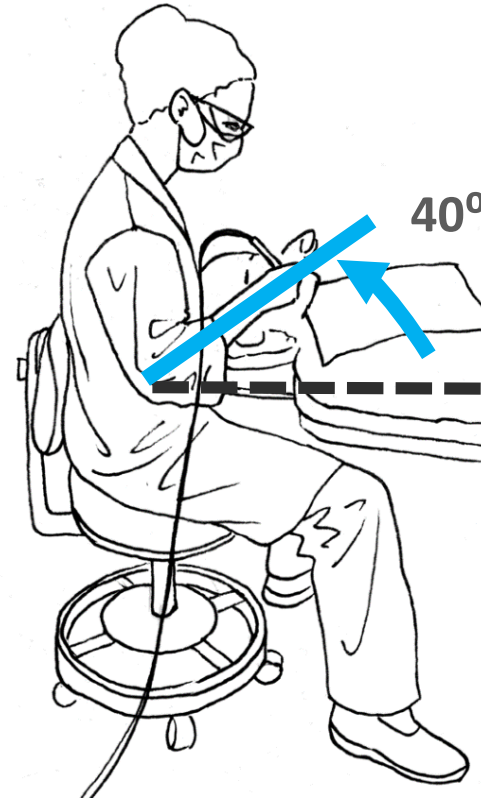
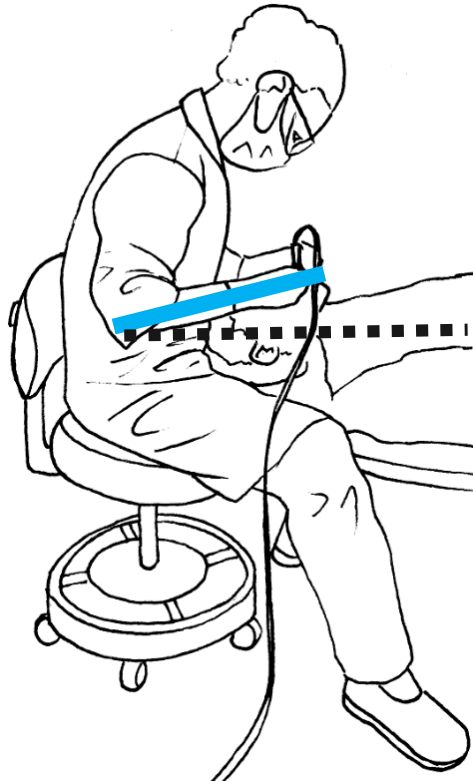
What do you think is the most ergonomic position?



What are the differences between the 2 postures?



Differences: the patient's chair is higher

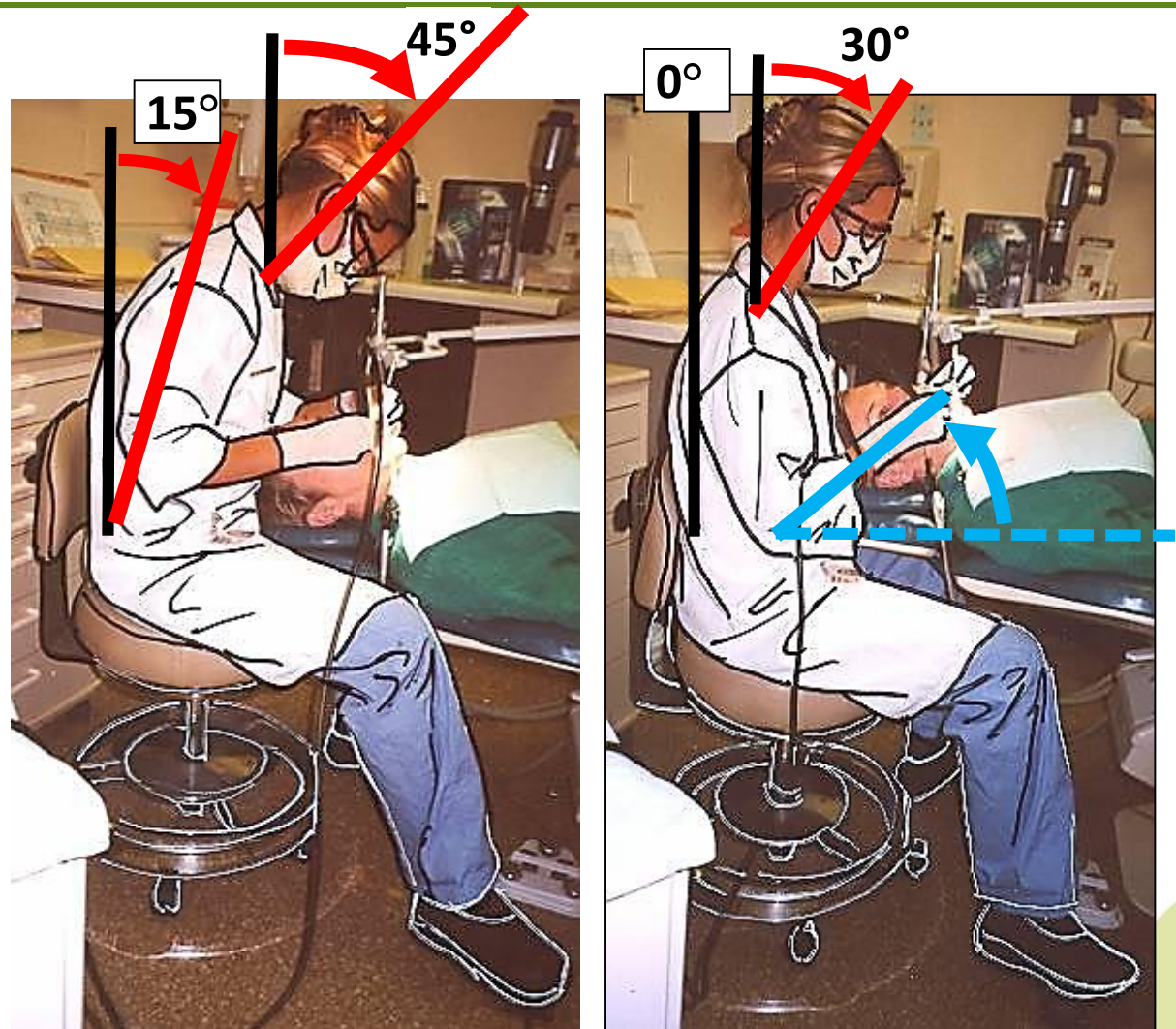


- Forearms are raised at 40°

Impacts of the change of height of the patient

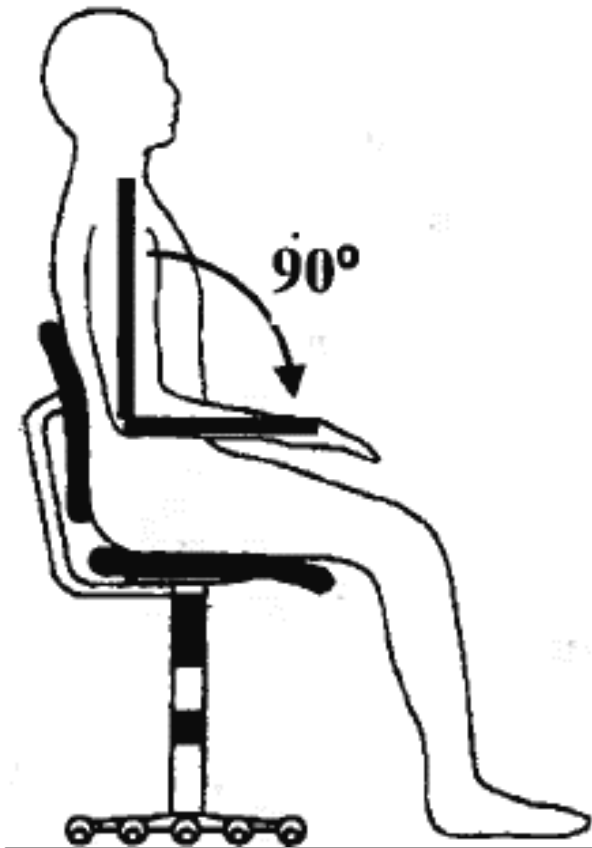
Raising the patient's chair allows

- neck flexion from 45° to 30°
- trunk flexion from 15° to 0°



Do your postures look like the "ideal" theoretical position?

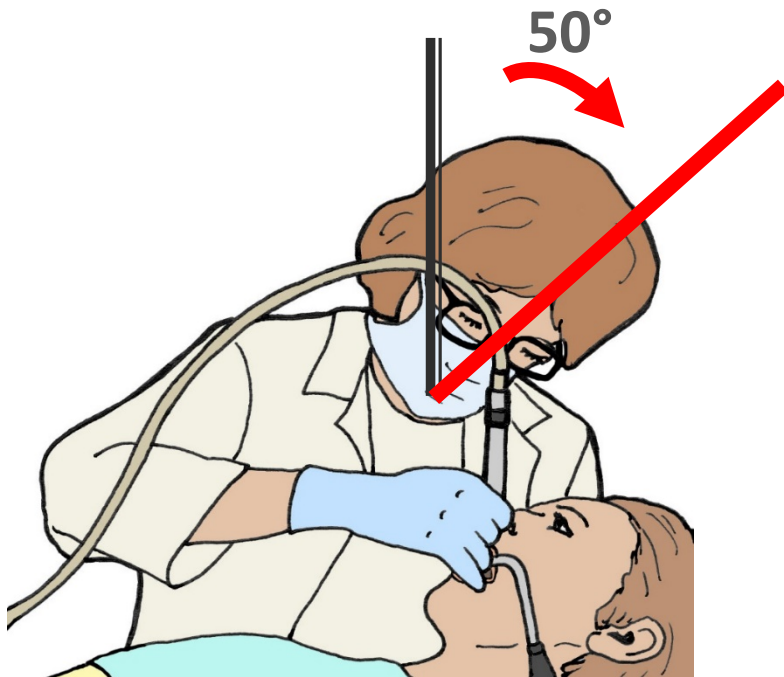
Rule of 90° at the elbow



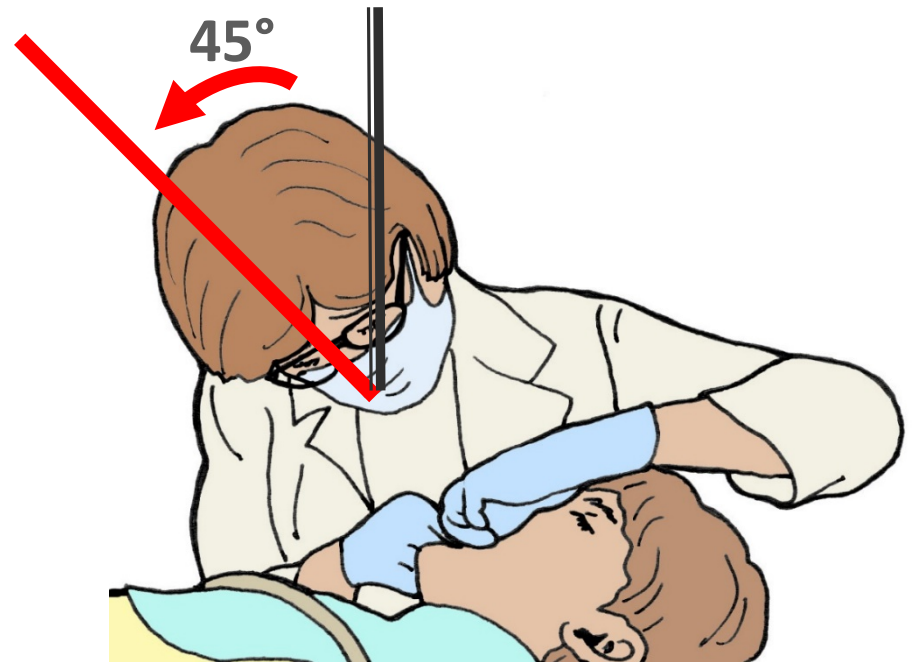
Hedge, 1998, p. 361

Observed postures at the side of the patient's head

Frequent front and side flexions of the neck



Right arm above
the patient's chest



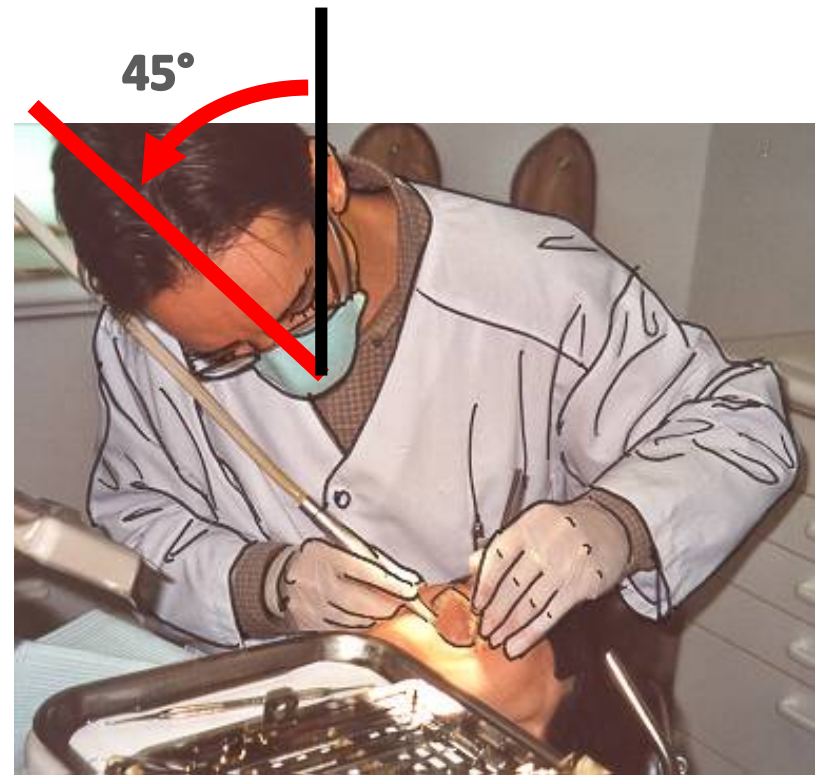
Left arm above
the patient's head



Dentist's postures often observed



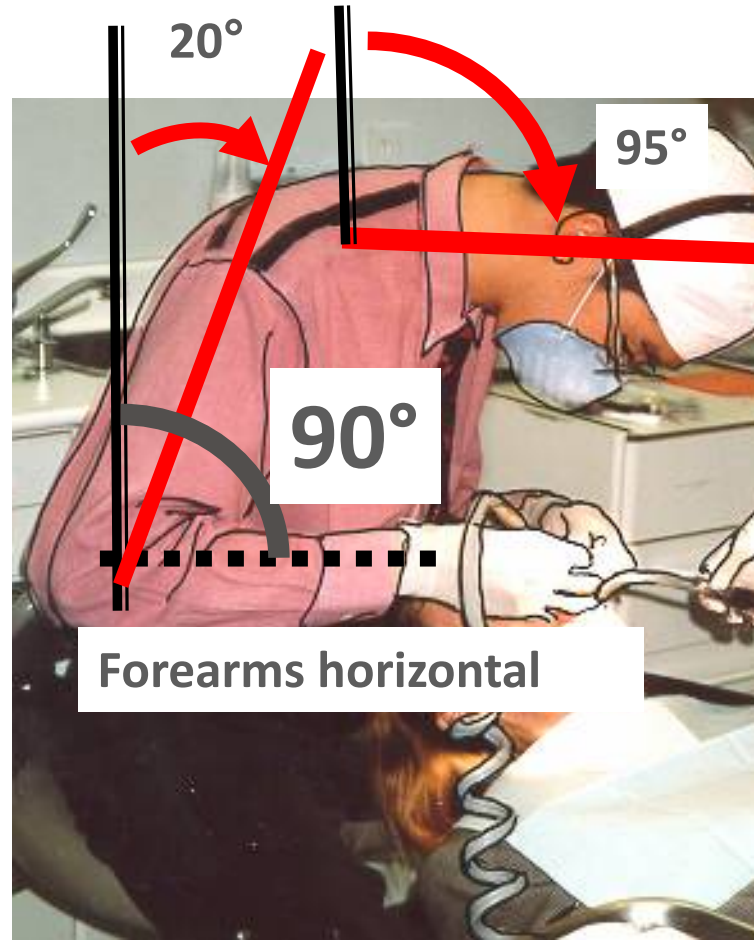
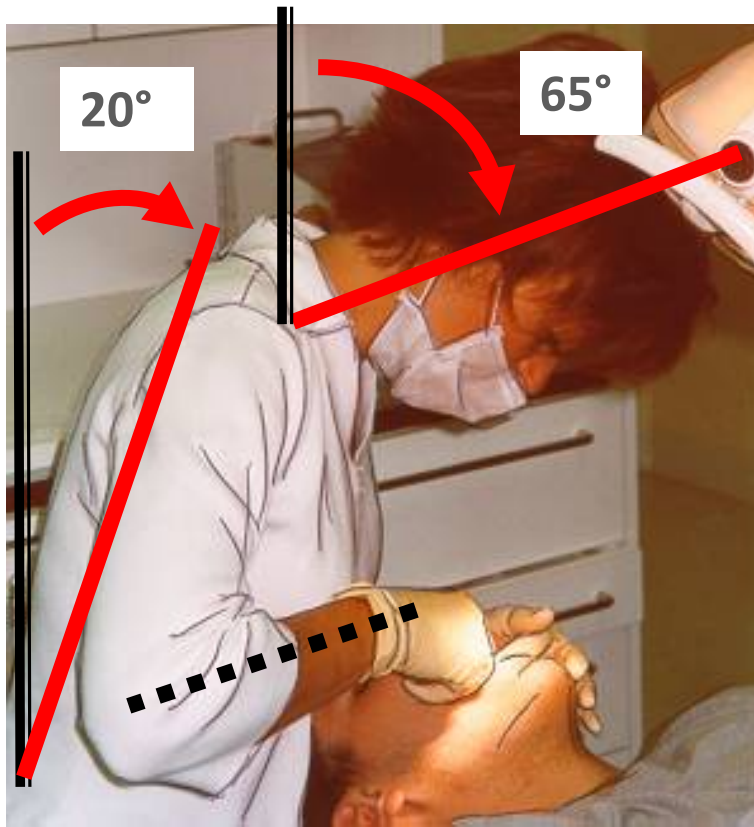
- Forward bending of the head



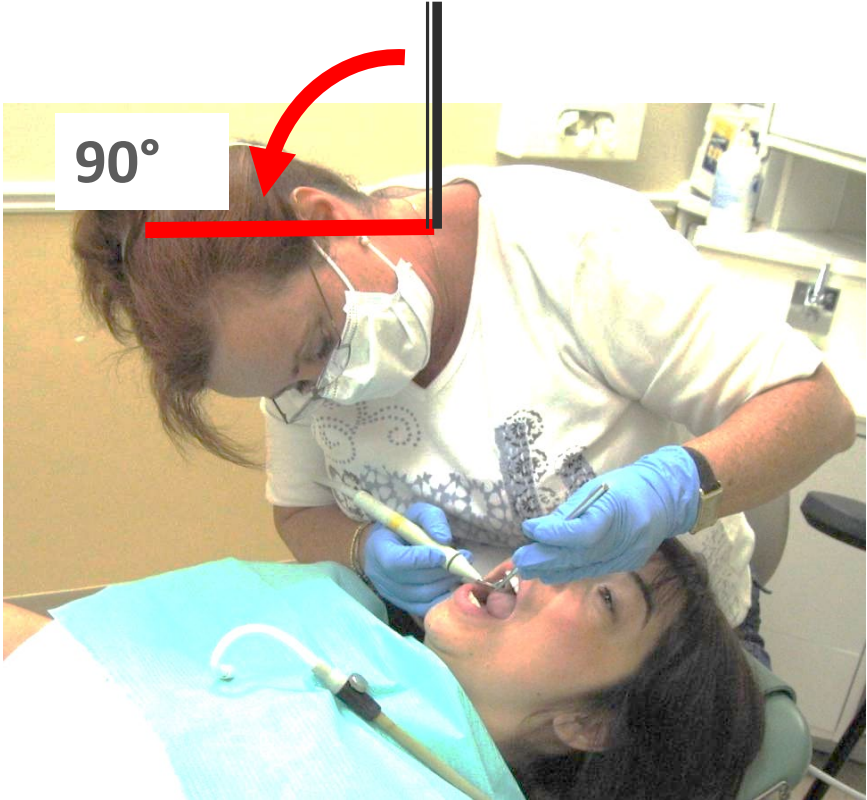
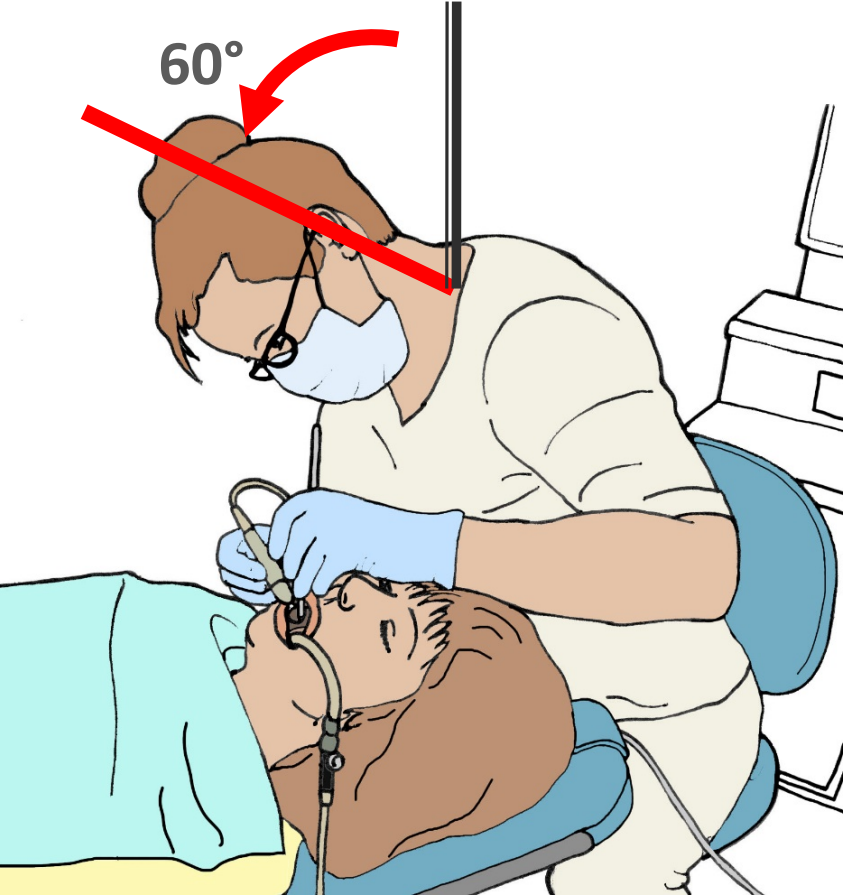
- Lateral and forward bending of the head



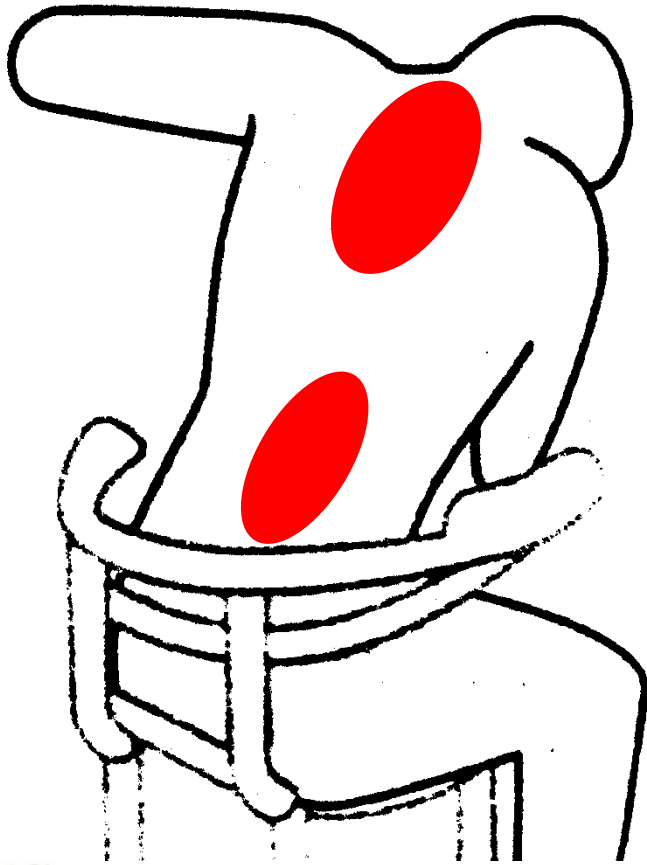
Elbows at 90° - Head and trunk flexion



Very awkward postures when working in direct vision



Typical position of dentists and hygienists



- Left shoulder separated from the body and elevated
- Neck bent and twisted
- Lower back bent and twisted

4. RISKY POSTURES FOR THE DENTAL ASSISTANT



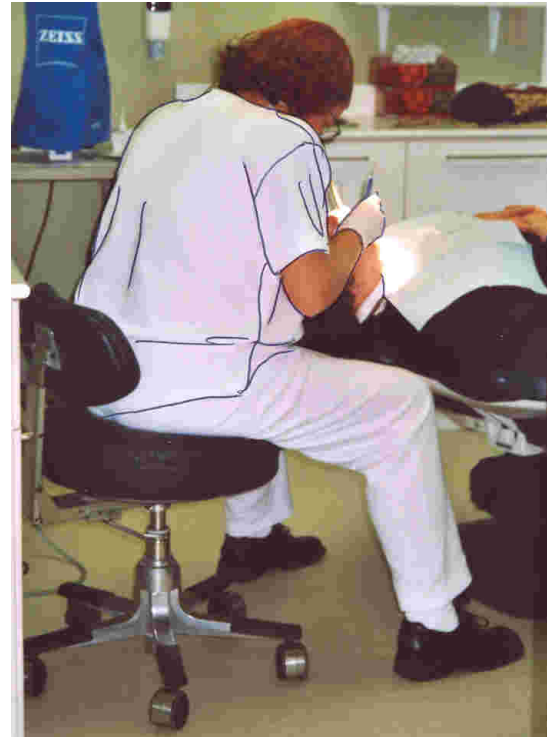
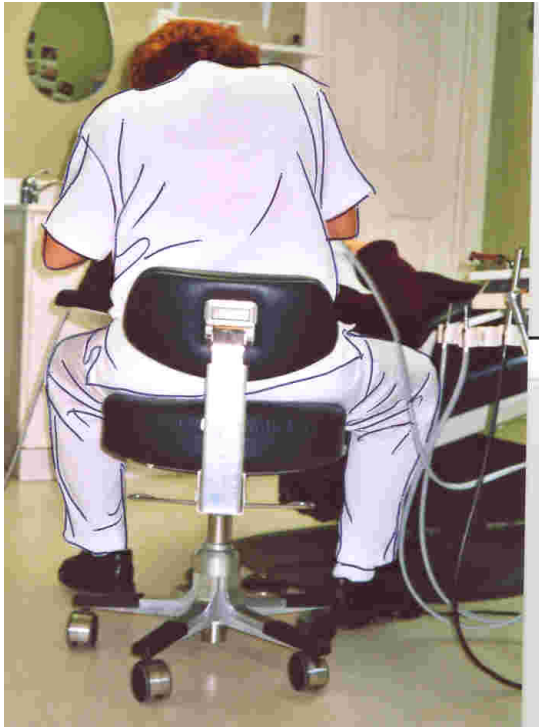
Leg position

Where can the assistant put her legs if the dentist is working in this position?



Where can the assistant place her legs?

In practice, when the backrest of the patient's chair is low, the dentist often has his back and neck bent



Postural analysis of dental assistant



When the dental assistant cannot insert her legs under the backrest of the patient's chair

- Her legs are aligned in the opposite direction of those of the dentist
- Her back and neck are almost always twisted

During their training, dentists work mostly without assistant

Poll 9

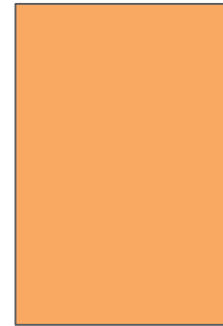
Should the dental assistant placed herself "a head higher" than the dentist?



YES

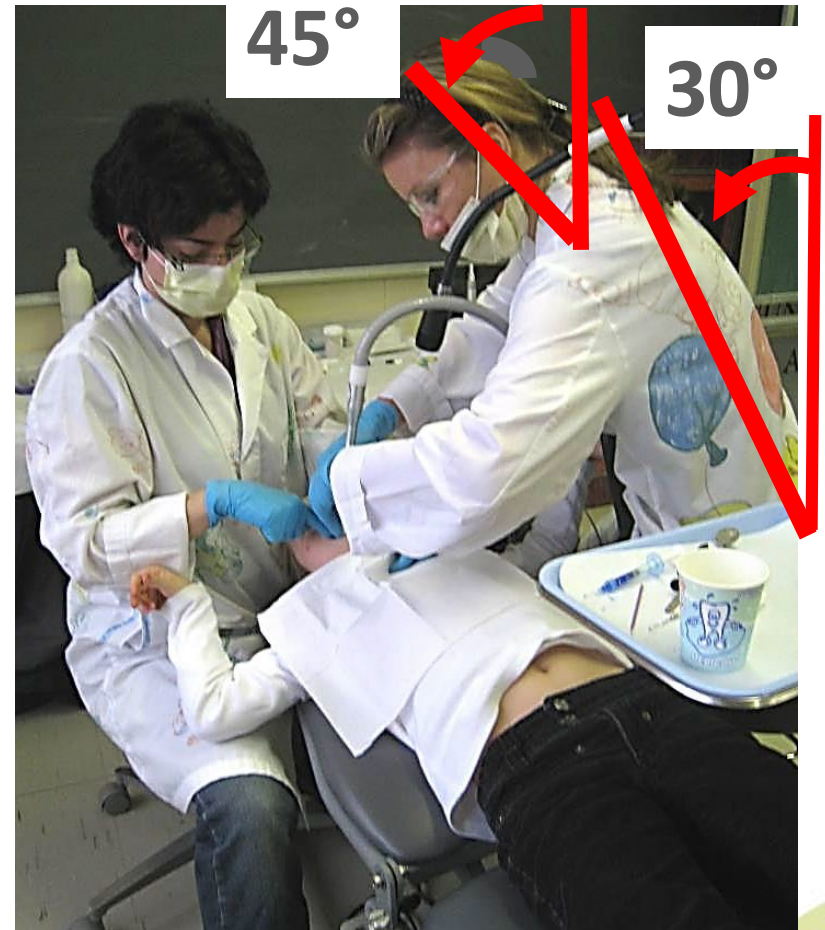


NO



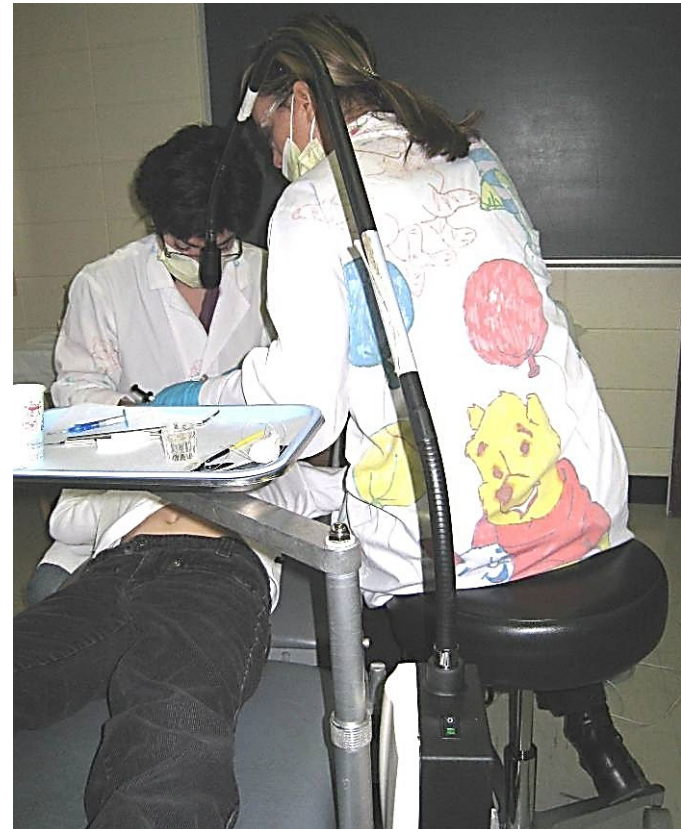
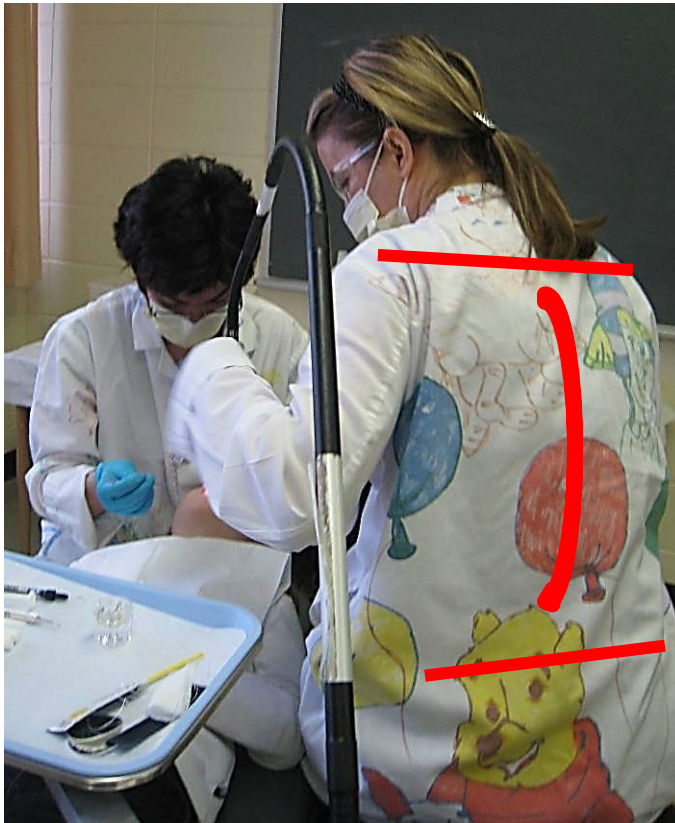
Poll 9 – Answer

When she is sitting "a head higher", the assistant often has awkward positions of the neck, lower back and shoulders



Postural analysis of dental assistants

Sitting “a head higher” than the dentist often causes twisting of the neck and back

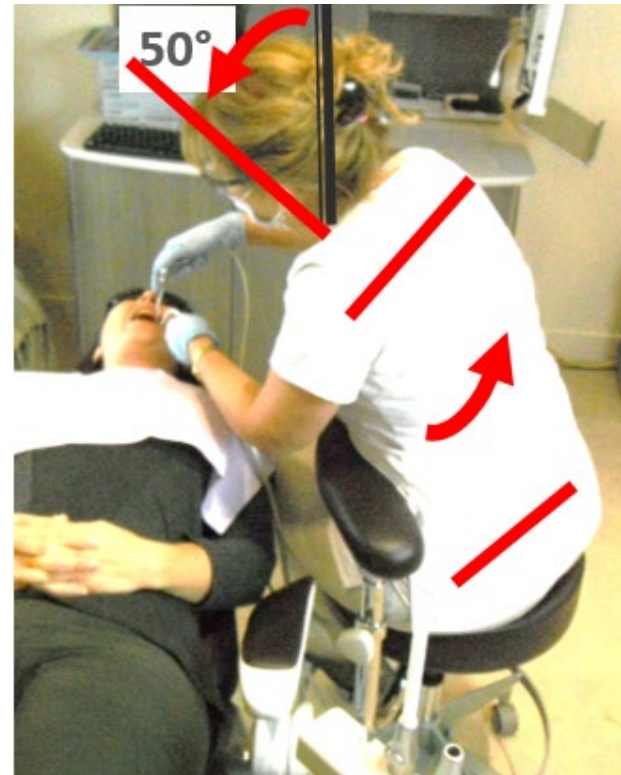


Postural analysis of dental assistants– Bending forward and twisting lower back

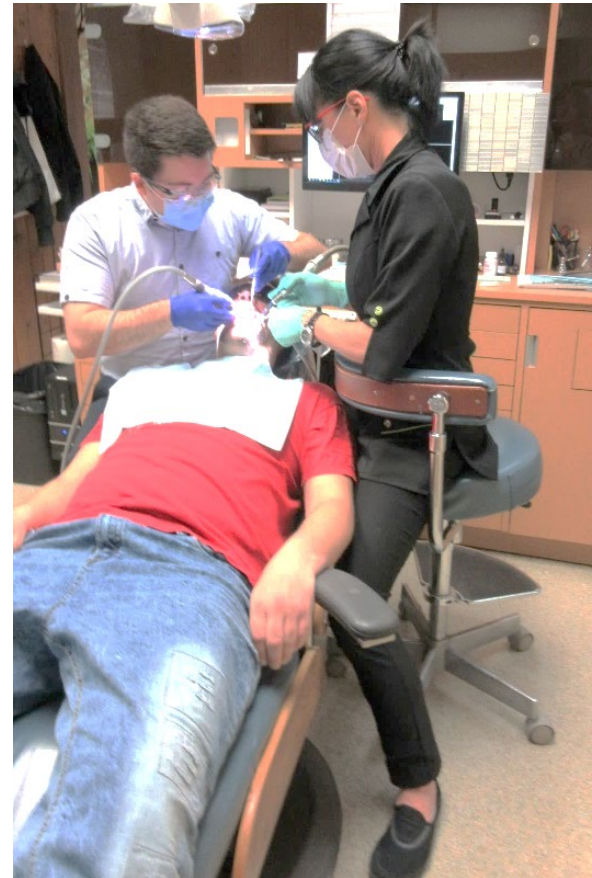
Assistant sitting at the edge of her chair



Assistant sitting in the center of her chair

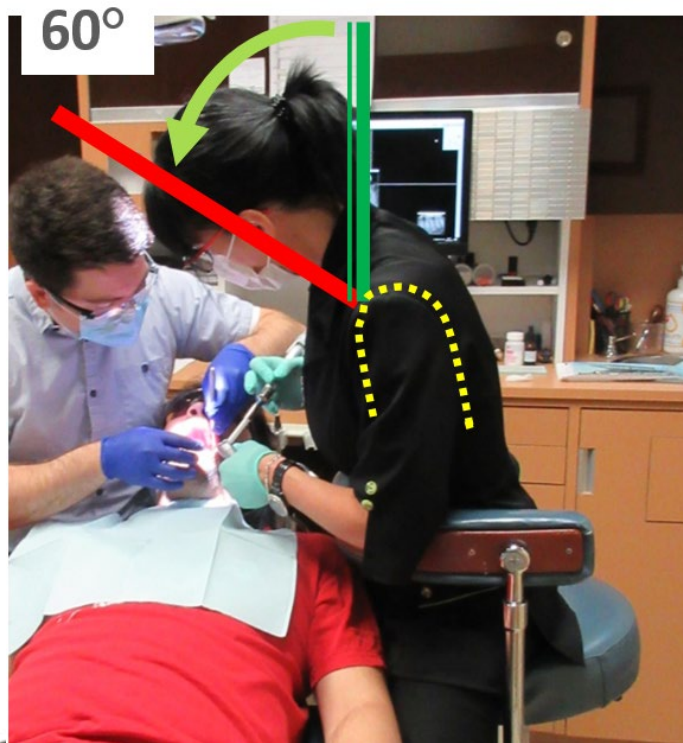


Postural analysis of dental assistants: large gap of the legs

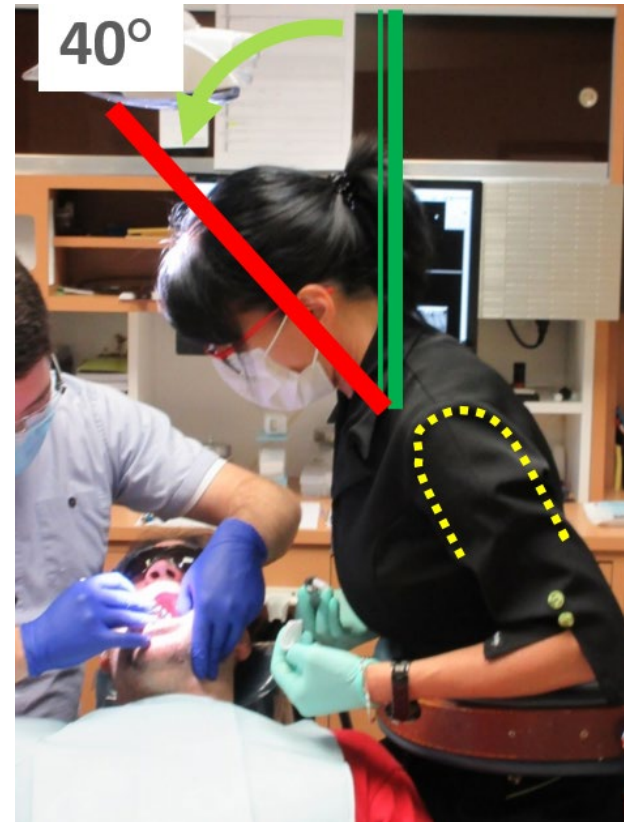


Postural analysis of dental assistants: Head and back bent

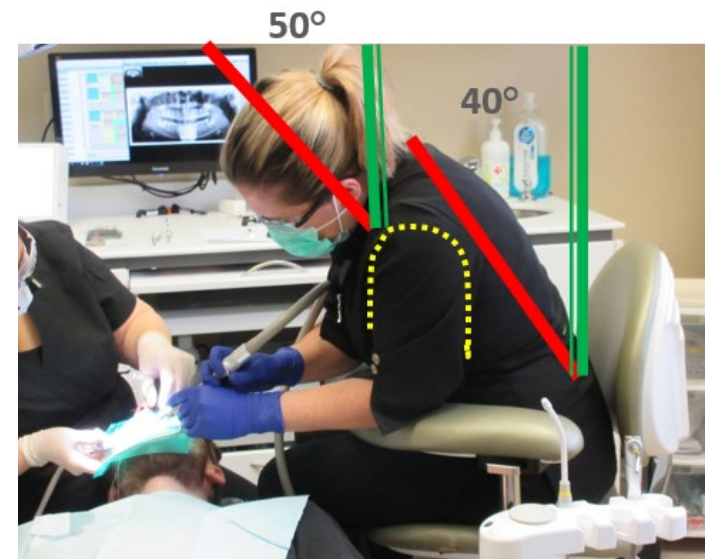
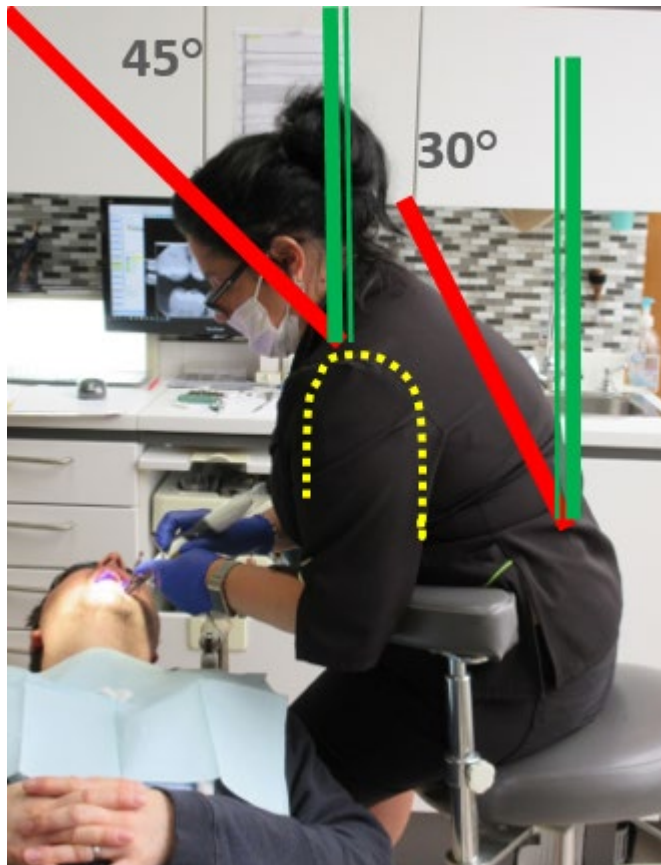
Head bent when holding the instruments in the patient's mouth



Head bent during waiting periods



Postural analysis of dental assistants: head and back bent



Postural analysis of dental assistants

Dental assistant's arms are often not supported by a narrow torso support

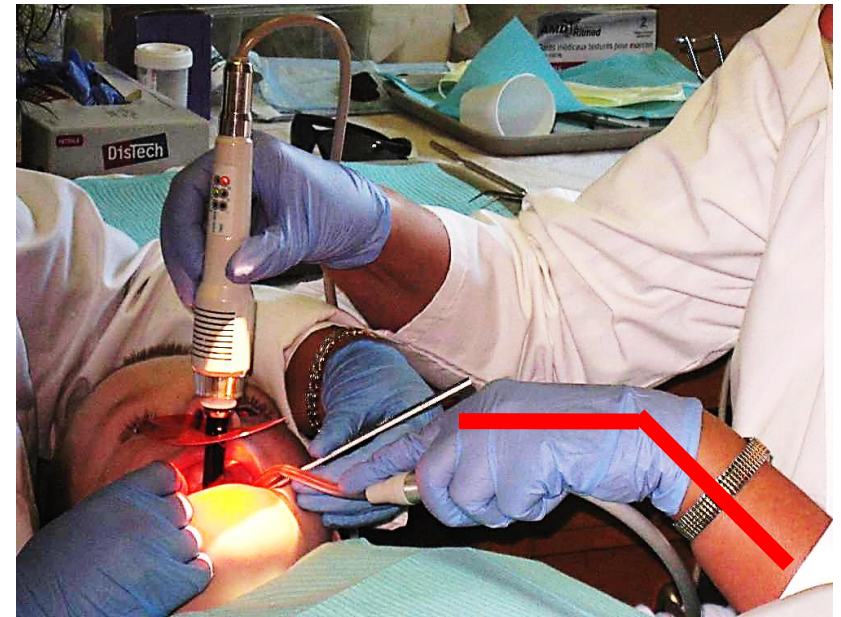


Postural analysis of dental assistants



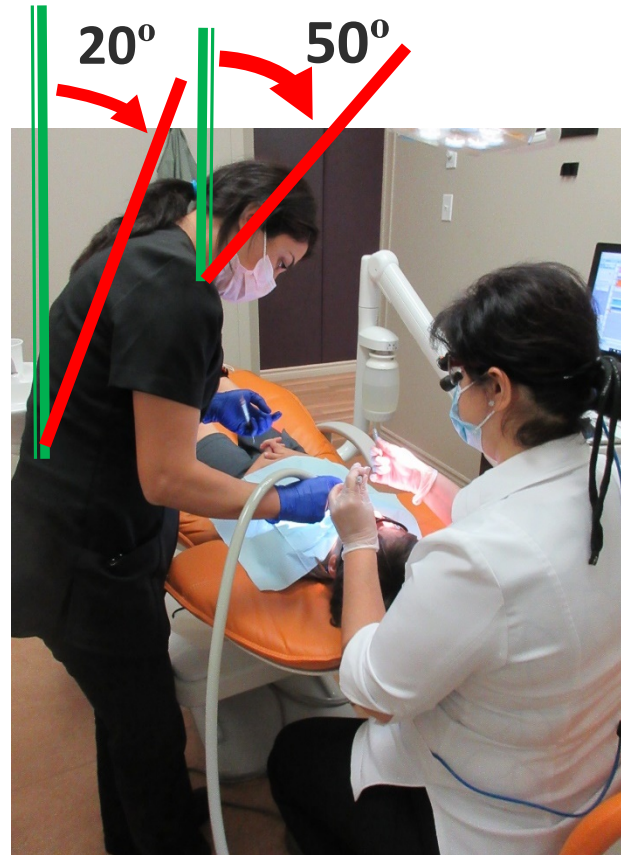
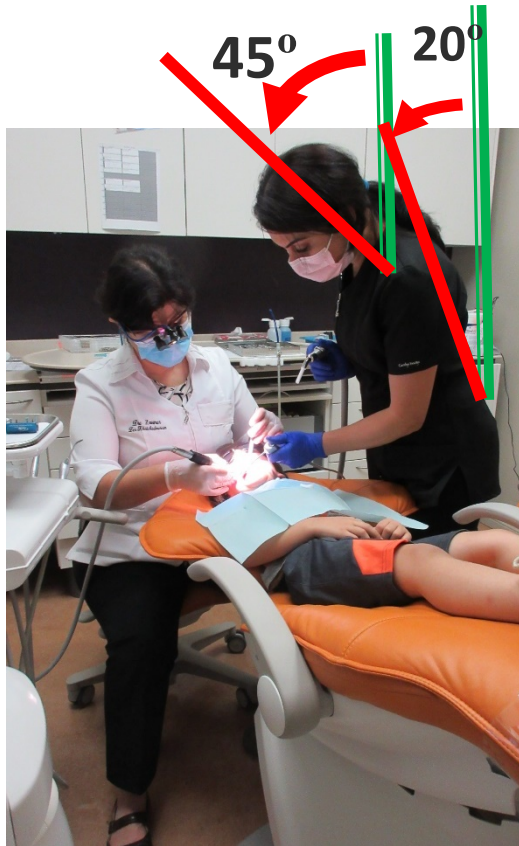
Neck stretched to succeed in seeing in the patient's mouth

Postural analysis of dental assistants



- Head bent and left wrist flexed while holding the suction
- Often, the dental assistant holds 2 instruments at the same time

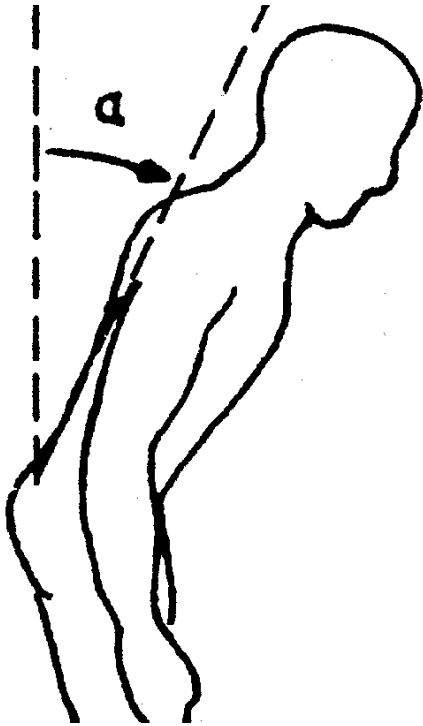
The standing position of the dental assistant when the dentist is seated may cause important flexions of the neck



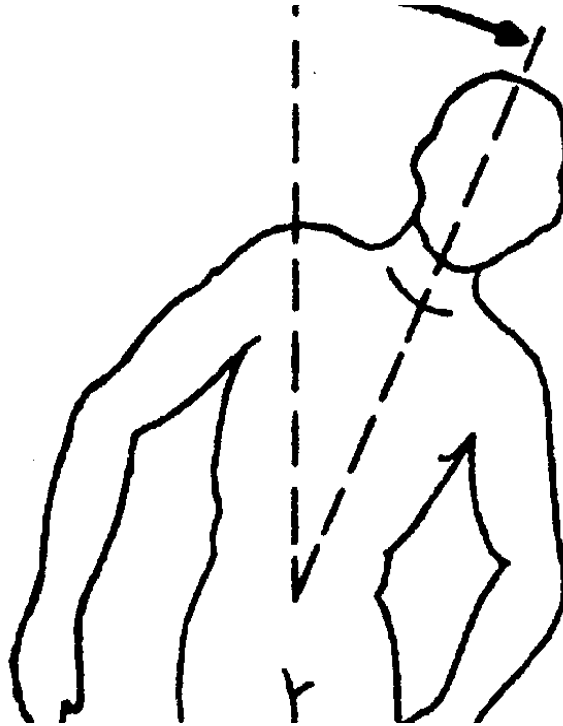
5. RISK FACTORS OF MSDs TO THE LOWER BACK



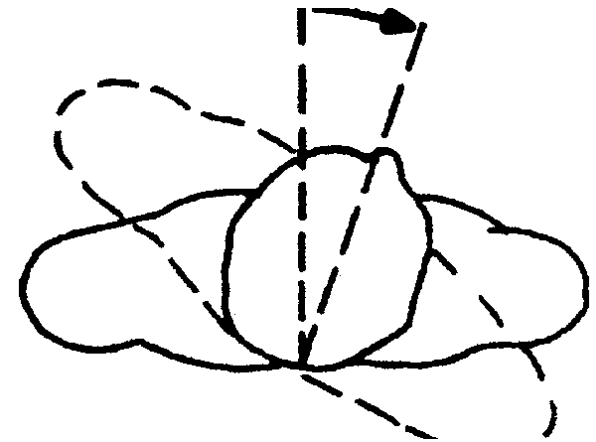
Risky postures for the lower back



Forward flexion

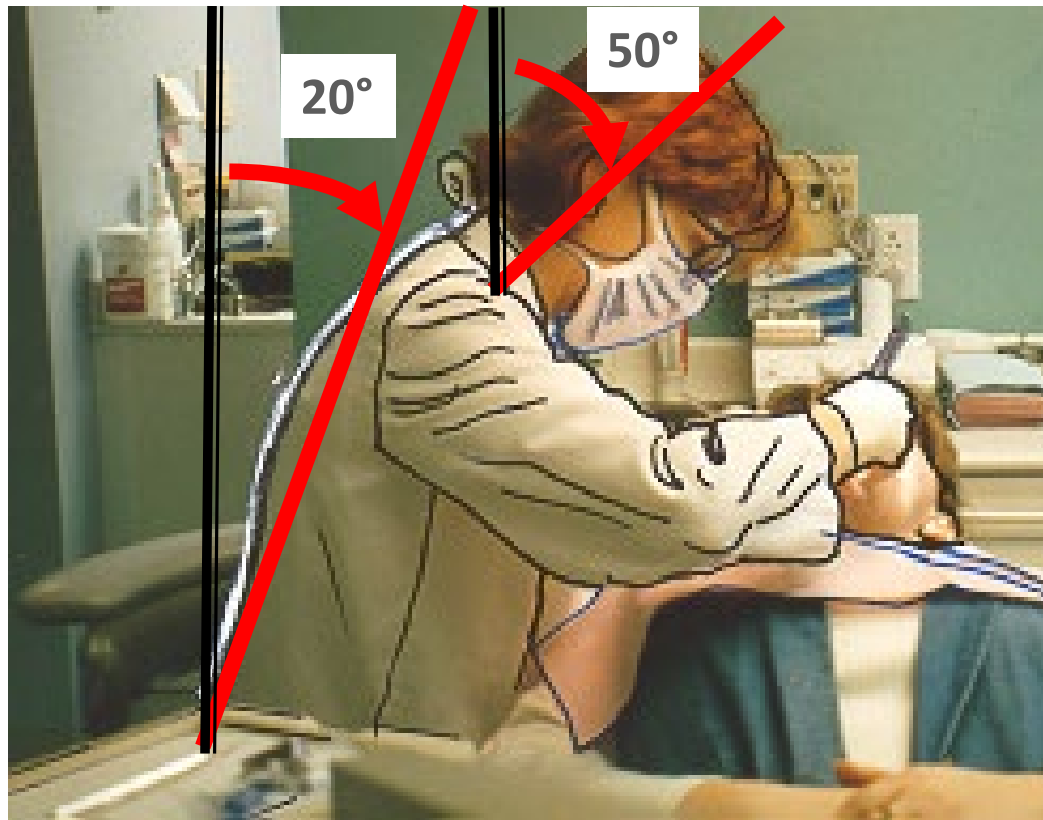


Lateral flexion

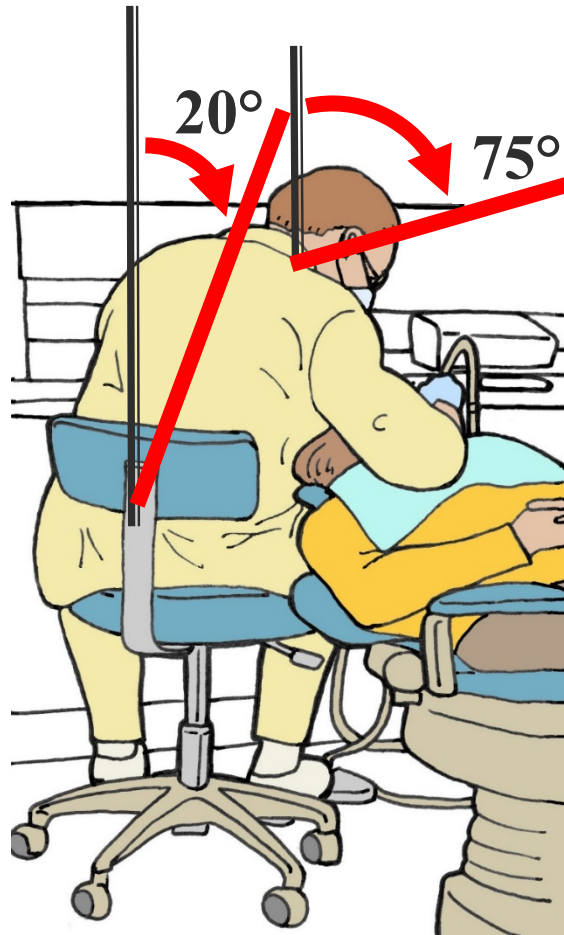


Twisting

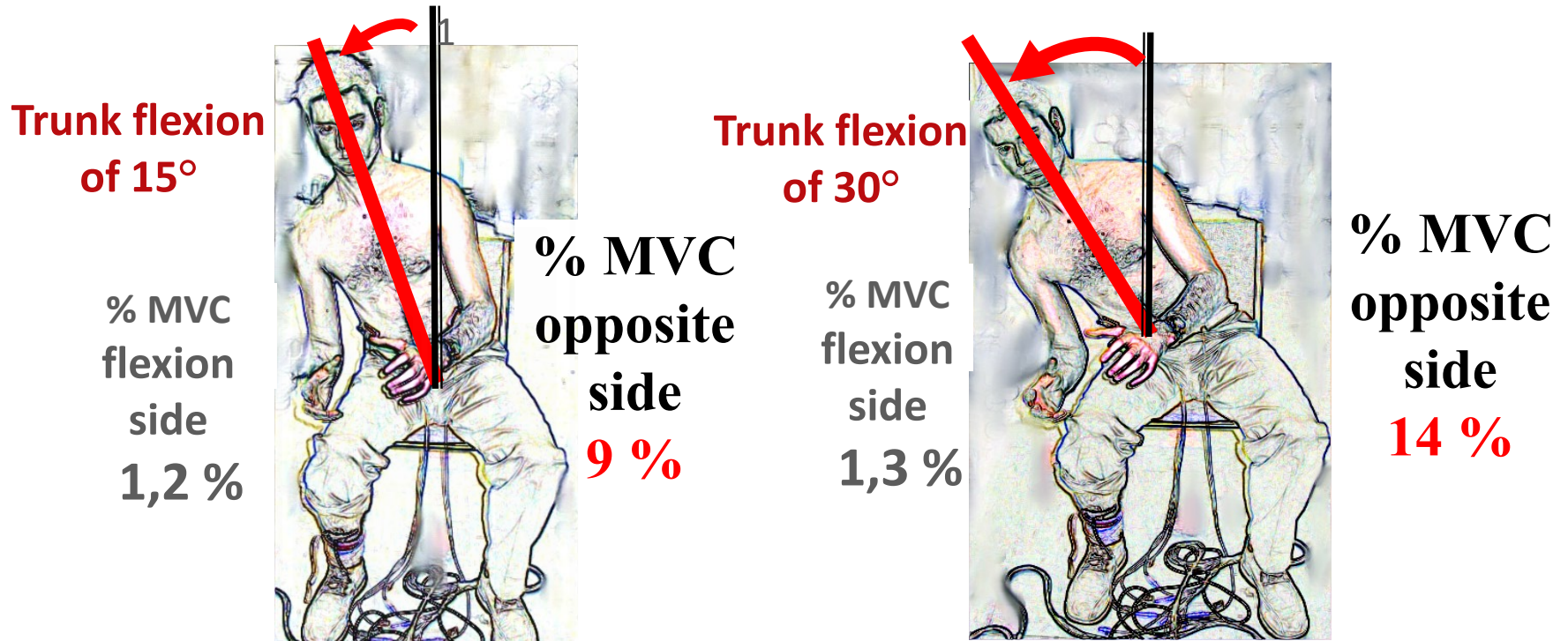
Forward flexion of the back and neck



Lateral and forward flexion the back and neck

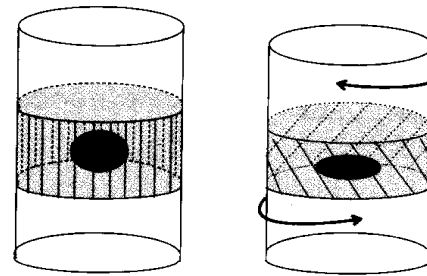
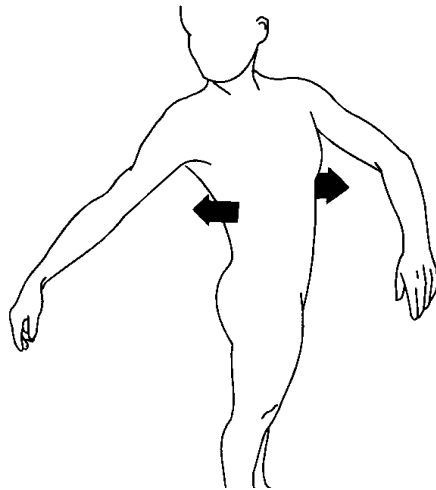


In lateral flexion, static contractions of the erectors spinea muscles on the opposite side of the one where we bent (% of Maximum Voluntary Contractions (% MVC)



The muscles of the lower back (erectors of the spine) remain in static contraction as long as the position is maintained to retain the trunk from falling to the side

Effects of torsion on the vertebral disc = danger for the disc



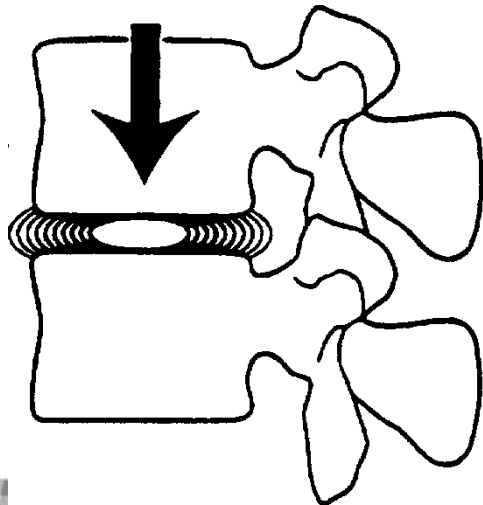
- Stretching and crossing fibers - nucleus flattening
- Reduced disc capacity to absorb pressure and shocks
- Increased risk of tearing

Safe limits for compression resistance of discs at L4 and L5 levels

- When the trunk is bending and/or in torsion, disc compression safe limits **decrease by 4 X**

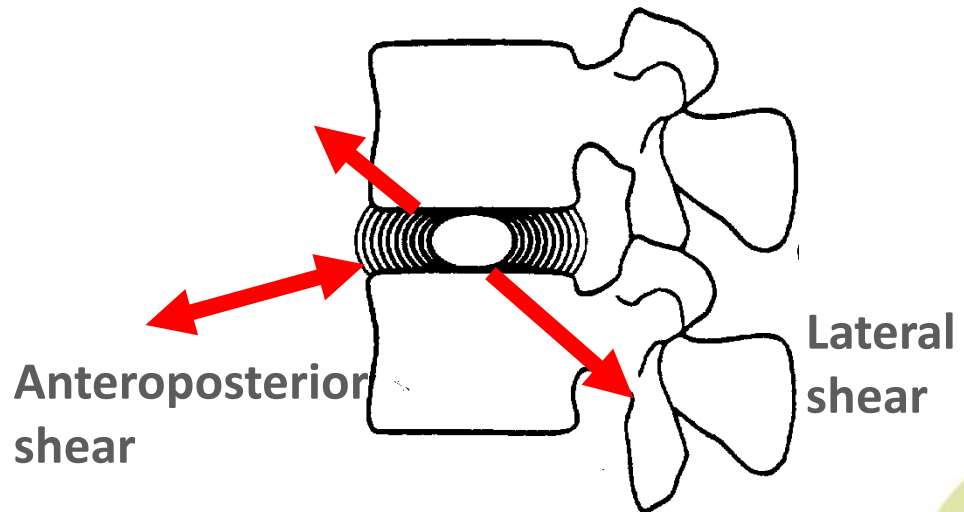
Straight back

**3 400 à 6 400 Newtons /
340 to 640 Kg-force**



Flexed or twisted back

**1 000 Newtons /
100 Kg-force**



Bernard et Brence, 1997

5. Risk factors for MSD for the back

NECK, UPPER AND LOWER BACK DISORDERS



Reference from a physiatrist

Pathologies of muscles and vertebrae

- Consultation Dr. Roger Vadeboncoeur, physiatrist, Université de Montréal

La pathologie fonctionnelle du rachis et des ceintures

1^{re} partie. *Le clinicien*, avril 1995, p. 159-170

2^e partie. *Le clinicien*, mai 1995, p. 155-168

« Functional Muscle Pathology of spine* and belts** »

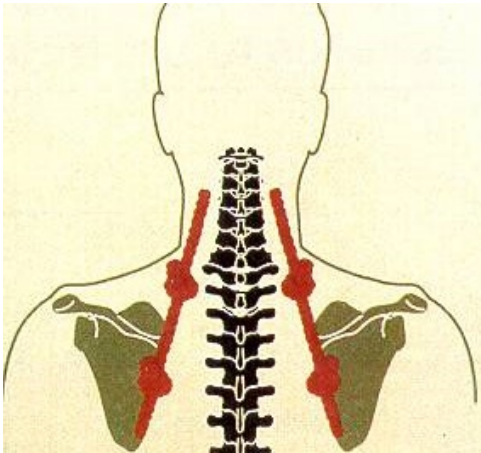
* *Spine = vertebral column*

** *Belts = scapular and lumbar belts*

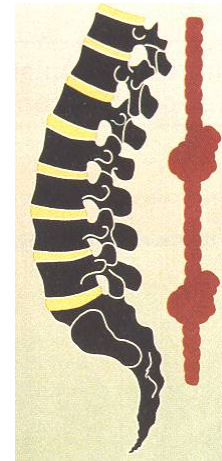


Functional Muscle Pathology

Knotted rope illustrates hypertonicity, shortening of the muscle at rest



**Cervicospinal level
(upper back)**



**Lumbopelvic level
(lower back)**

- Caused by functional overload of muscles
- Due to either overuse, bad habits, static problems or joint injury
- Reduction in the muscle's irritability threshold (exaggerated activation of the muscle in doing simple movements)

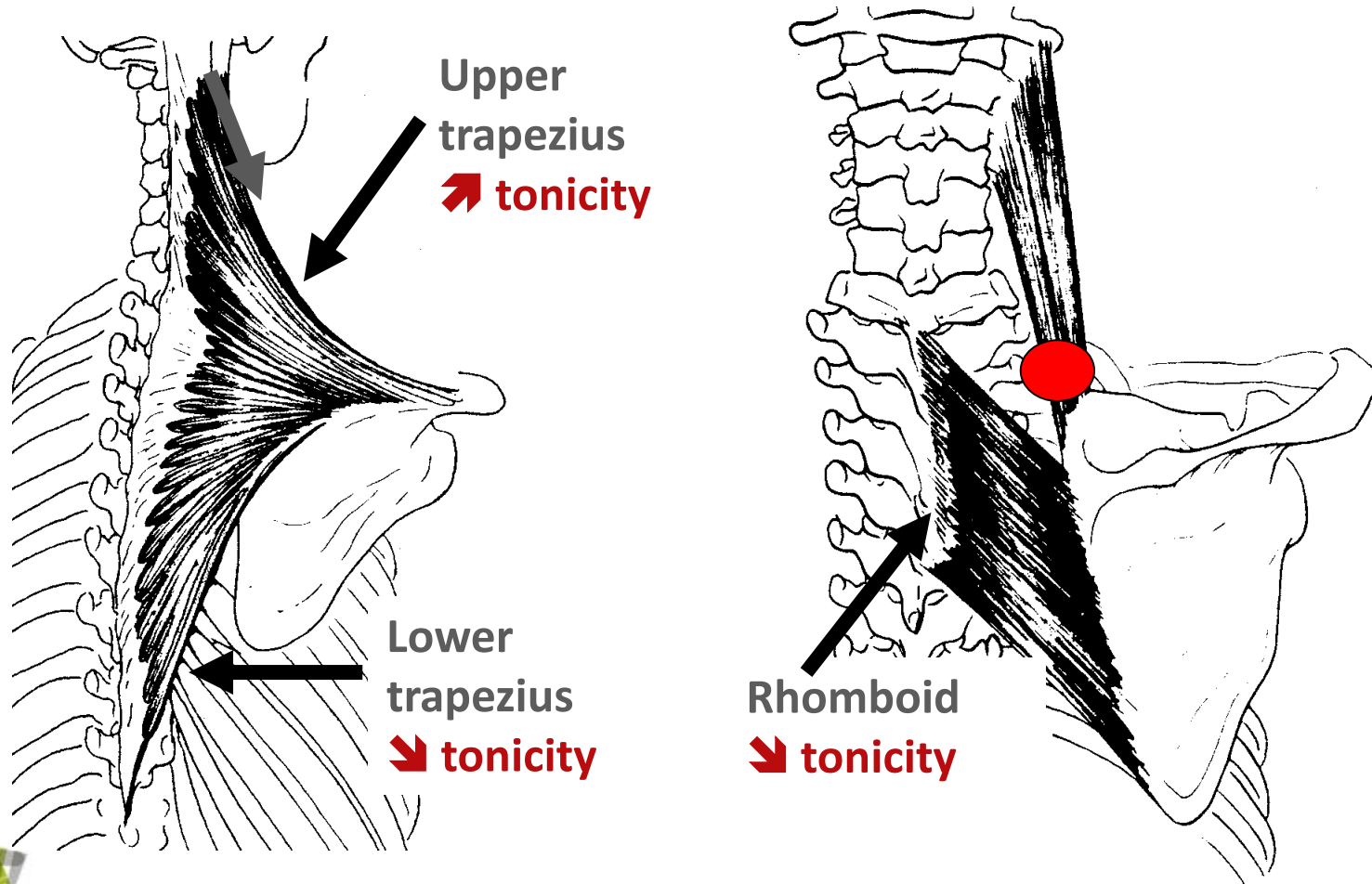
Vadeboncoeur, 1995, p. 157

Functional Muscle Pathology: imbalance of muscles

Hypertonicity (muscle retraction-shortening)	Hypotonicity (reflex inhibition)
Upper trapezius	Lower trapezius
Certain spinal erectors of the rachis (lower back)	Rhomboids
Large and small pectoral	Abdominals



Imbalance between trapezius and rhomboid



Calais-Germain, 1991, p. 123 et 124

Elements affecting myofascial pain

Elements that can ↗ them

- Sustained and intense muscle contractions
- Rapid passive stretching of the muscle
- Local cold compress
- Cold damp weather

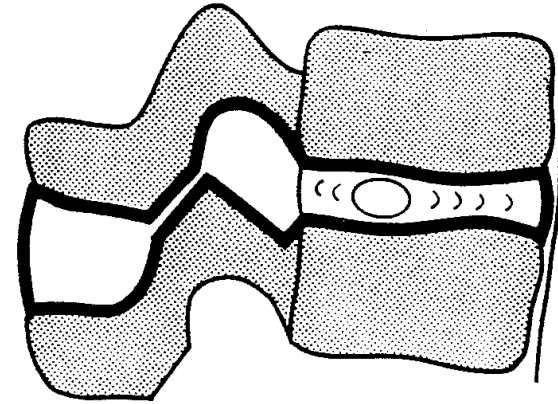
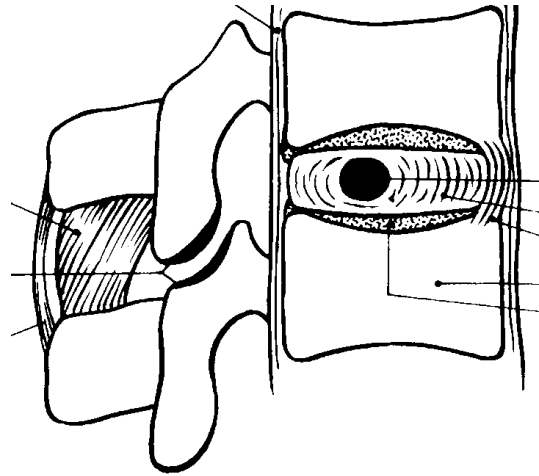
Elements that can ↘ them

- Frequent short periods of rest
- Slow passive stretching exercises under hot shower spray
- Local heated cushion or pad (wet if possible)
- Short periods of gentle exercise (swimming in warm waters)



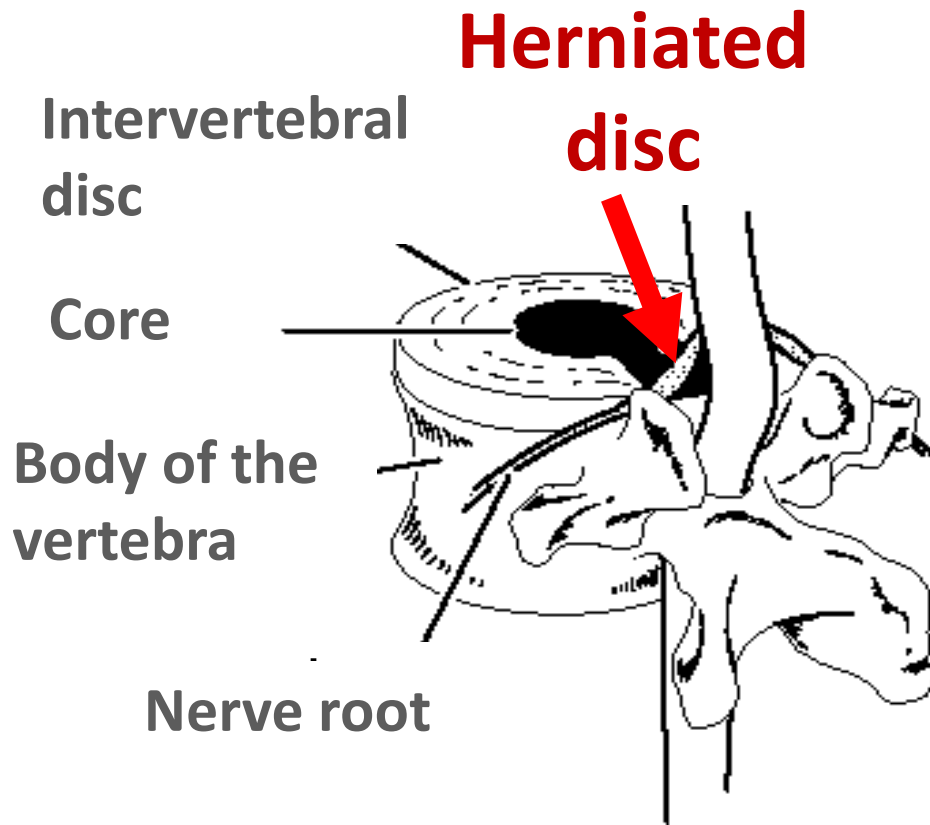
Pathologies of vertebral joints :

Minor Intervertebral Dysfunction (MID)



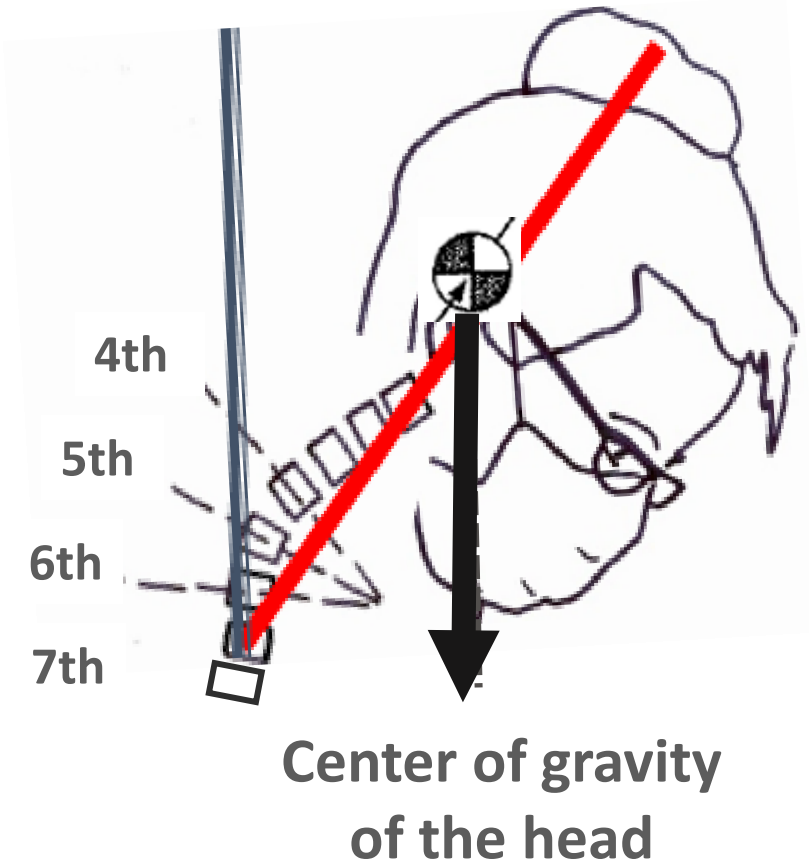
- **Mechanical dysfunction** or reflex of the intervertebral mobile segment (functional unit of two vertebrae)
- Self-maintained by asymmetrical postures

Pathologies of vertebral joints : herniated disc



- Repeated application of forces can cause small cracks in the disc rings
- These can affect their ability to retain the core
- The pain comes from the compression of the nerve root

Effects of forward flexion on the 4th, 5th and 6th cervical vertebrae (eg. angle 35 °)



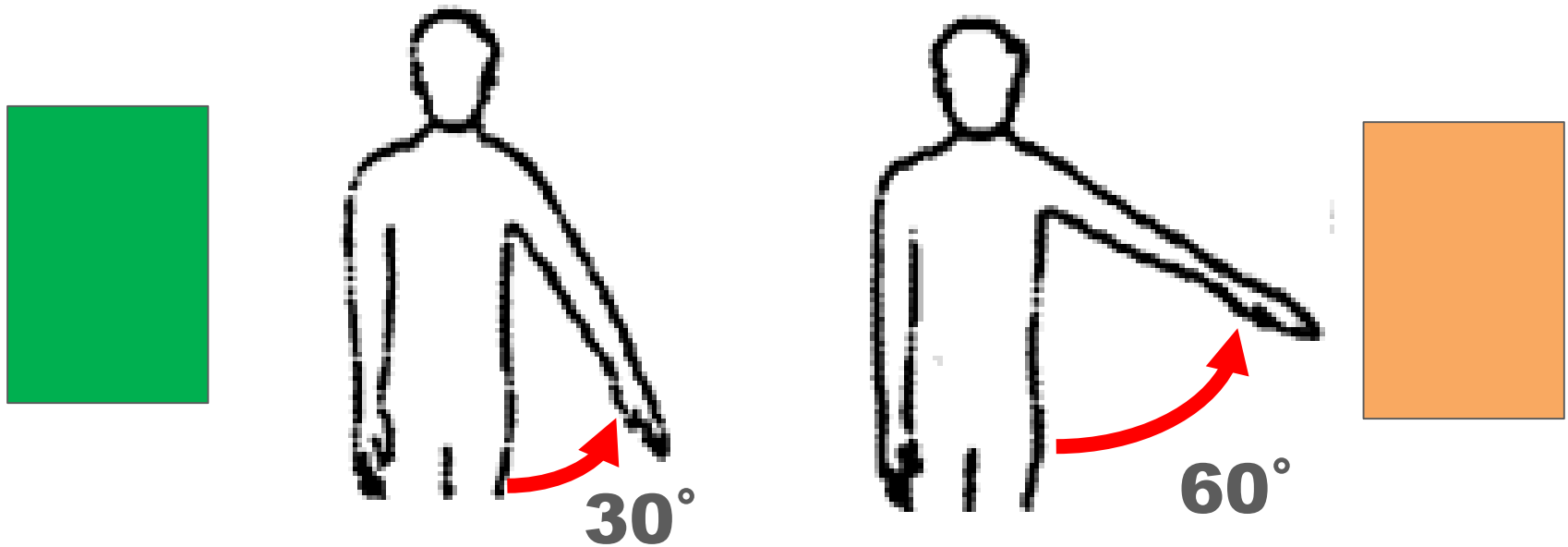
- When the head is in forward flexion:
 - the anterior part of the 4th, 5th and 6th cervical vertebrae is compressed
 - **Danger of MID** (Minor Intervertebral Dysfunction)
 - **Danger of cervical discs herniations**

6. RISK FACTORS FOR MSDs TO THE SHOULDERS



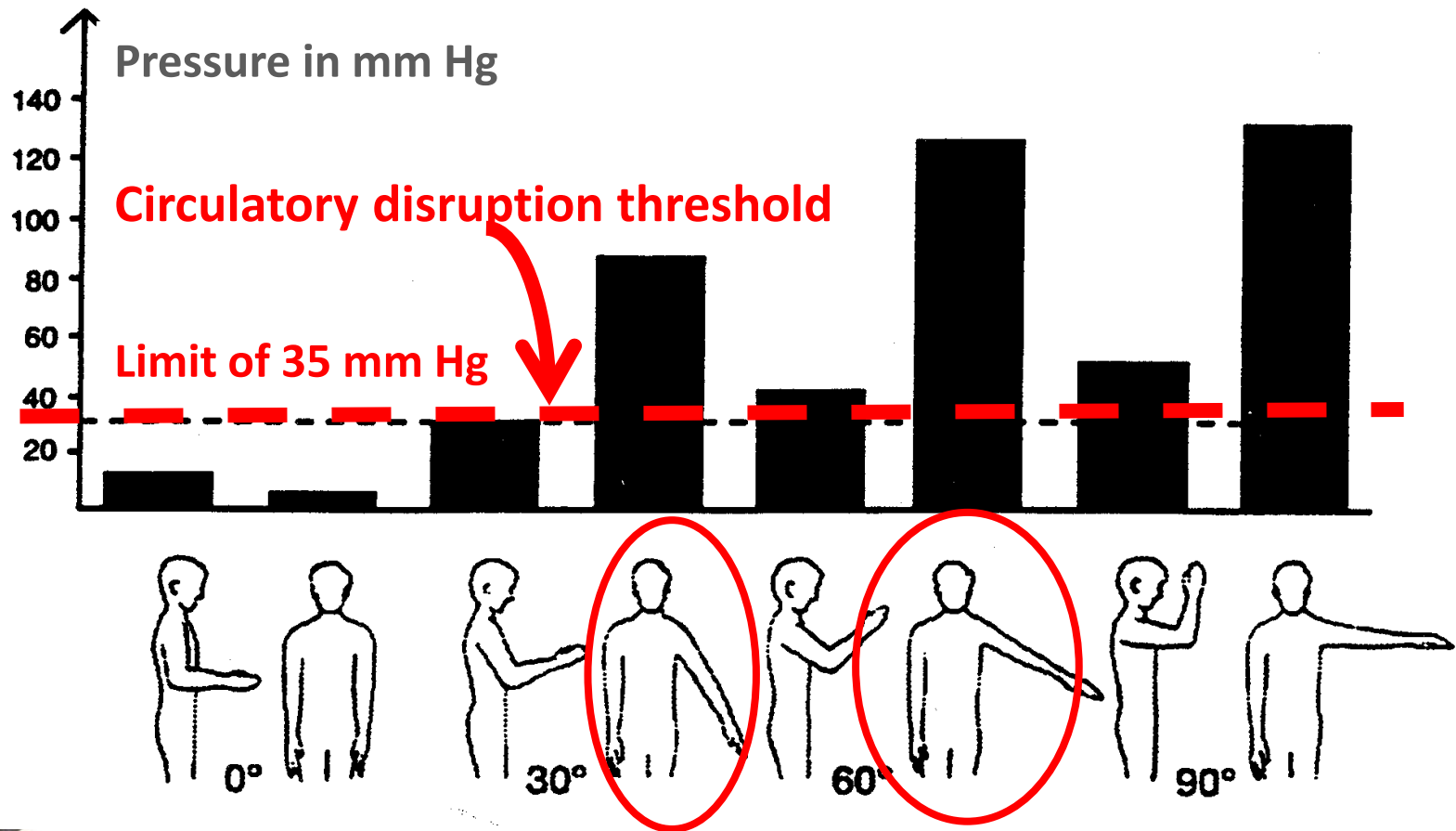
Poll 10

At what angle of opening the arm to the side is there a risk of tendon injury on the top of the shoulder?



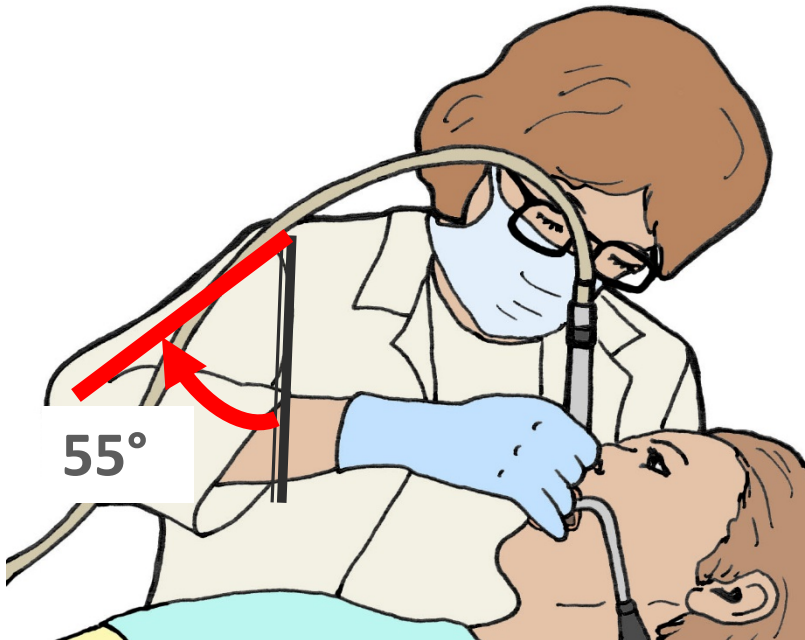
Poll 10 - Answer

Pressure in the supraspinatus tendon according to the position of the arm from 30° to the side

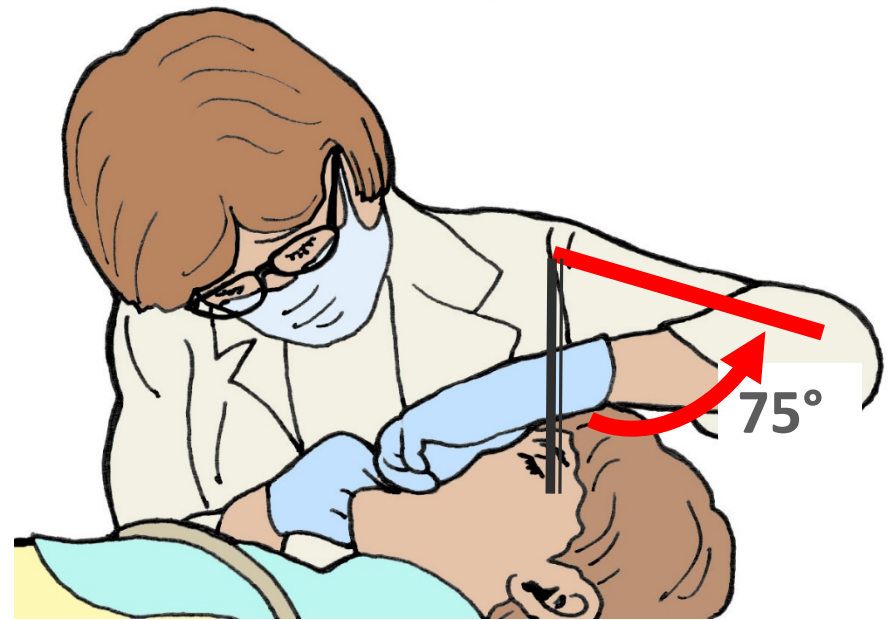


At the side of the patient's head, arms are often held away from the body (abduction)

Right arm above the thorax
at 9:00

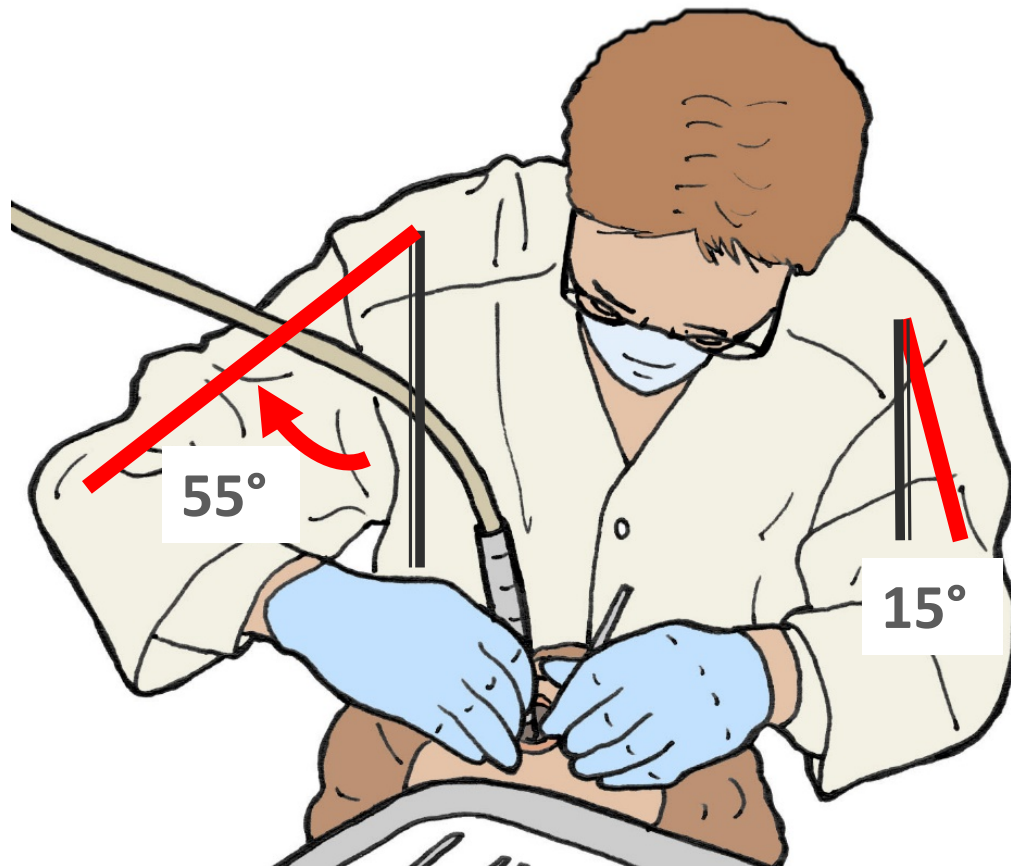


Left arm above the head
at 10:00

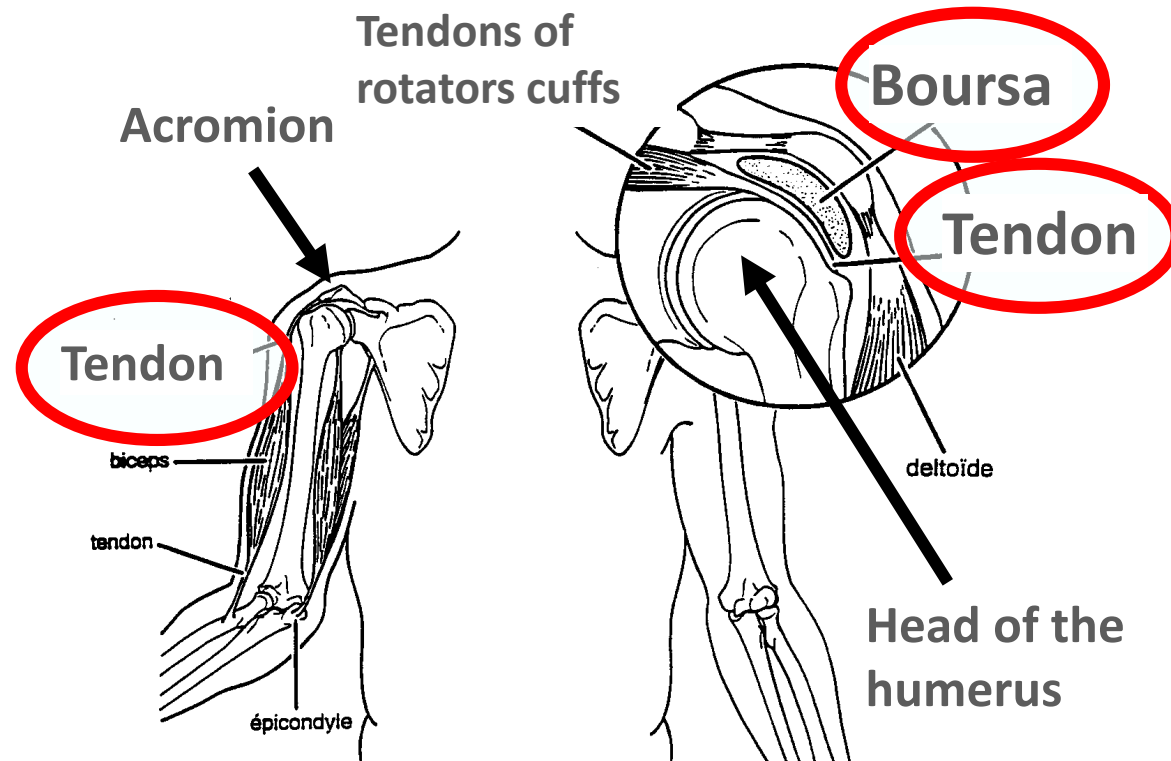


At the back of the patient's head, when the patient's chair is at low height (*at waist level*)

Right arm is often held away from the body



Shoulder structures



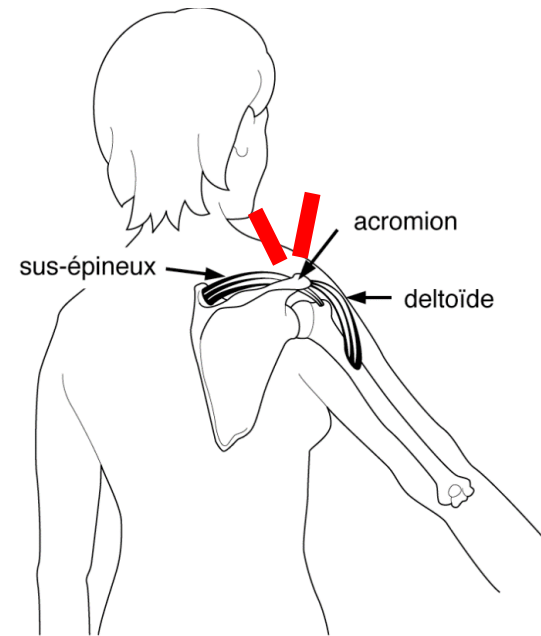
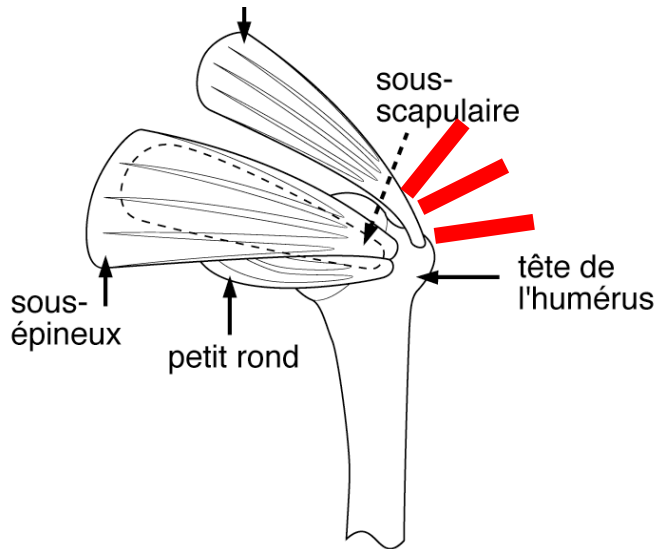
- Muscles attached to bones by tendons
- Shoulder bursa: promotes the sliding of the tendons on the bones



4 rotator cuff muscles and tendons.

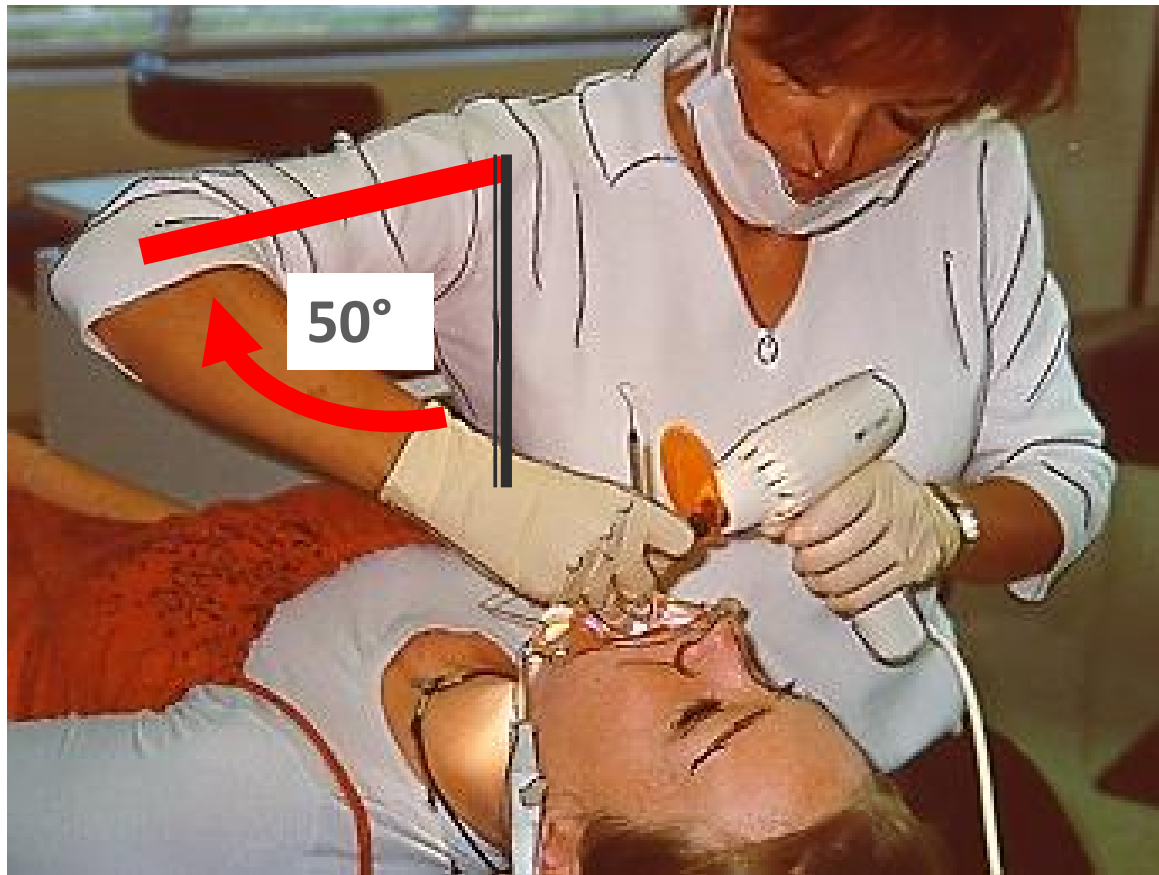
Of the 4, the supraspinatus tendon is the most subjected to tendonitis, because it is wedged under the acromion when the arm is out to the side

Supraspinatus tendon



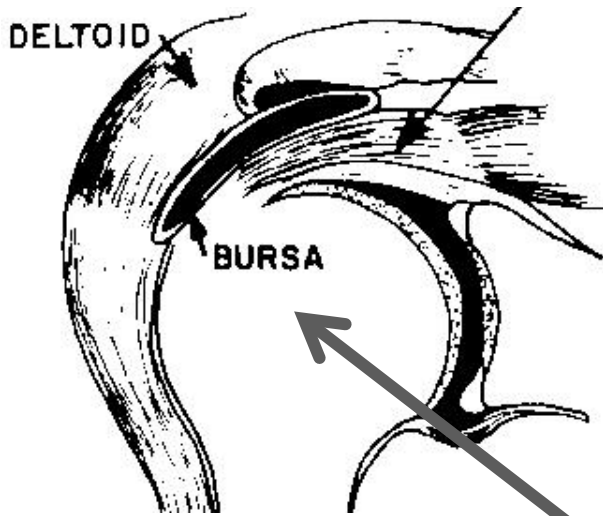
When the arm is out to the side, the supraspinatus tendon is stuck between the acromion and the head of humerus

Arm in abduction (away from the body)



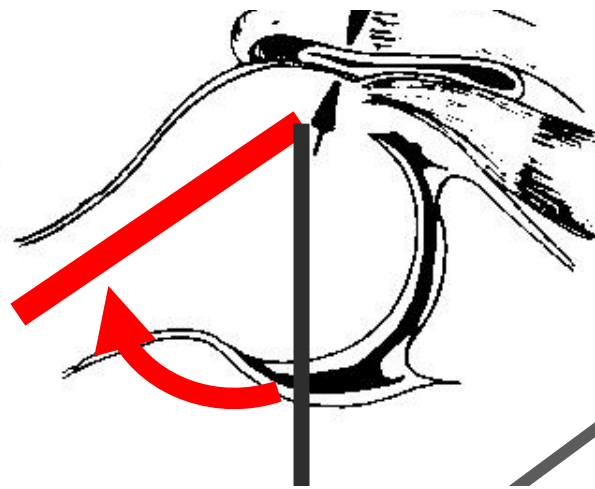
Supraspinatus tendinitis caused by the arm spread apart from the body

Normal



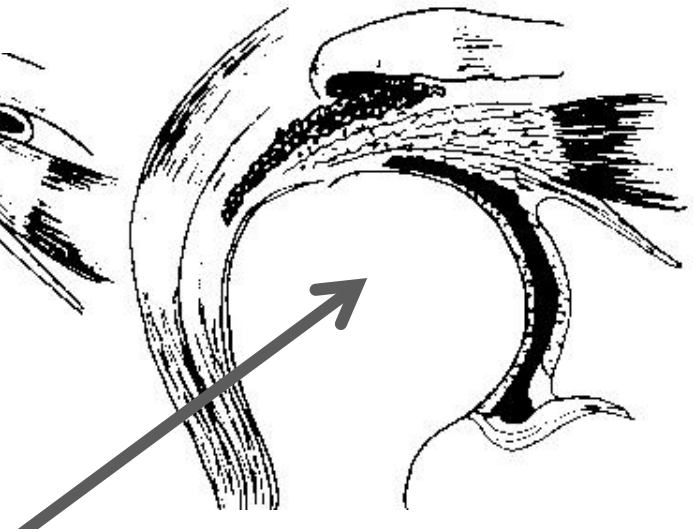
Subacromial impingement on abduction

Local pressure



Humeral head

Degeneration of the tendons and the bursa

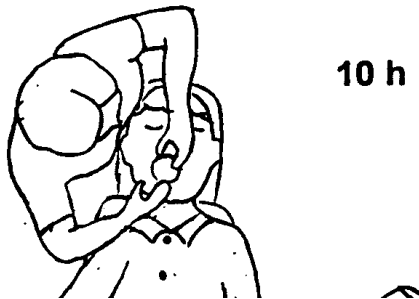
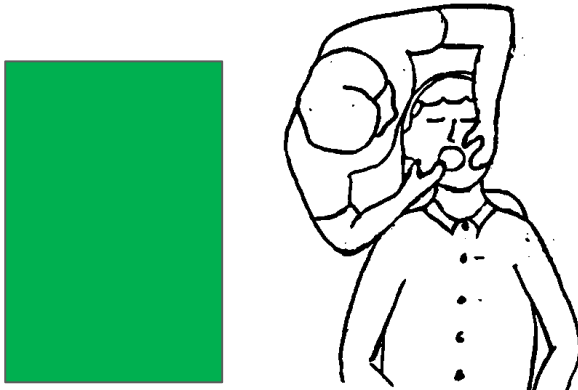


(Also called rotator cuff tendinitis)

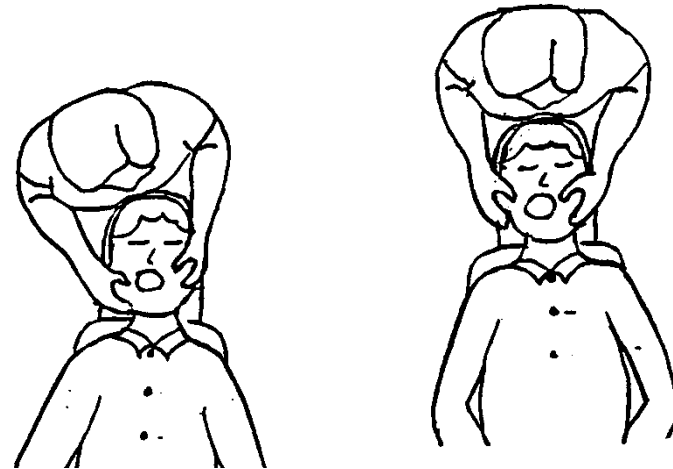
Poll 11

Best hourly positions for the shoulders ?

At the side of patient's head?
(at 8:00, 9:00 and 10:00)



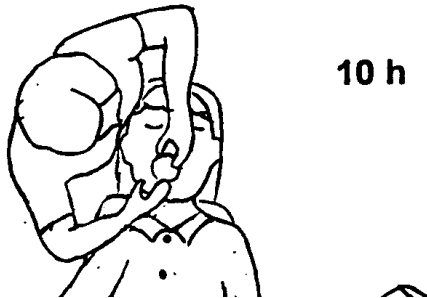
Behind patient's head?
(at 11:00, 12:00 or 13:00)



Poll 11 - Answer

Behind patient's head, arms are usually more relaxed

At the side of
patient's head



Behind
patient's head



7. RISK FACTORS FOR MSD TO THE HIPS



In position at the patient's side, the legs are wide apart



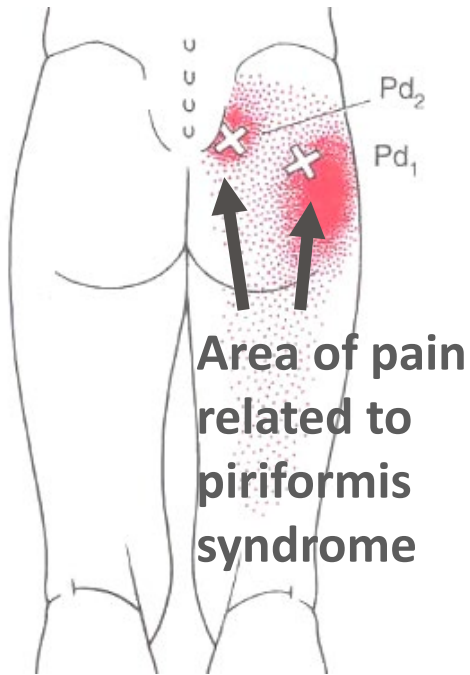
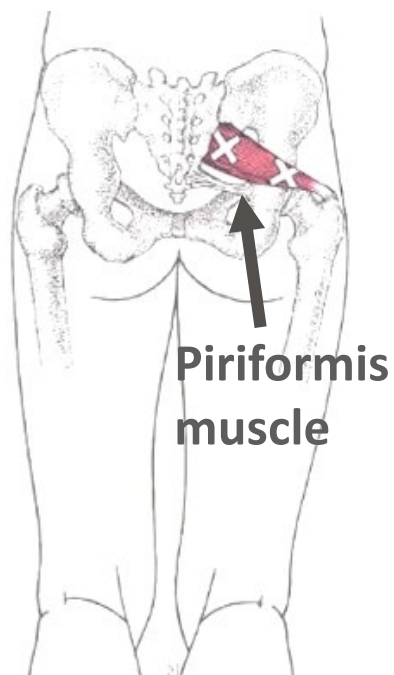
Ultrasonic pedal



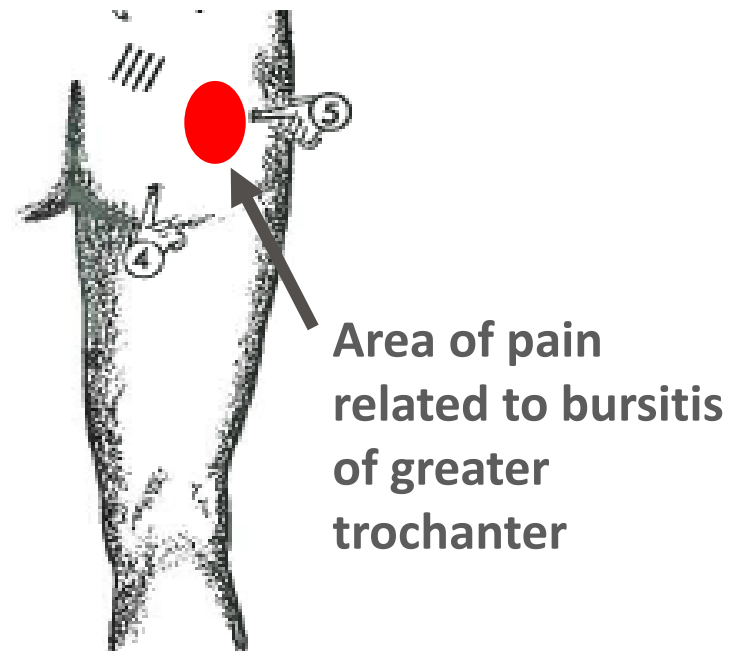
Locations of similar pains for 3 different diagnoses

1. Irritation of the sciatic nerve

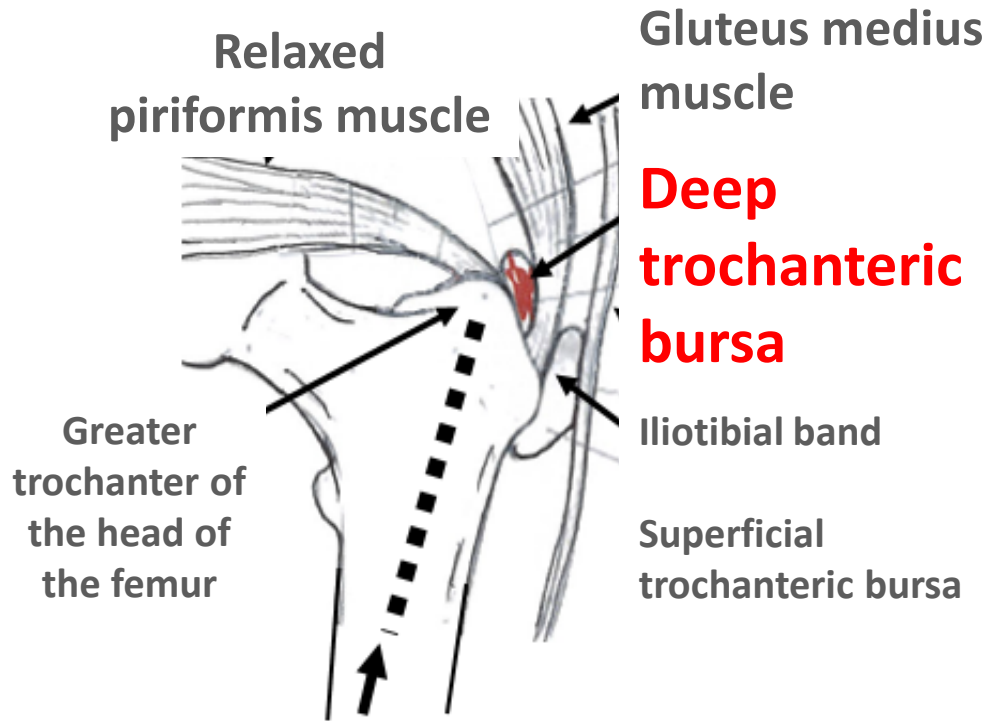
2. Piriformis or pyramidal syndrome



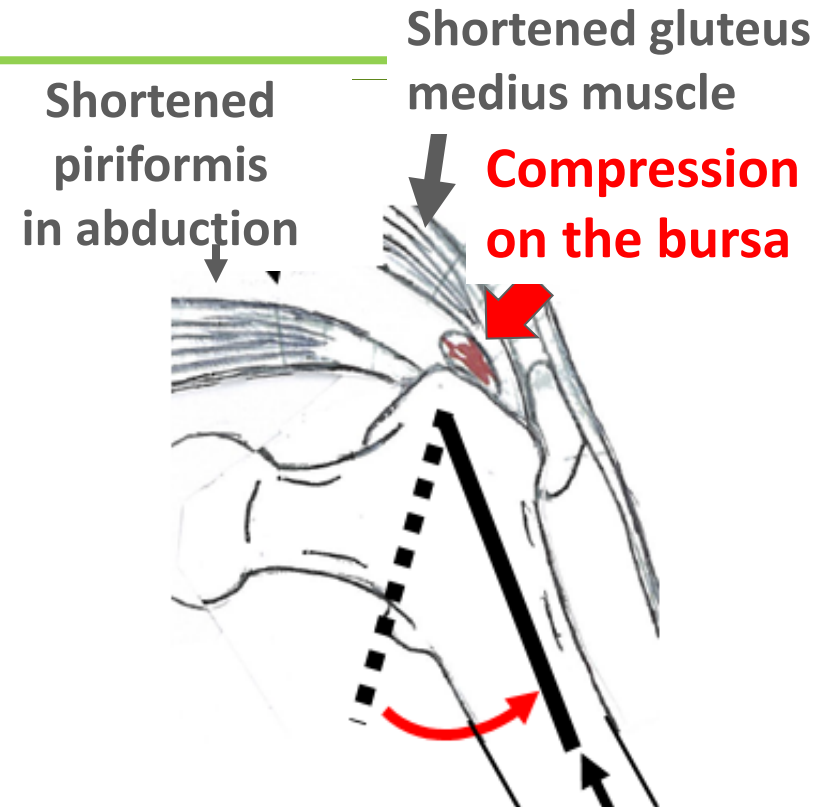
3. Bursitis of greater trochanter



Position with legs spread ↗ risk of bursite of the hip by compression on the the deep trochanteric bursa

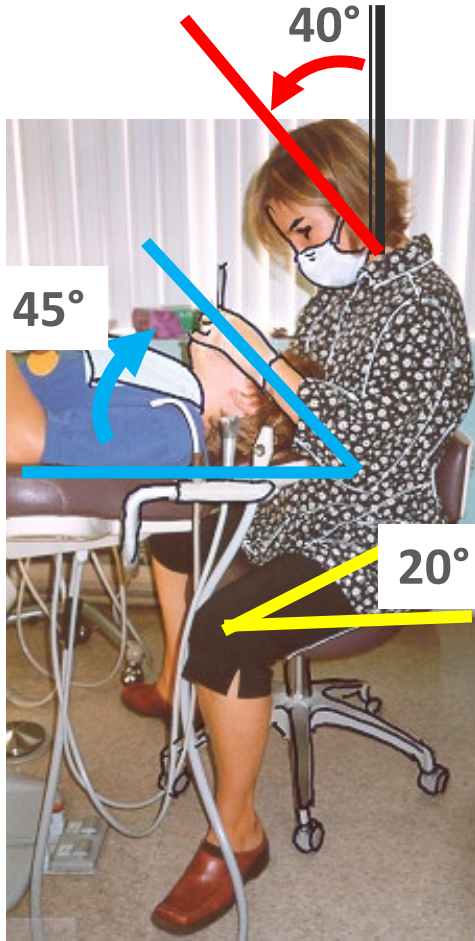


Natural position of femur when legs are aligned (parallel)



Position of femur when legs are spread

Adopt good postures



- Patient placed higher and flat
- Elbows close to the body
- Forearms raised from 30° to 45°

Standard
stool

2ND PART: SOLUTIONS

NOTIONS OF EYE-TASK ERGONOMICS,
WORKING METHODS, EQUIPMENTS,
ENVIRONMENT



Can we question the position of the forearms parallel to the ground (angle of 90° / arm)?

Let's shake the columns of the temple!!!



8. NOTIONS OF EYE-TASK ERGONOMICS

The vision limits of the eye influence the bending angles of the head

Eye-task vision distance

"Effective" weights of the head according to its bending angles



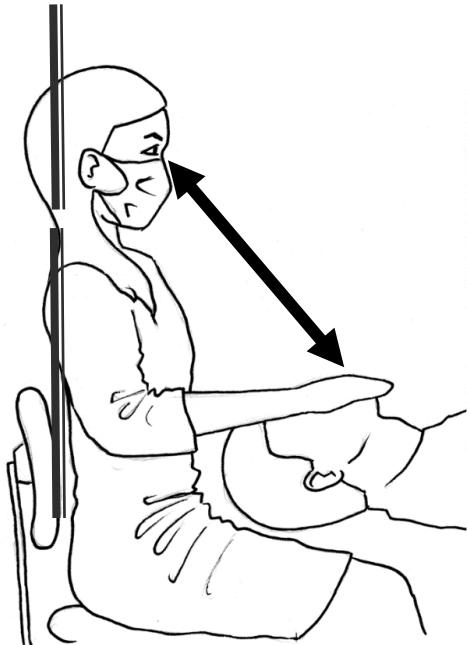
8. Notions of Eye-Task ergonomics

**THE VISION LIMITS OF THE EYE INFLUENCE
THE BENDING ANGLES OF THE HEAD**



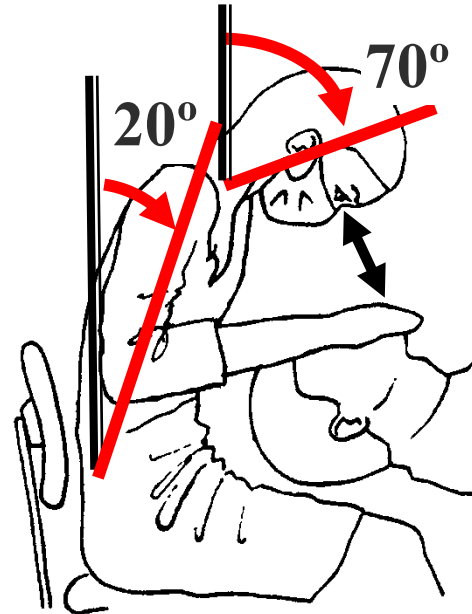
The vision limits of the eye influence the position of the neck and back

Theoretical "Ideal" position:
neck and back straight to see
in the patient's mouth placed
at the height of your waist



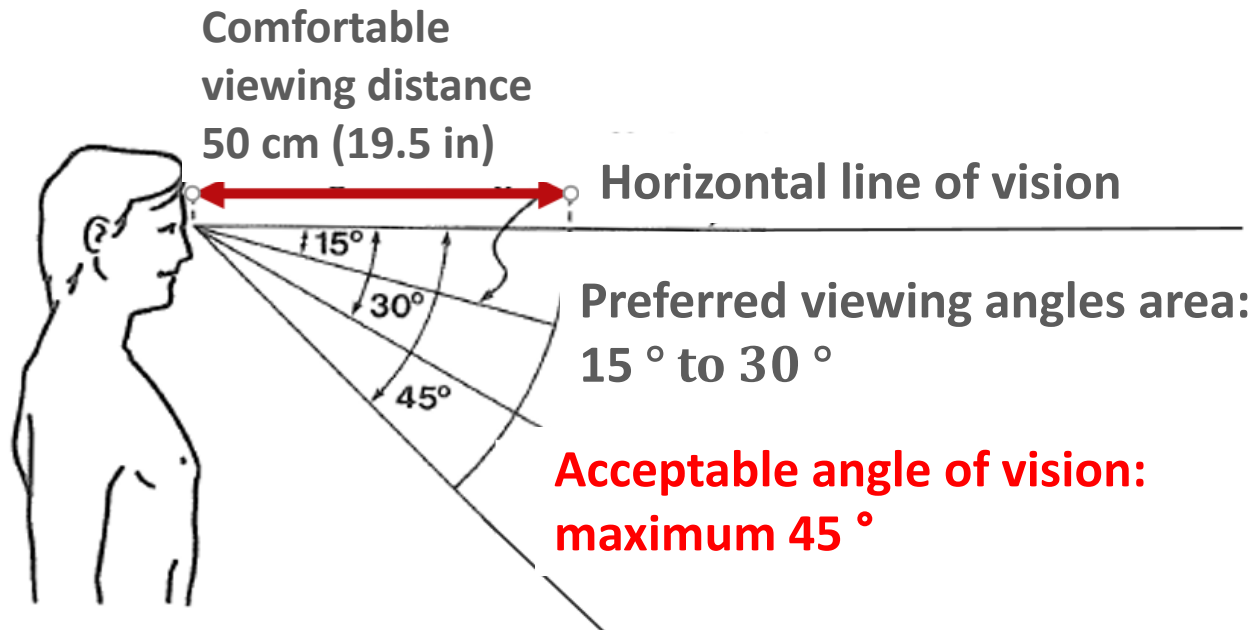
POSITION OFTEN OBSERVED

WHY ?

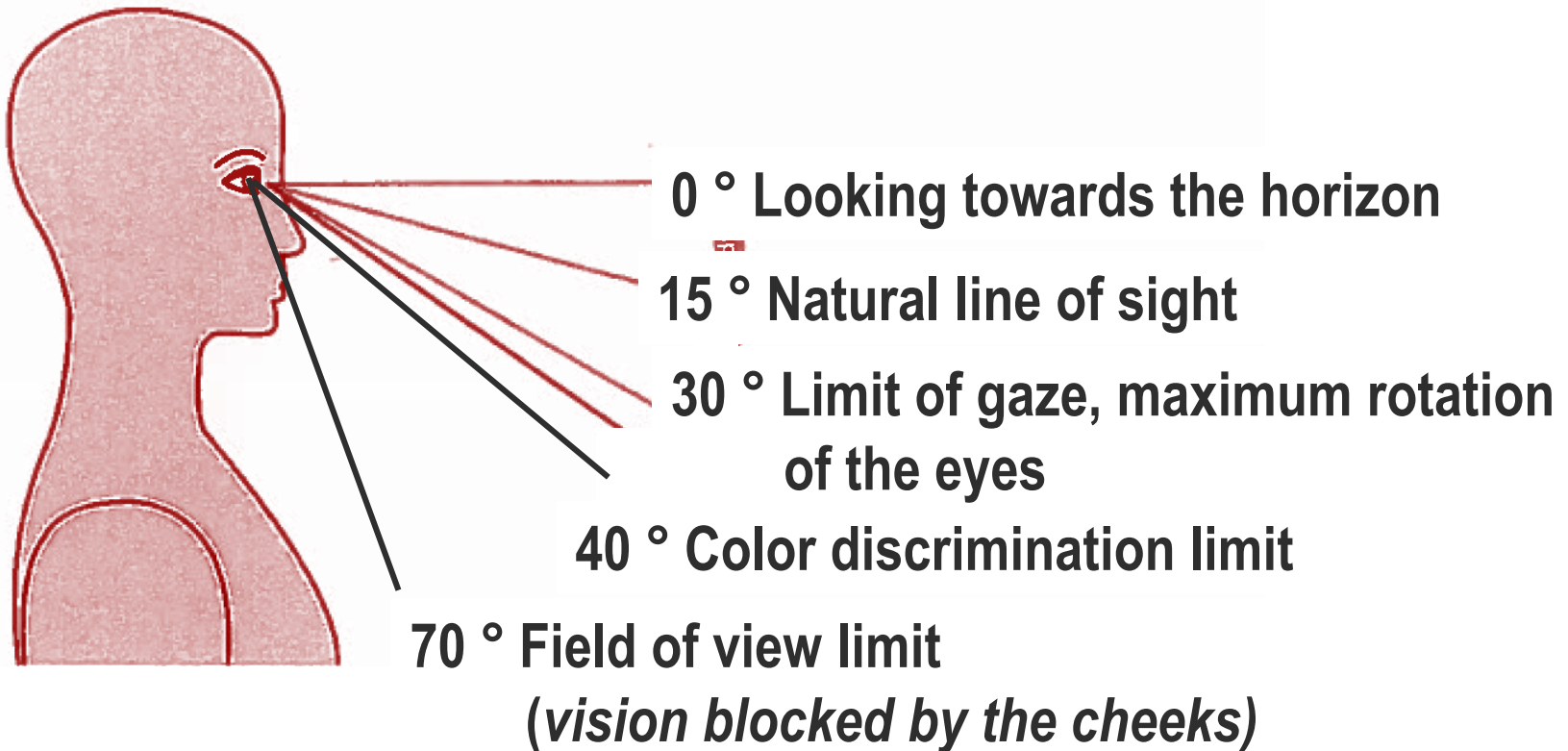


Normal viewing angles when the head is straight

- From 30 ° angulation, the head and neck tilt forwards, the neck muscles are under tension to support the weight of the head

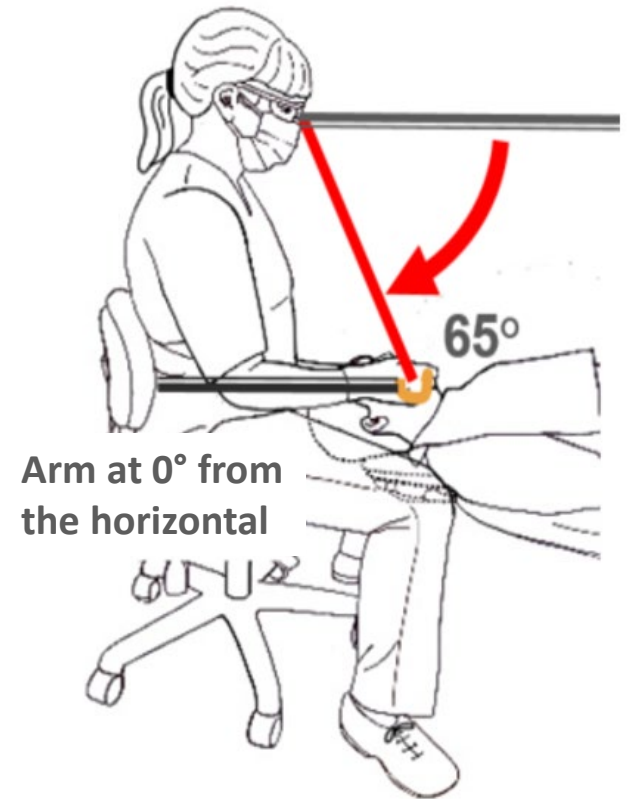


Normal viewing angles when the head is straight

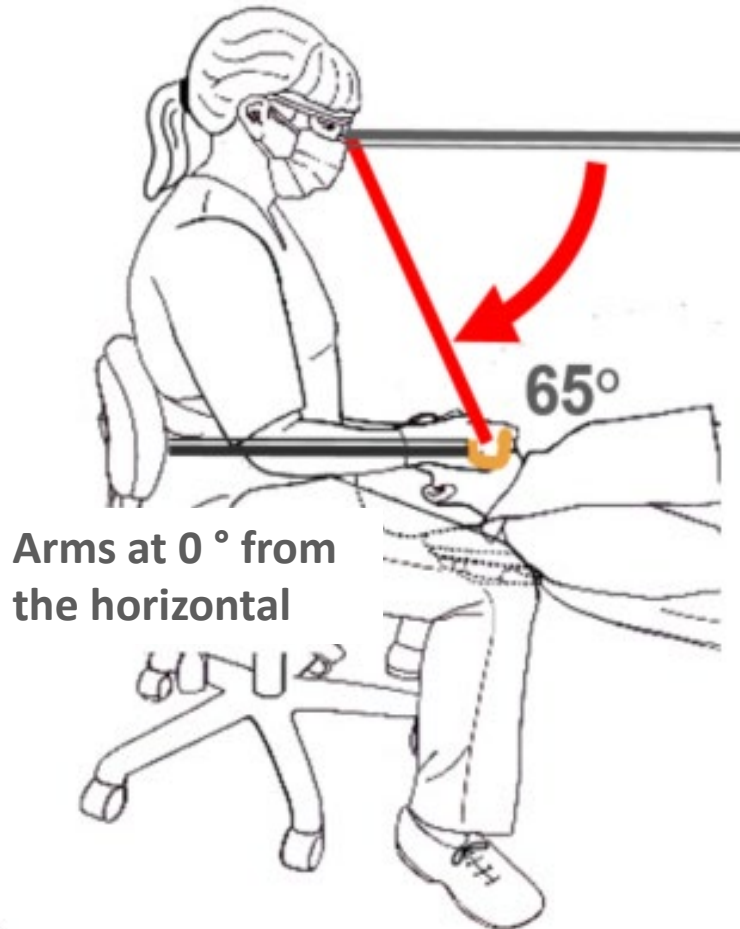


Field of vision when forearms are at 90° (0° from horizontal) and the patient's mouth at waist height

- Viewing angle at about 65° from horizontal
- The distance from the eye to the inside the mouth is at about 75 cm (29.5 in.)
- We have just seen that the **maximum acceptable viewing angle was 45°**



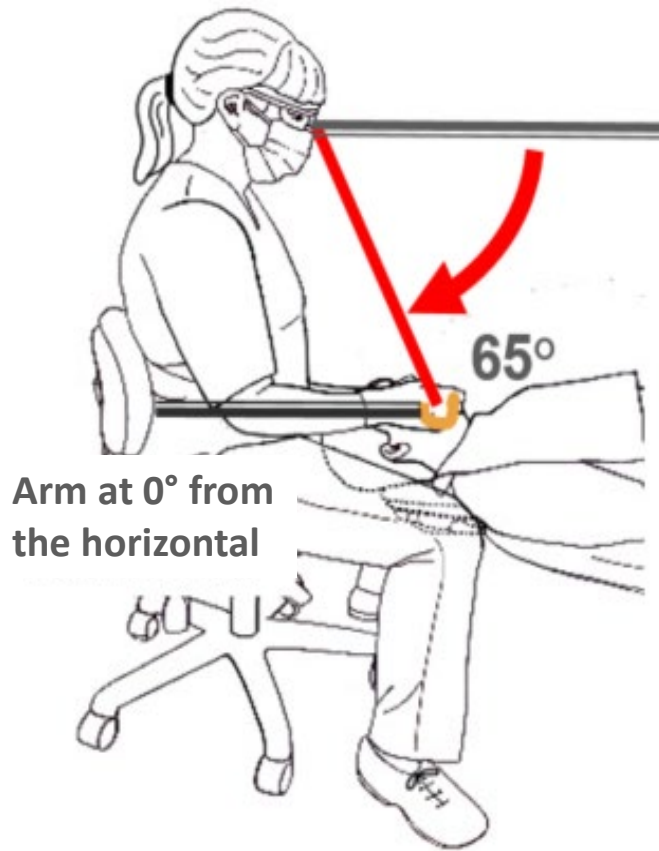
Often recommended position for adjusting the height of the patient's chair



- According to Gehrig (2017), the patient's chair is lowered until the tip of the patient's nose is below your waist! *
- The patient's mouth is even lower
- If you keep your head straight, the viewing angle to see in the mouth is 65°

*Gehrig, 2017, p. 12

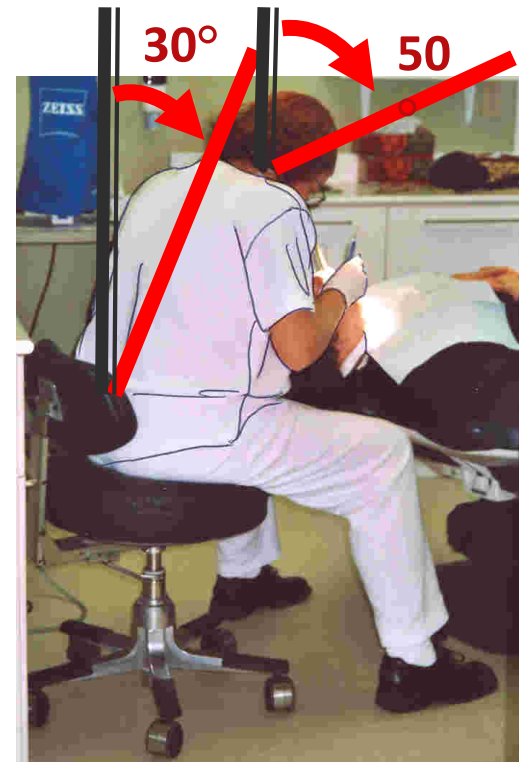
When the patient's chair is placed low (between the knees)



- Is it possible to see in the mouth without bending the head?

When the patient's chair is placed low (between the knees)

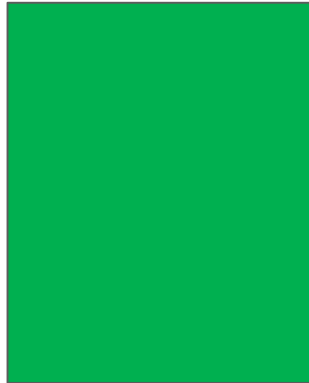
- You have to spread your legs a lot (?)
- The neck and back are very leaning (?)



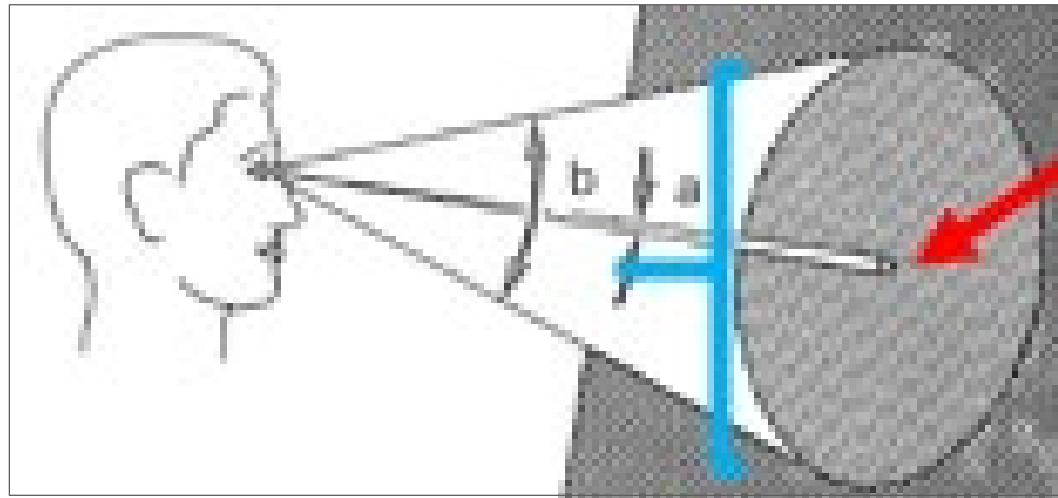
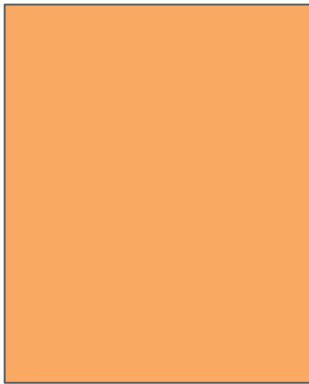
Poll 12

In the field of vision, the very precise and clear vision, covers by how many degrees?

1 degree

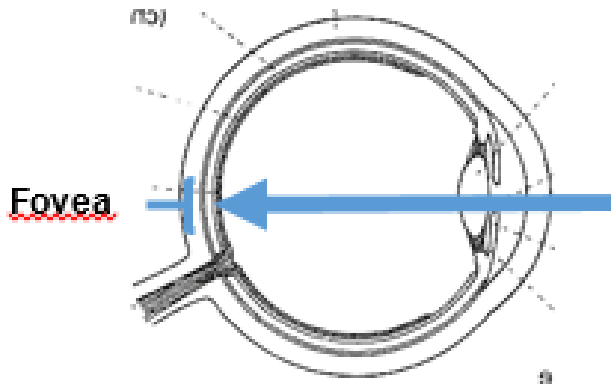
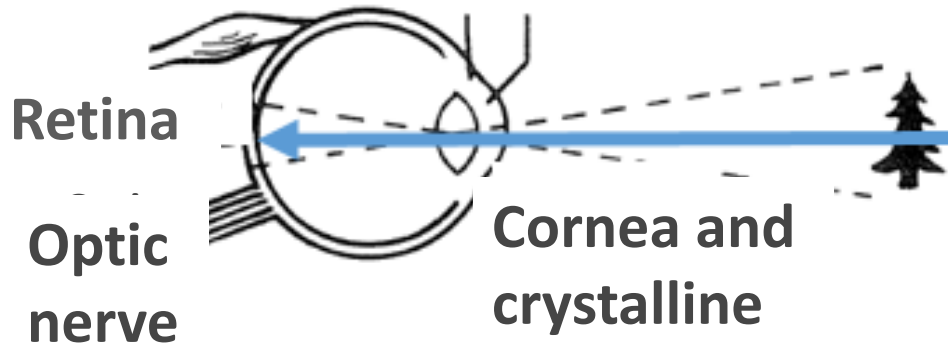


10 degrees



Poll 12 - Answer

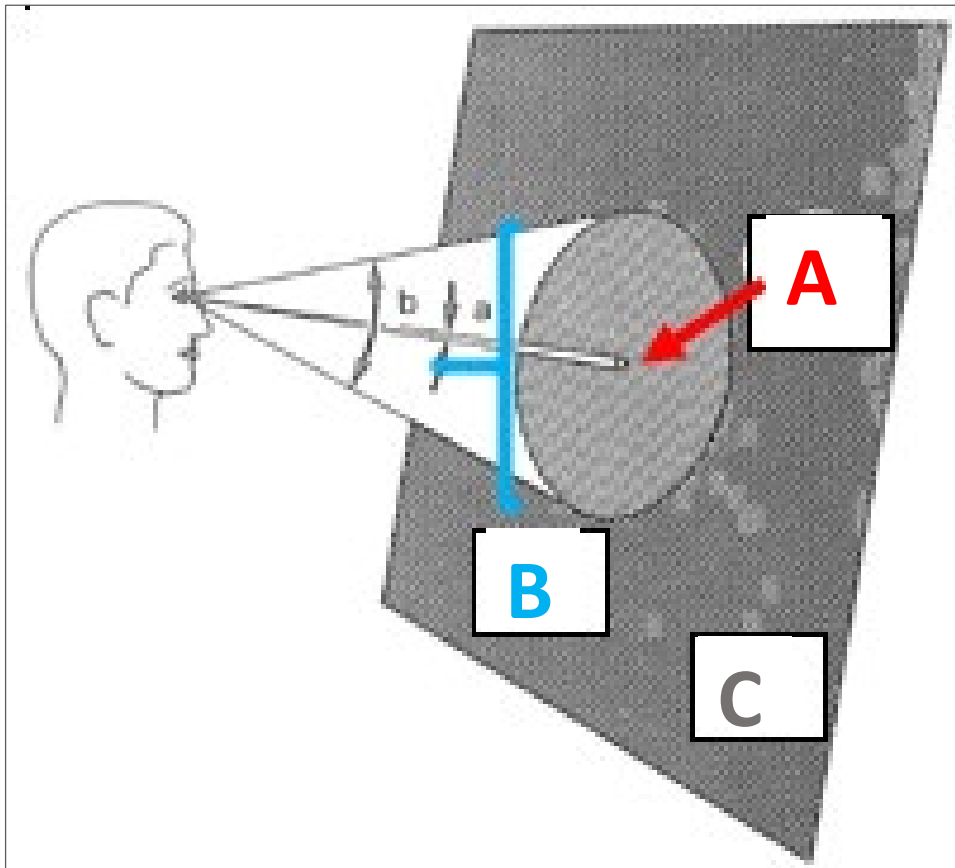
Precise vision limits of the eyes: the fovea (small area on the retina)



- The retina captures the images in the back of the eye and transmits them to the brain through the optic nerve
- The central vision zone of the retina is called fovea
- The fovea captures images with high precision, **but it covers a visual angle of only 1°**

Poll 12 - Answer

Diagram of *Field of View* when your head is straight



- A.** Zone of 1 °:
captured by the fovea,
(very precise and clear
vision)
- B.** Zone from 2 ° to 40 °:
medium field
(blurred vision)
- C.** Area 41 ° to 70 °:
outside field limited by
cheeks, nose
(objects are almost not
seen unless they move)

With forearms at 90 °, you can not keep your neck and back straight

It's normal !!!

- You do high precision job
- Your patient's mouth is placed outside your field of view

From a viewing angle of 30°



your head tilts on its own



8. Concepts of eye-task ergonomics

EYE-TASK VISION DISTANCE

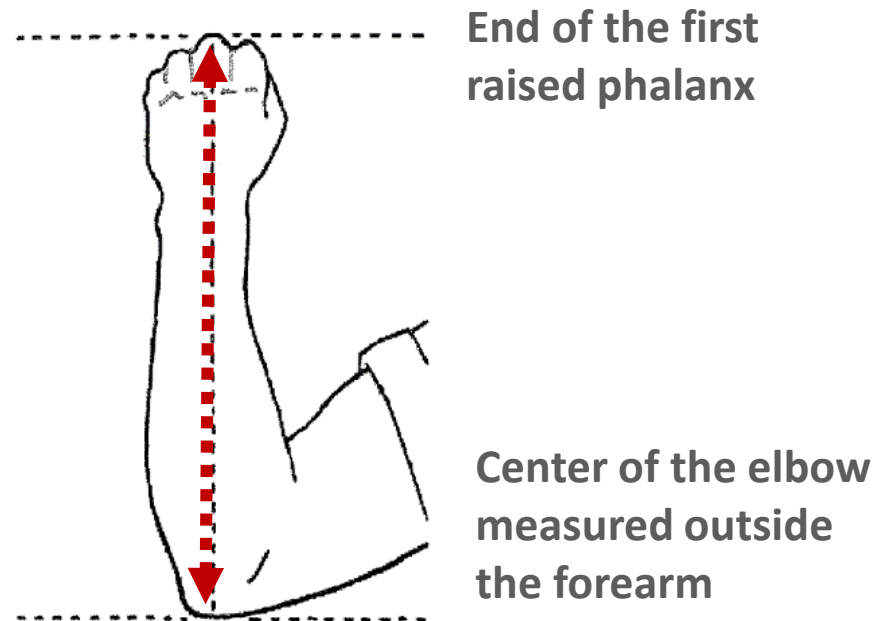


Reference for a good eye-to-task distance

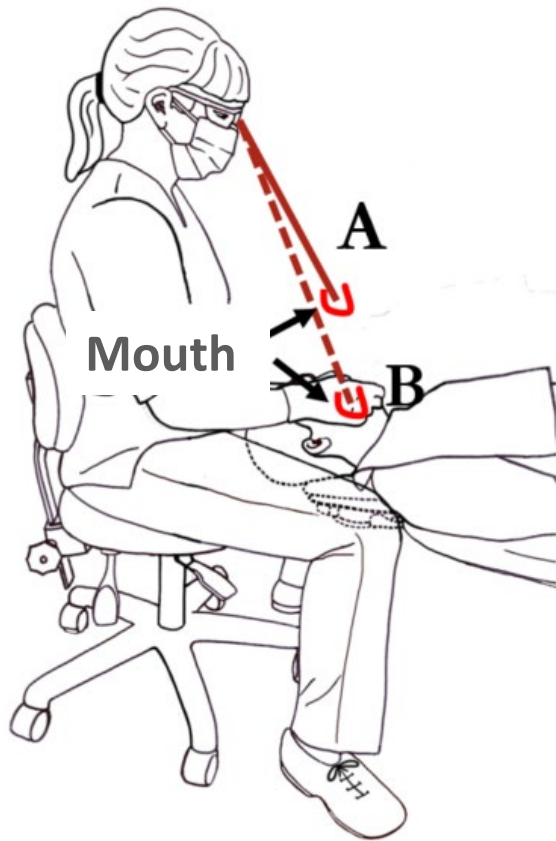
- Reading distance = Hamon distance (length of the forearm)

Average reading distances

	Cm	In
Women	35	14
Men	45 to 50	18 to 20



Eye-to-task distance problem when you patient is placed low



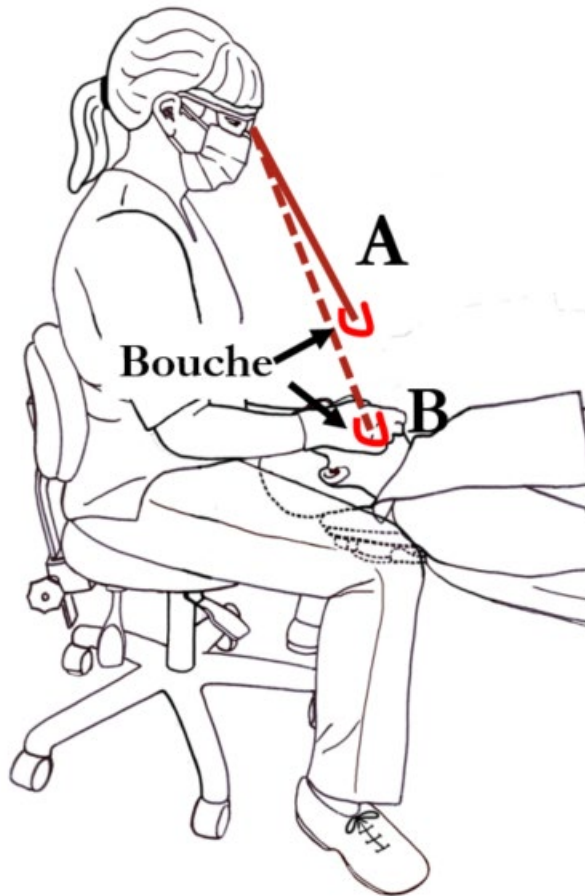
A

- Reading distance = 35 to 50 cm (14 to 19 inches)
- Length of forearm: 35 to 50 cm (14 to 19 in)

B

- When your patient is placed low
- Length to see in the mouth: about 75 cm (29.5 in)

Raise patient chair and raise forearms to ↘ eye-to-task distance



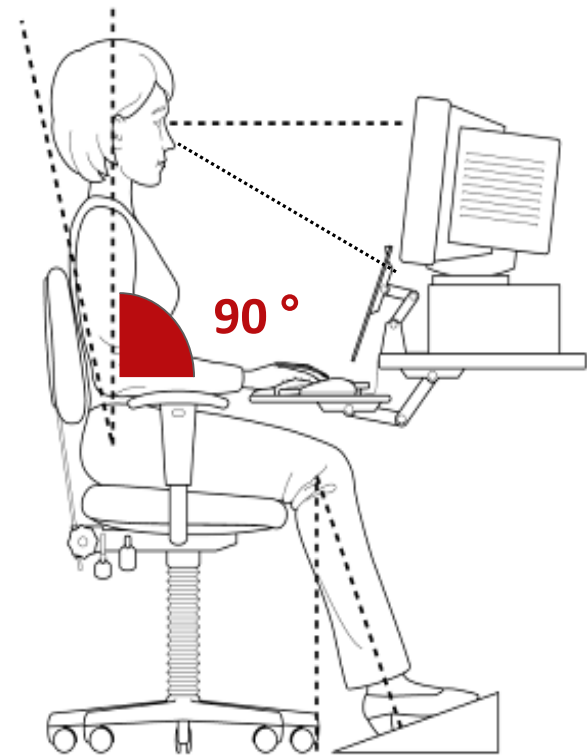
- To reach Hamon distance (**A**)
 - **Women:** about 35 cm (14 inches)
 - **Men:** about 45 to 50 cm (18 to 20 inches)

The "ideal" theoretical position (forearms at 90°) is the same as the one for on-screen work

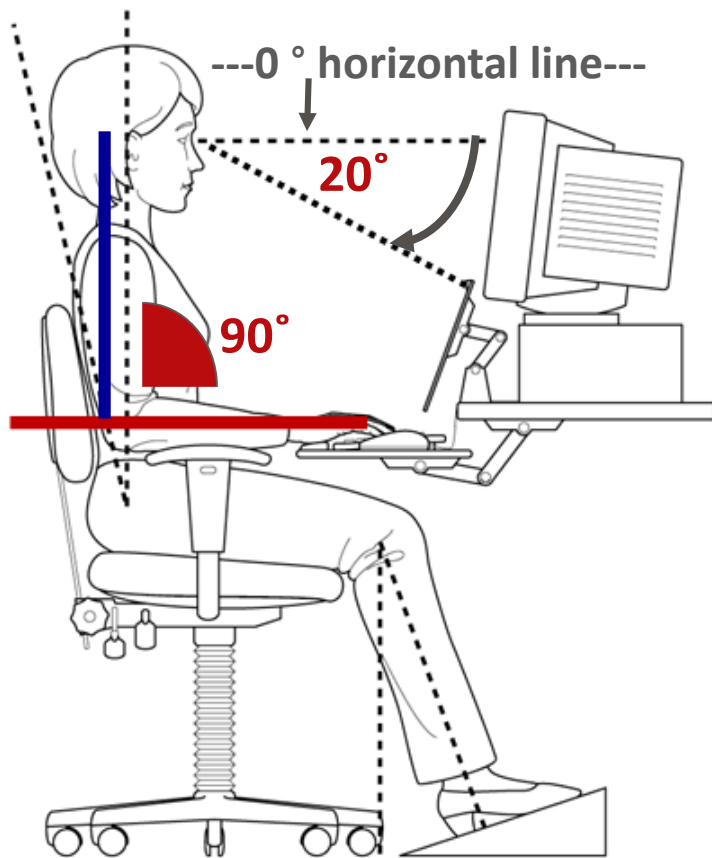
Mouth of a patient



Computer screen

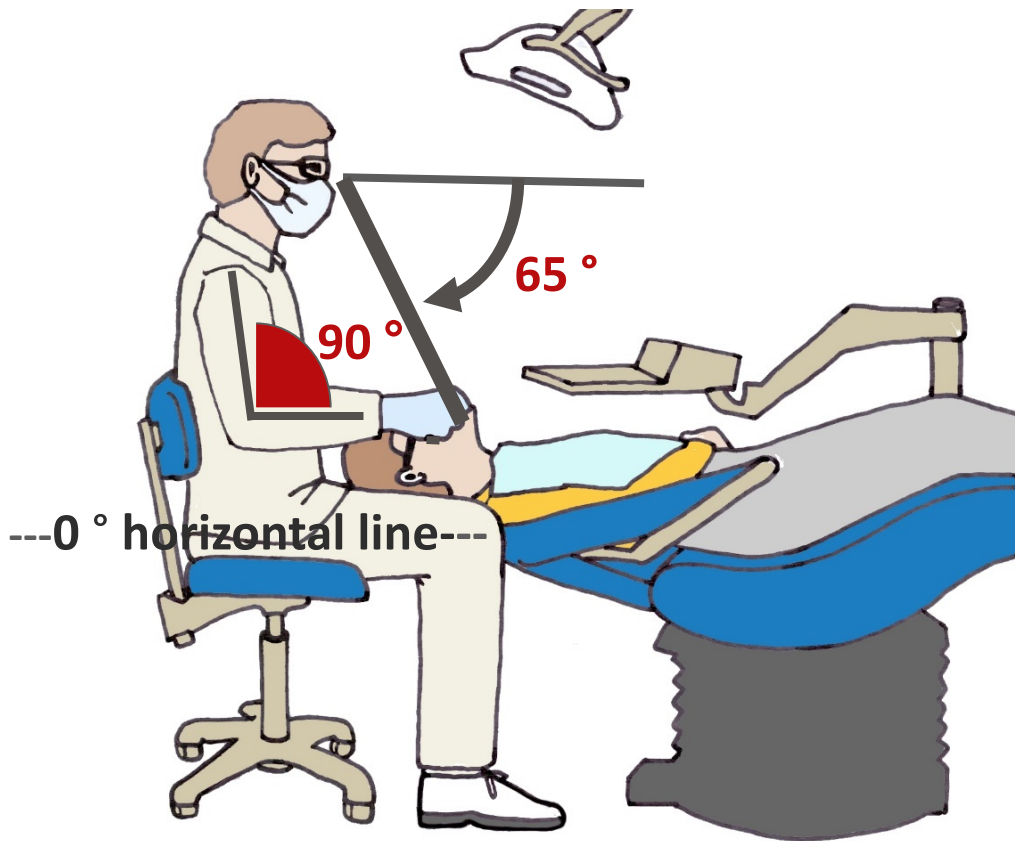


Position of the forearms at 90 ° for computer work



- Screen placed to allow front vision of 20 ° below the horizontal line
- Recommended position for touch typist (*don't look at the keyboard*)
- Arms supported by fixed forearms supports
- Only one level of hand work, parallel to the floor

Impact of position of the forearms at 90° (or 0° from the horizontal line)

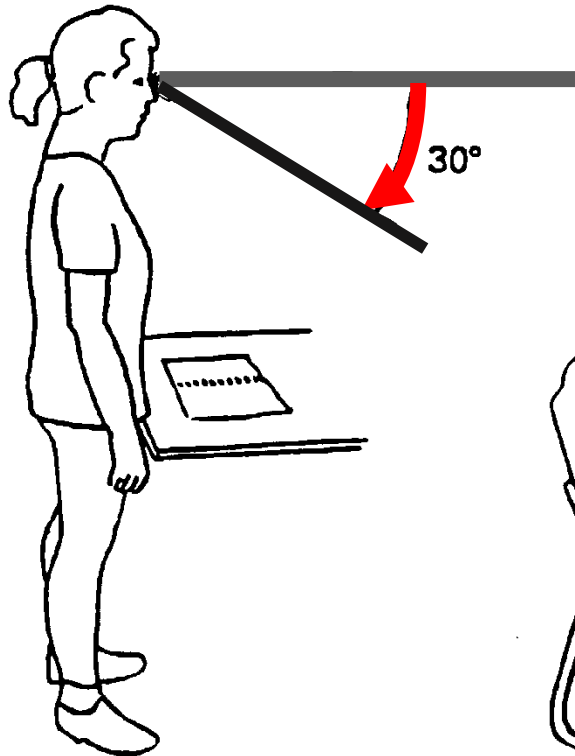


- To be able to see in the mouth
- The 65° angle is outside normal viewing areas
- Requires the use of magnifiers with long focal lengths

Limits of viewing angles for neck comfort

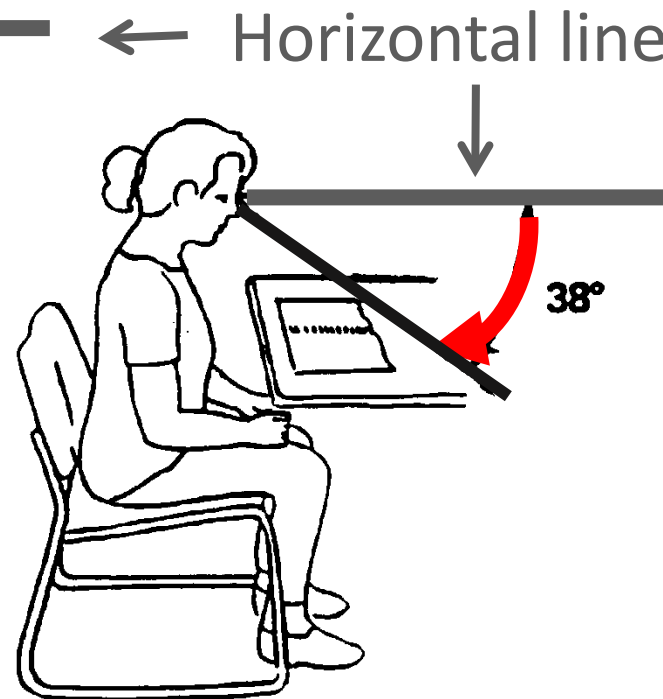
Standing:

30 ° from the horizontal

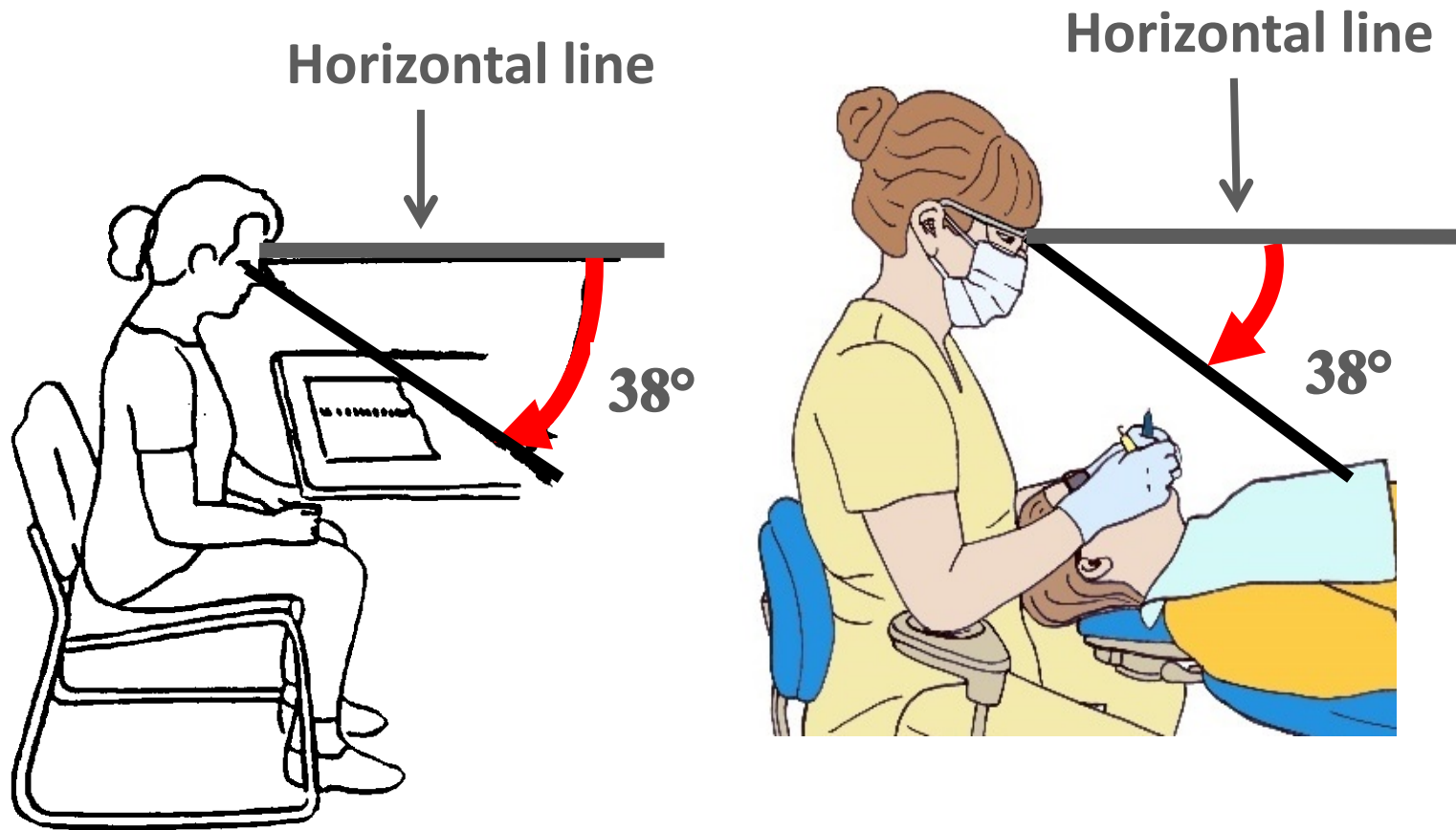


Sitting:

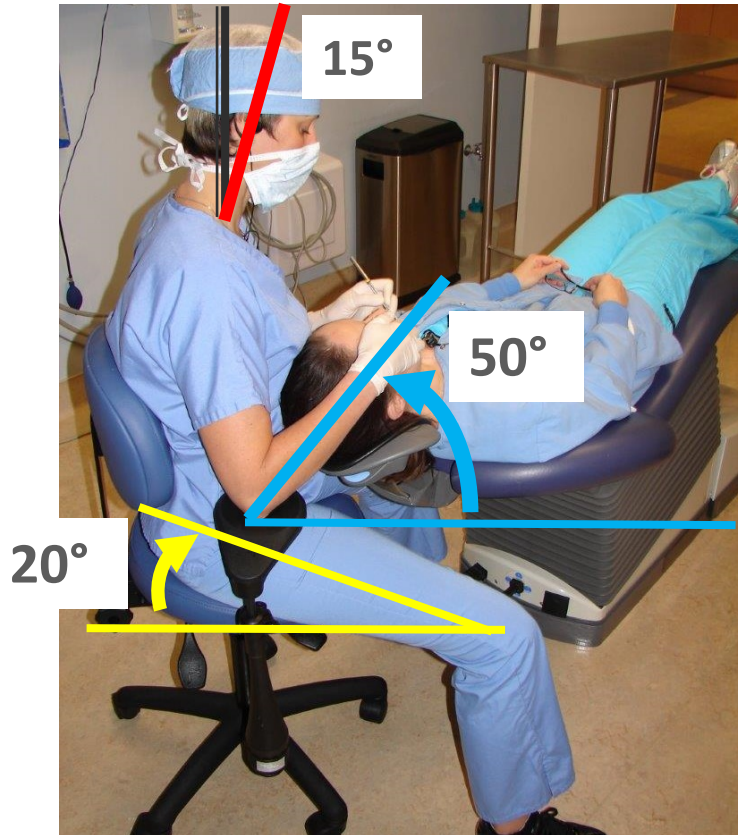
38 ° from the horizontal



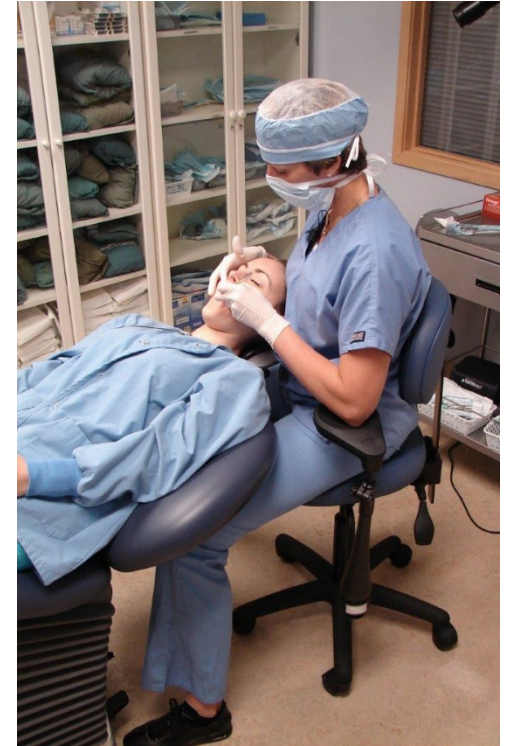
In dental care, the patient's mouth is outside the comfort zone of the neck



The eye-to-task distance is \downarrow by placing the patient higher and raising the forearms

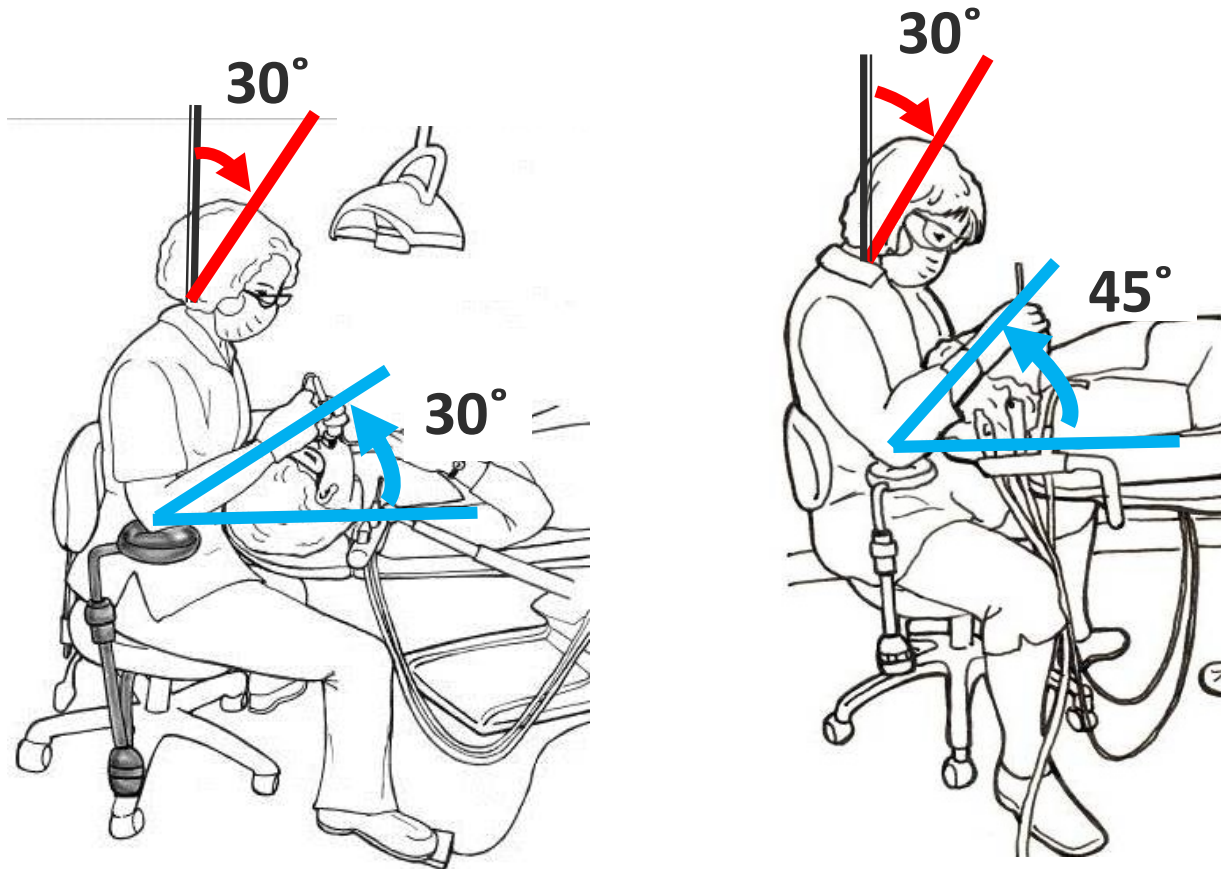


- Straight neck - 15° (*without magnifying glasses*)
- Straight back
- Lower back resting on the lumbar support
- Forearms raised up to 50°



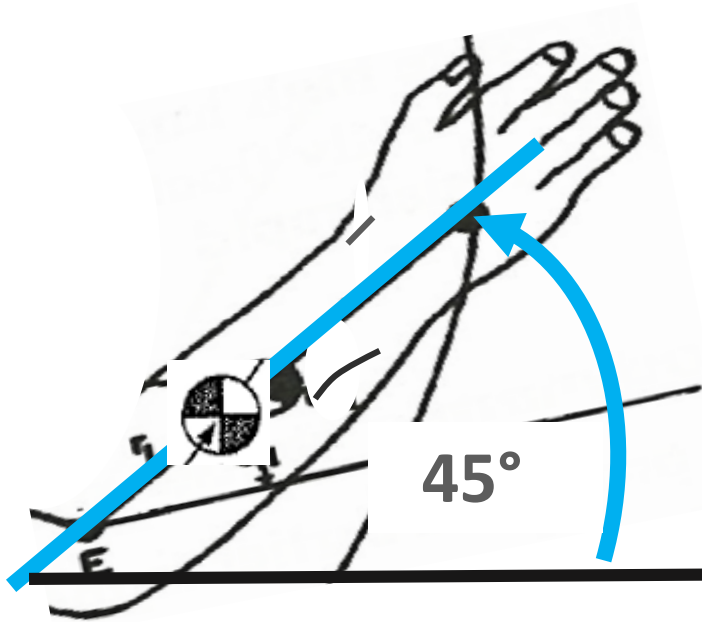
Recommended height to place the patient's head to \searrow flexion of the neck

- Place the patient's mouth at about breasts height



Poll 13

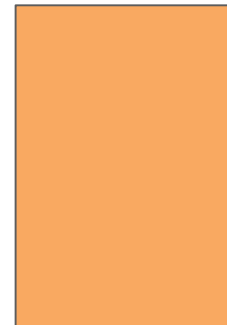
When the forearm is raised 45 °, the biceps effort is



↘ 30%

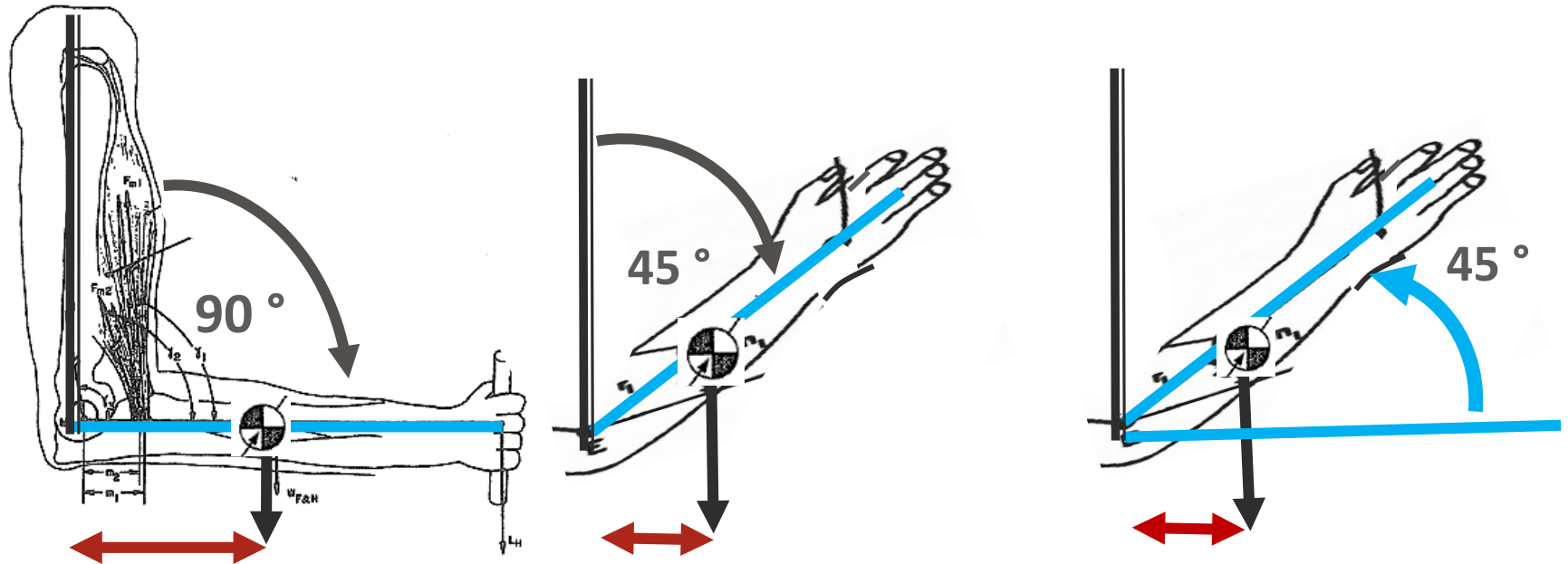


↗ 30%



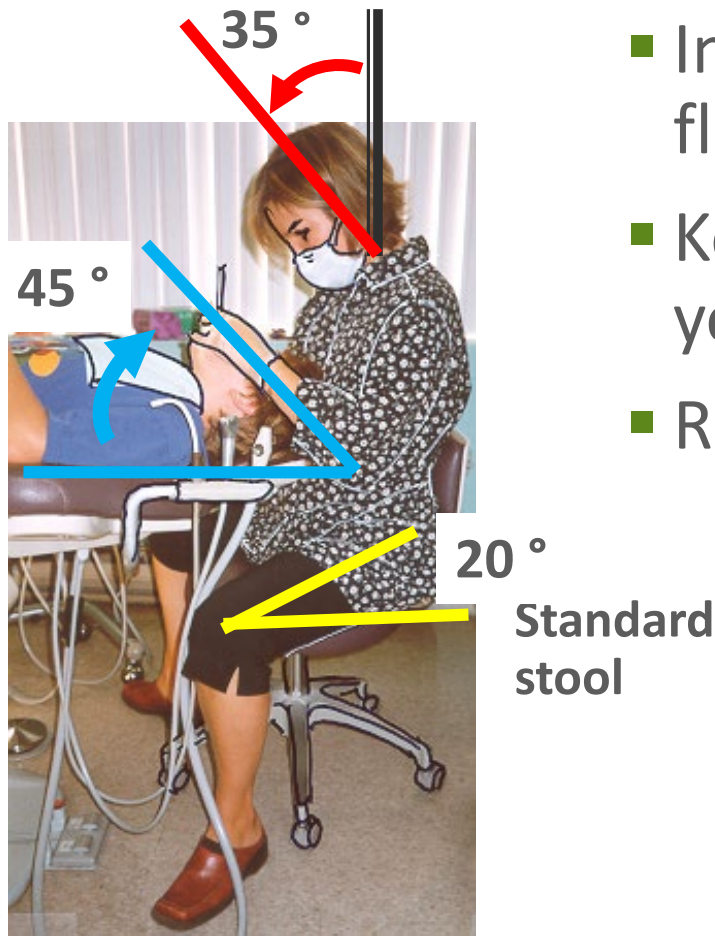
Poll 13 - Answer

When the arm is raised to 45° ,
the biceps effort are \searrow 30%



- The effort of the biceps to counter the force of gravity on the forearm around the elbow is \searrow because the lever arm is shorter

Methods for good working positions



- Install the patient higher and flat
- Keep your elbows close to your body
- Raise the forearms 30 ° to 45 °

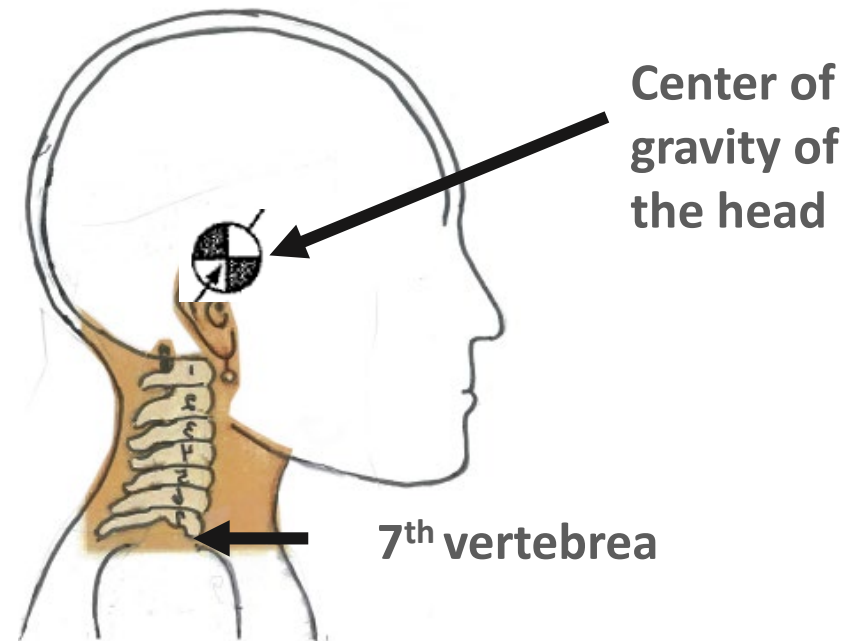
8. Concepts of eye-task ergonomics

***"EFFECTIVE WEIGHT"* OF THE HEAD ACCORDING TO THE BENDING ANGLE**

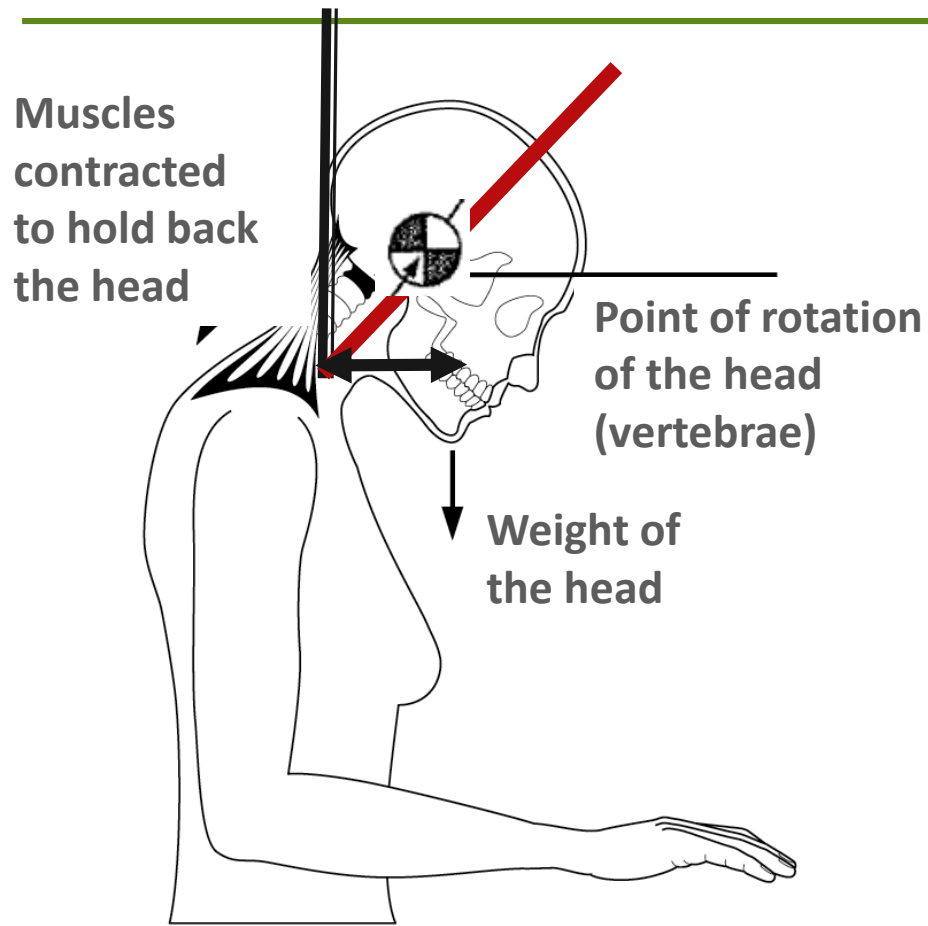


Rotation point at the 7th cervical vertebra

- When the head is straight, the cervical vertebrae are aligned one above the other
- Locate the rotation point at the front of the 7th vertebra to measure the flexion angles

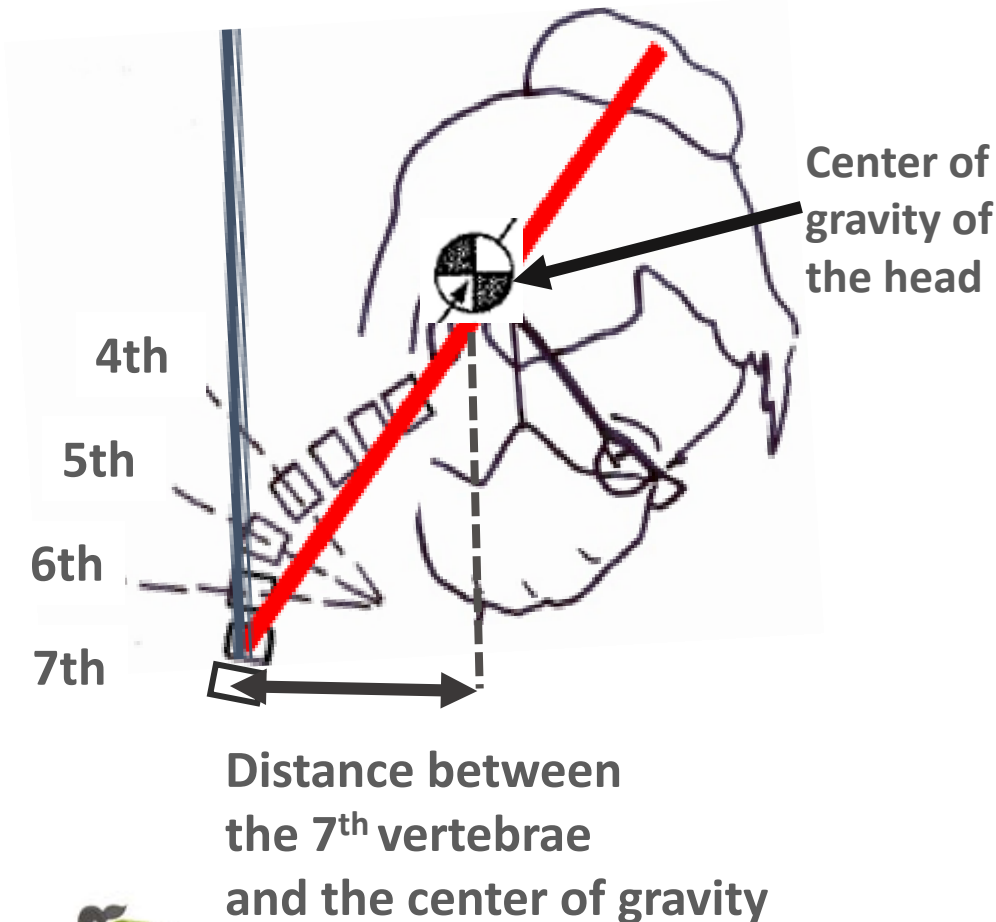


Tilt effects of the forward flexion of the head (eg. 45°)



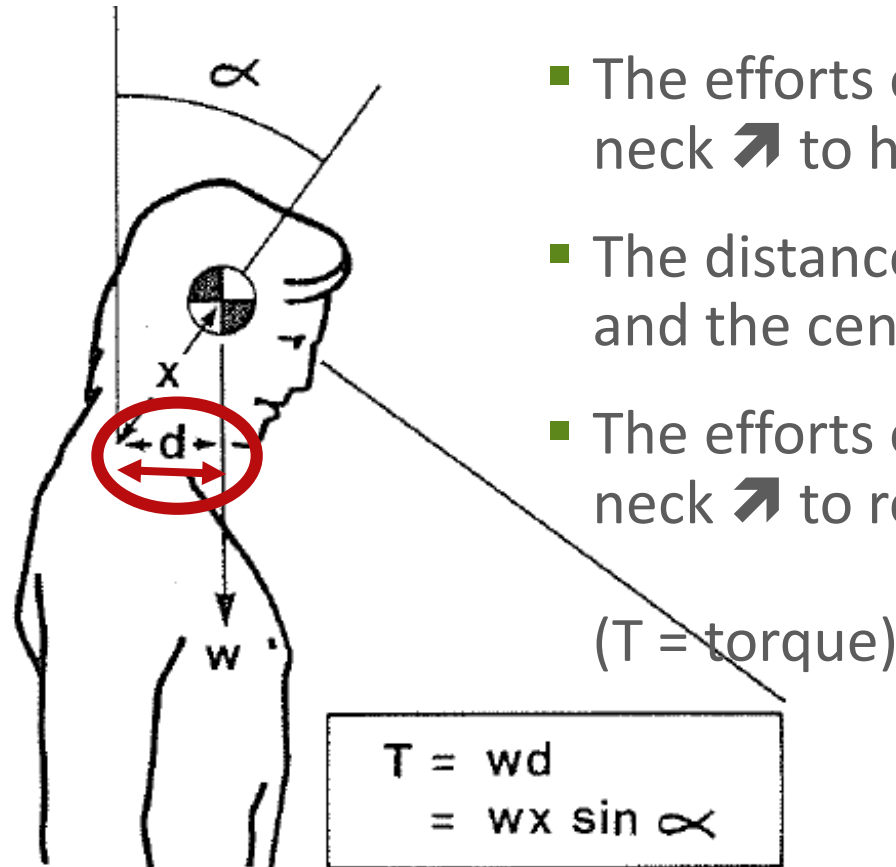
- Upright, the head weight is approximately 5.5 kg (12 lb)
- When the head is tilted forward: its **“effective” weight** ↗ for the vertebrae and neck muscles that hold it

When the head is bending, its "effective weight" is multiplied by the distance between the 7th vertebra and the center of gravity of the head



- In forward flexion, the distance between the 7th vertebra and the center of gravity is ↗
- The distance between the 7th vertebrae and the center of gravity ↗ the "effective weight" of the head", which is the effort required to hold it back

Impacts of flexion of the neck



- The efforts of the muscles of the back of the neck ↗ to hold the head
- The distance ↗ between the 7th vertebra and the center of gravity of the head
- The efforts of the muscles at the back of the neck ↗ to retain the weight of the head

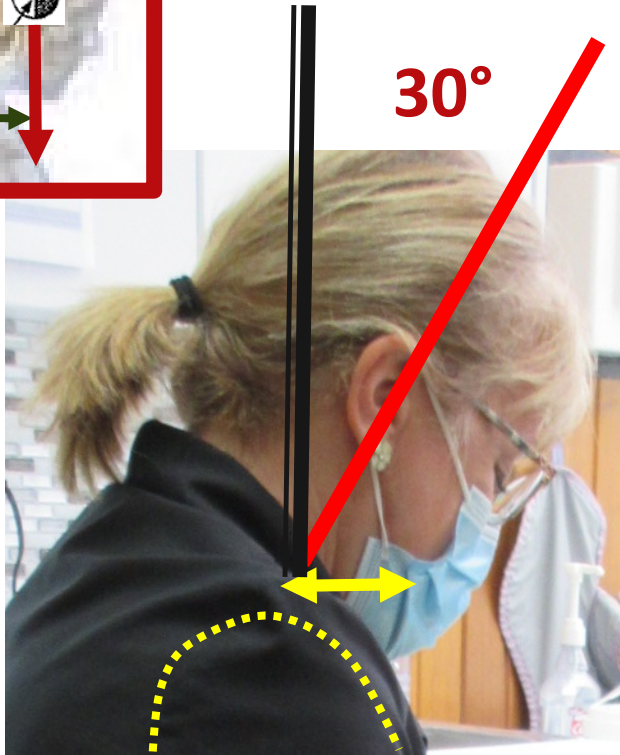
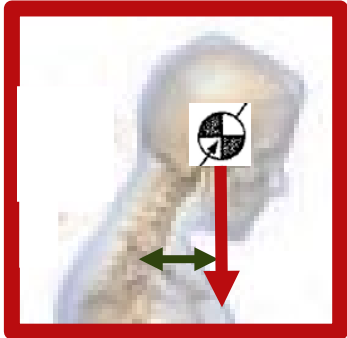
Calculations of “*effective weight*” of the head according to bending angles

- Compression forces are exerted at the base of cervical vertebrae
- These forces include
 - Weight of the head
 - Strength of the pulls exerted by the muscles
- These forces ↗ with the flexion of the head
- This ↗ its “*effective weight*”
- **The calculation of the “*effective weight*” of the head, according to different angles of forward flexion, were performed at the 7th cervical vertebra, with the *Cosmoswork assessment package* (software)**



Poll 14

When the head is tilted forward **at 30 °**, in what proportion does its “*effective weight*” increase?



Upright, the weight of the head is approximately 5.5 kg (12 lb)

■ **Weight X 2**
(12 kg / 27 lb)

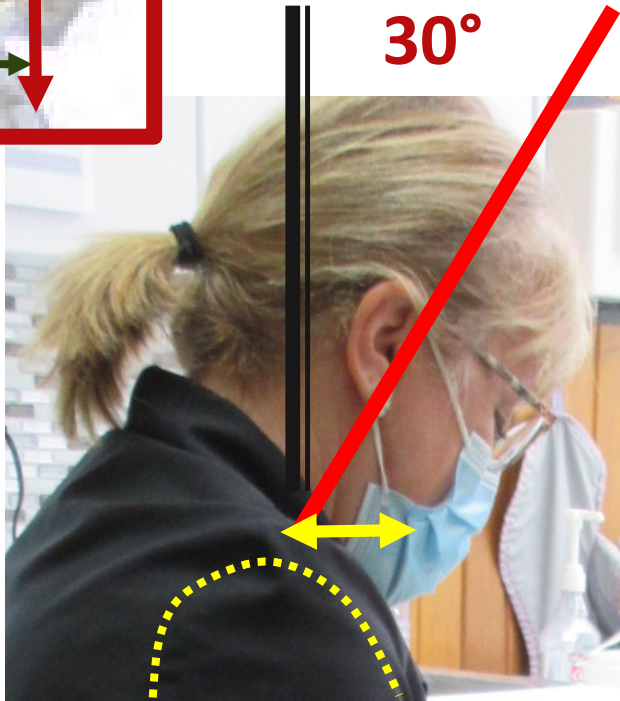
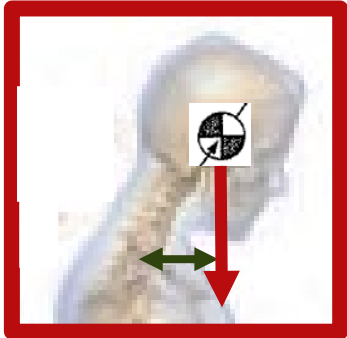


■ **Weight X 3**
(18 kg / 40 lb)



Poll 14 - Answer

When the head is tilted forward **at 30 °**,
its "*effective weight*" increases **by 2 X**

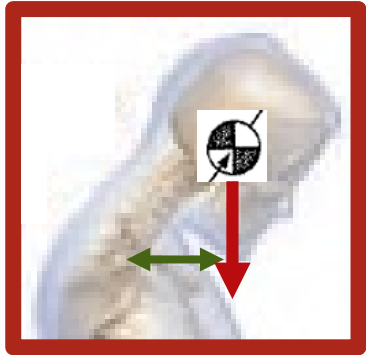


Upright, the weight of the head is approximately 5.5 kg (12 lb)

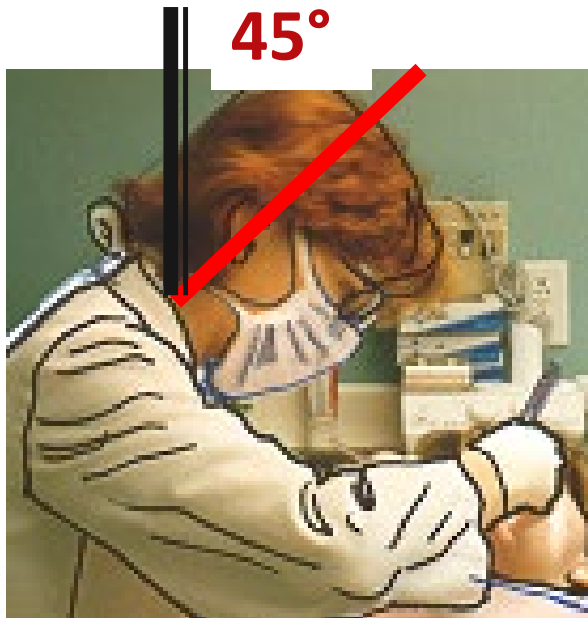
- **Weight X 2**
(12 kg / 27 lb)



When the head is tilted forward at **45 °**,
its "*effective weight*" increases **by 4 X**



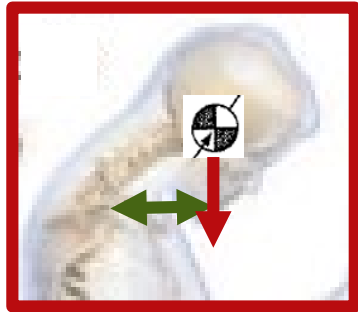
Upright, the weight of the head
is approximately 5.5 kg (12 lb)



(22 kg / 49 lb)



When the head is tilted forward at **60 °**,
its "*effective weight*" increases by **5 X**



Up right, the weight of the head is
approximately 5.5 kg (12 lb)



(27,5 Kg / 60 lb)

➔ About 1 lb per degree !!!!

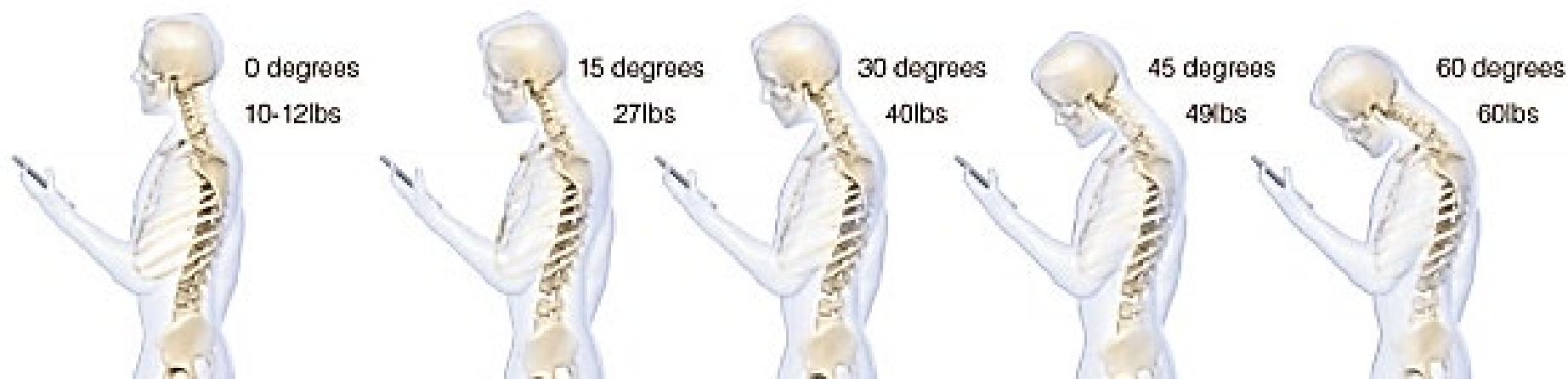
Tilting of the head increases **up to 5 X** the “*effective weight*” of the head

“*Effective head weight*”, calculated on the 7th cervical vertebrae, with neck tilt from 0 ° to 60 °, **↗ from 5.5 to 27 kg (12 to 60 lb)**

Bending angle of the head	Effective weight of the head on the column	
	kg	lb
0 °	5,5	12
15 °	12,3	27
30 °	18,2	40
45 °	22,3	49
60 °	27,3	60

Calculations done at the 7th vertebra, with *Cosmoswork assessment package*

Flexion of the neck is often associated with the positions of drooping shoulders and rounded upper back



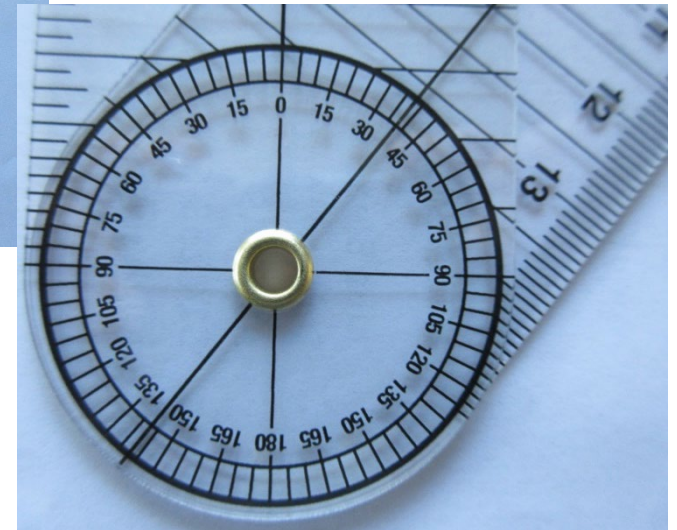
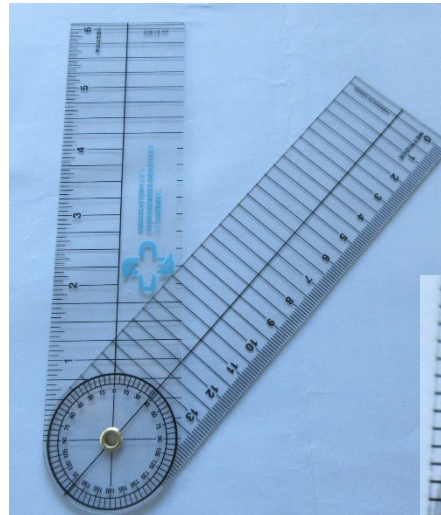
Postures present when using cell phones and tablets

Calculations done at the 7th vertebra,
with *Cosmoswork assessment package*

Hansraj, 2014

EXERCISE

You will learn to evaluate work postures by measuring the angles of different parts of the body while working (neck, lower back, arms and forearms)



The ACDQ provides each of you with a protractor.
You have a document of 8 pages in your kit.
We will practice!



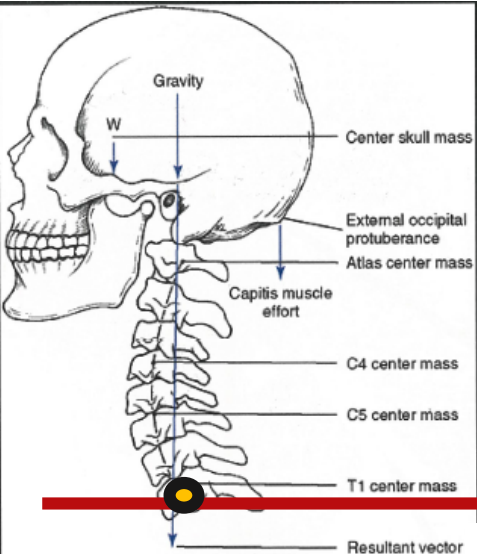
Learn how to measure the angles of the working postures



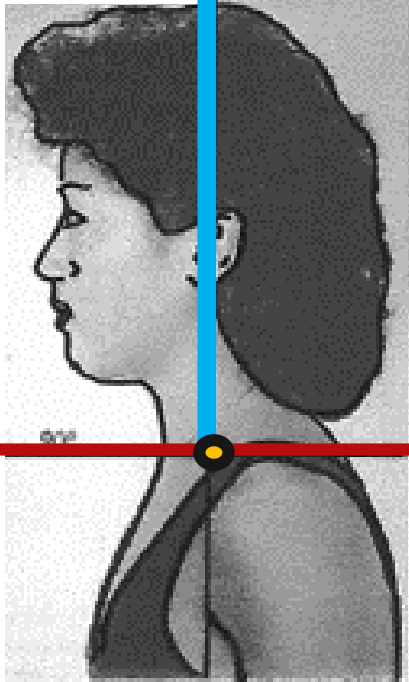
- To facilitate the position of the landmarks, wear well-fitted and/or light colored clothing allowing to visualised well the body parts being evaluated (e.g. neck open)
- Attached your hair, if needed
- During your work, ask somebody to take pictures of you, as much as possible, really from the side, or from the front, depending on positions evaluated
- Print a copy, full page, of each photo taken (8 ½ x 11”)



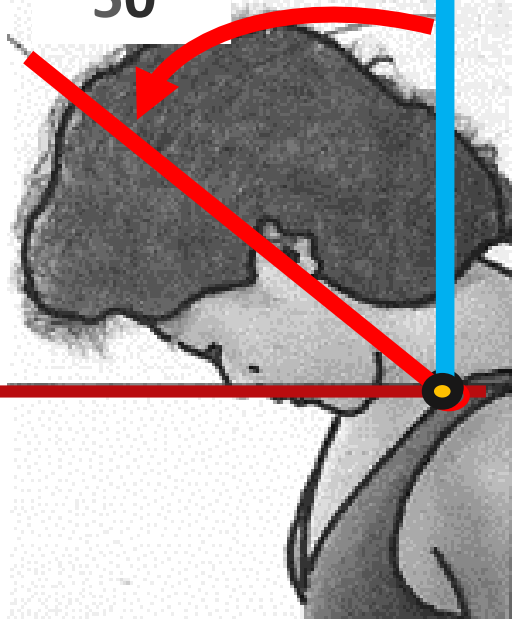
To measure the angle of flexion of the neck, you will need 2 photos



0° Neutral



50°



7^e
vertèbre
cervicale

Rotation point located at the base of the neck in front of the upper arm

Adaptation de Williams-Pedreti, 1990, p. 66

<https://musculoskeletalkey.com>

9. SOLUTIONS - METHODS

"Design by feel" approach

Facilitating means to put the patient's chair back flat

Move the patient's head several times

Take supports

Do some activities standing to vary the postures
(eg: dental exams)

Have instruments whose tubing does not pull

Ask the patient to hold the suction and tubing of heavy
instruments

Methods for the assistant



In 2018

FINDING

Almost all dental workers work with their necks tilted

QUESTION

Is it possible to work in a different way?



Activity

- Close your eyes and keep them closed
- Imagine that you have to introduce a needle into a button
 - Place your hands so you do not prick them
 - Hold the position of the arms
 - Open your eyes
 - Observe the position of people close to you



In the year 2000

- Annual Congress of the International Ergonomics Association, San Diego, California
- Japanese dentists present their approach developed in the early 1980s



9. Solutions - Methods

« DESIGN BY FEEL » APPROACH

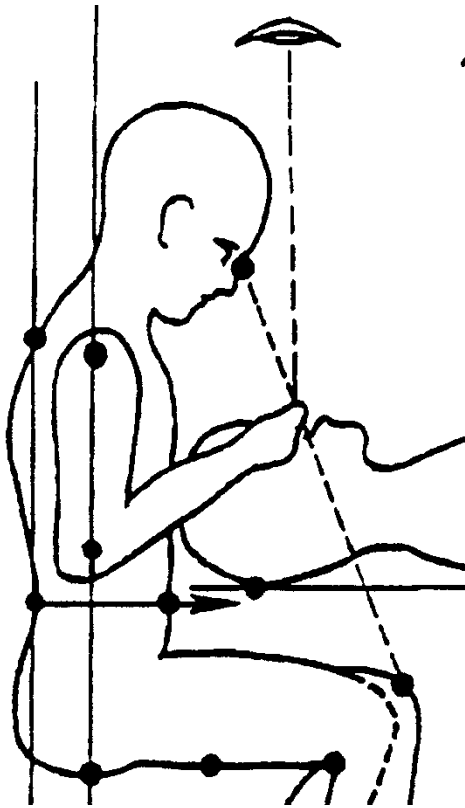


« *Design by feel* » approach



- Designs inspired by sensations in the body
- Approach developed in Japan (1980)
- Used to determine the best working positions in dentistry
- Positions similar to our exercise to adjust the watch or insert the needle into the button

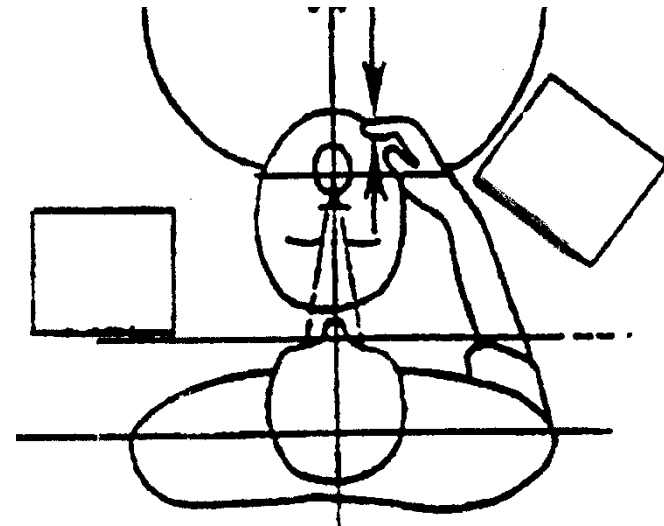
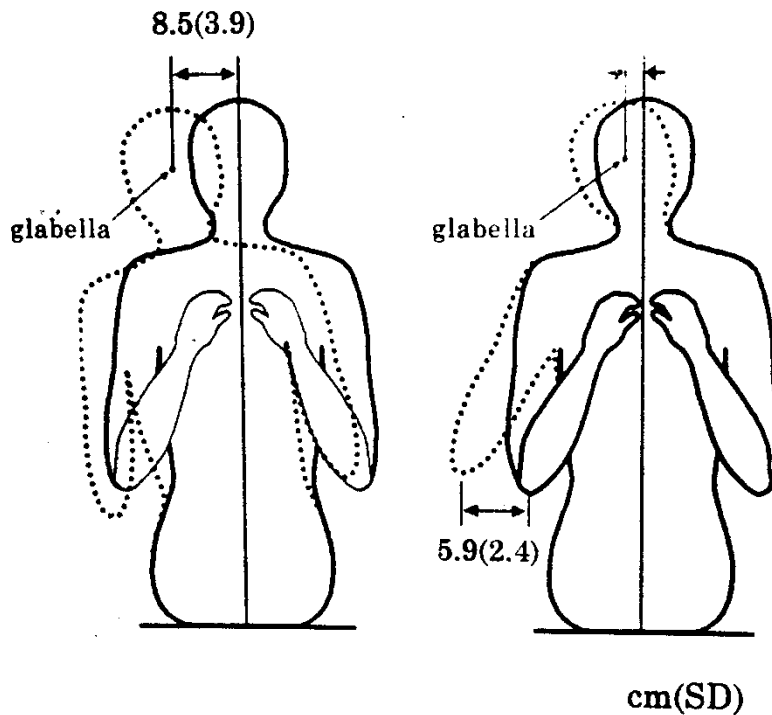
"Design by feel" approach



Belensky, Michael, 1998, p. 285,
Witenstrom et Kasaguchi, 2000, IEA Congress (*Poster session*)

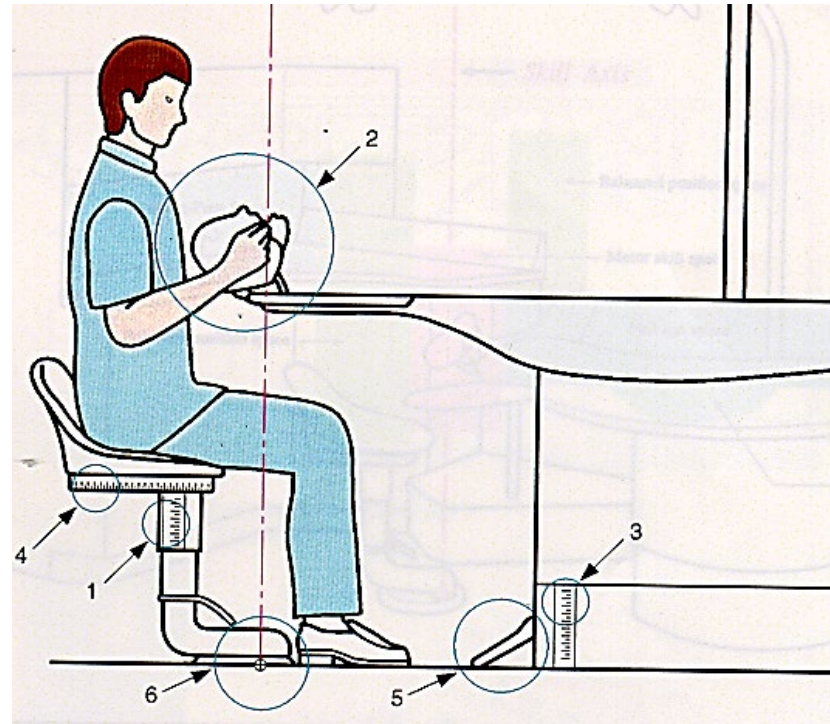
"Design by feel" approach

- Position majoritairement à l'arrière (12 h)



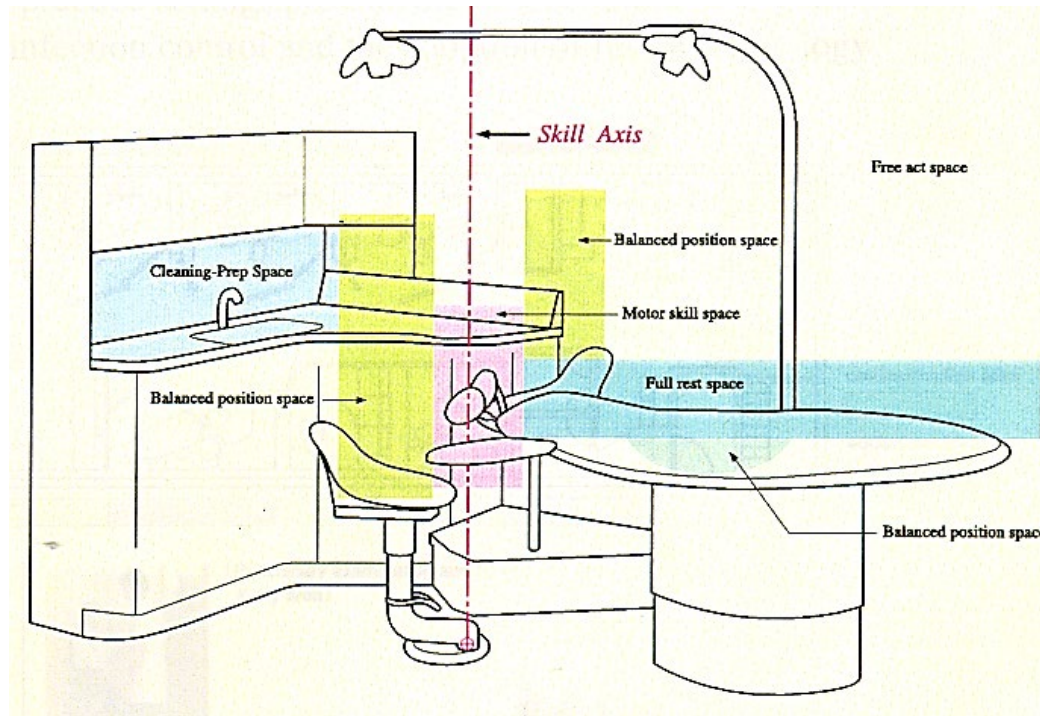
"Design by feel" approach

- The patient is placed higher and on a flat surface

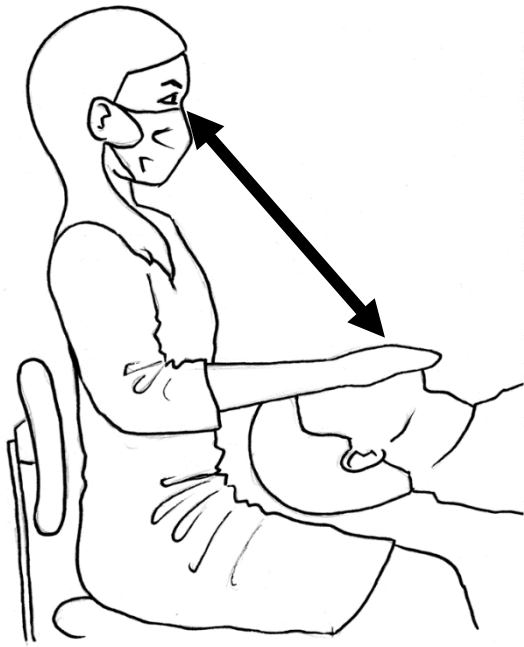


"Design by feel" approach

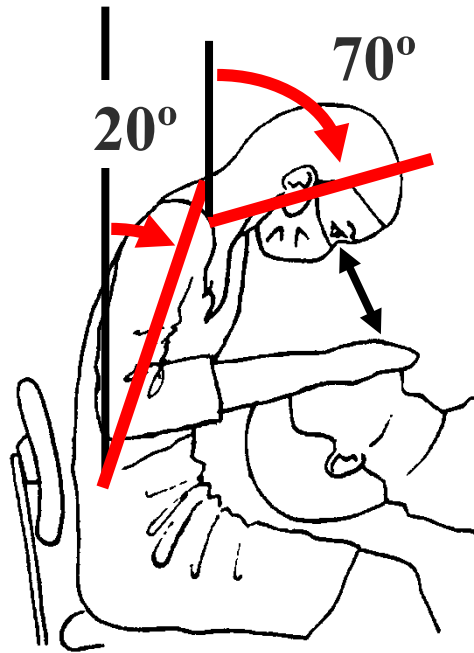
- Use a dental bed instead of a patient chair with backrest



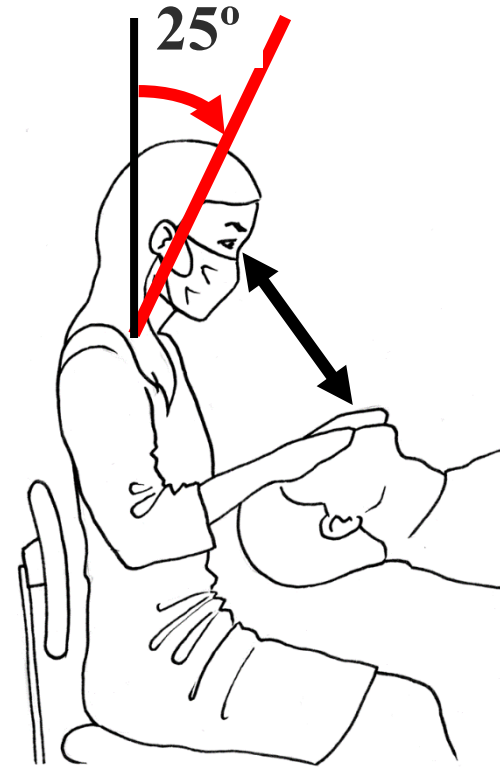
The position of your neck and back depends on the height of the patient's head



Ideal theoretical position



**Observed positions:
tilted neck and back**



**Straighter position of neck
and back when the patient
is placed higher**

Adaptation Rucker, 1998, 9. 197-201

Adopt the 12 o'clock position

- Make it easier to turn or move the patient's head



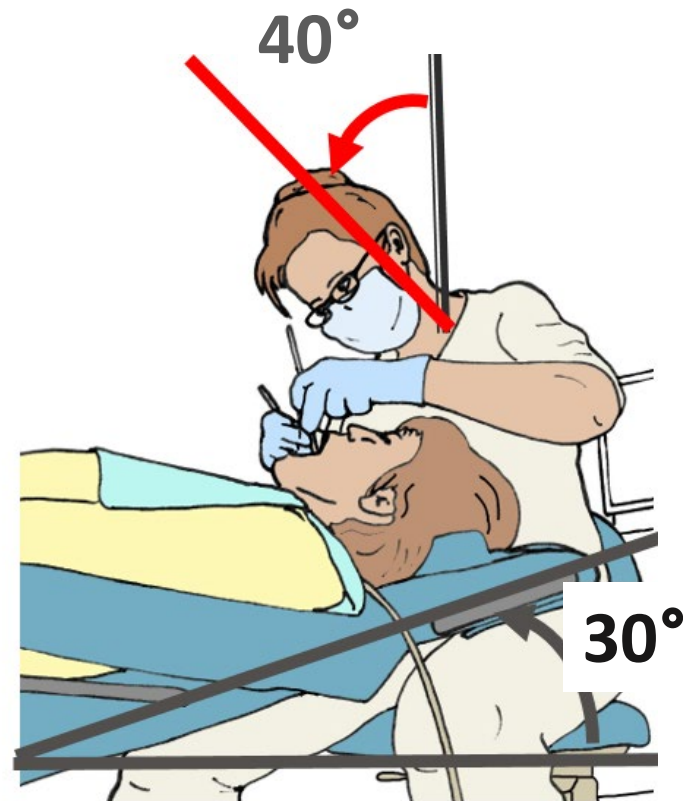
9. Solutions - Methods

**FACILITATING MEANS TO PUT THE
PATIENT'S CHAIR BACK FLAT**

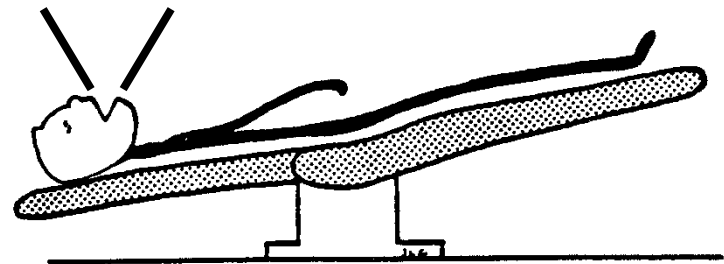
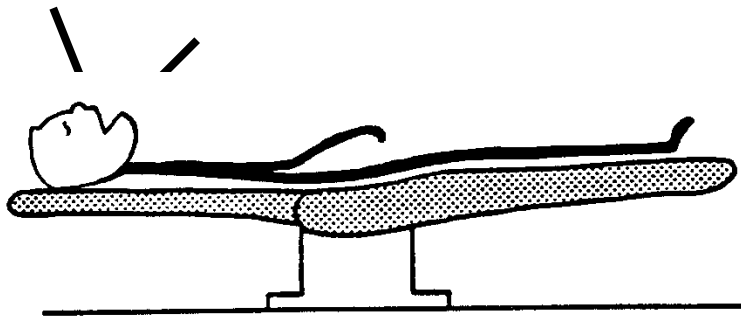
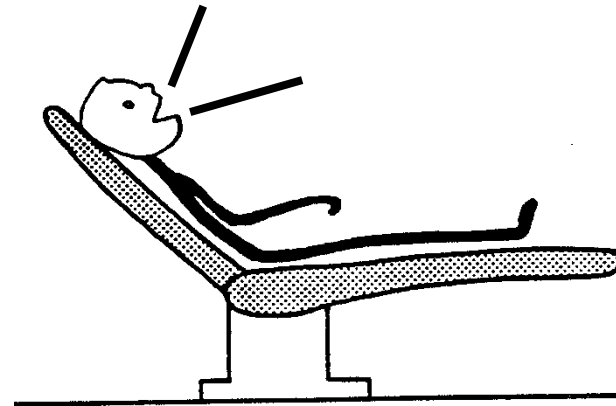
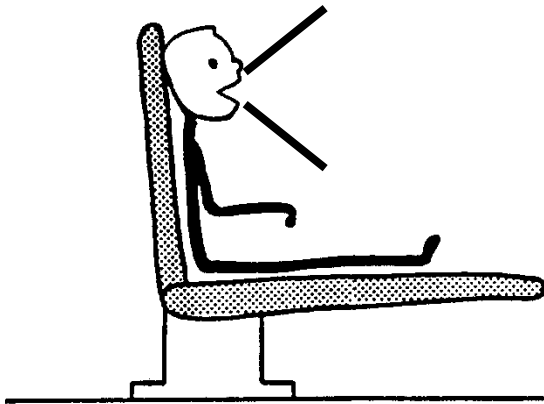


Postures problems when height of patient's chair is low and its backrest is raised

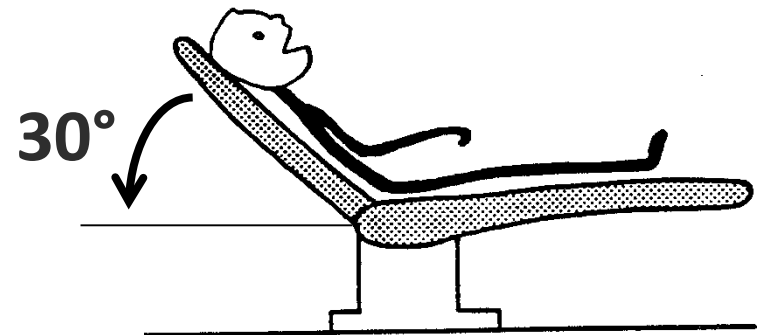
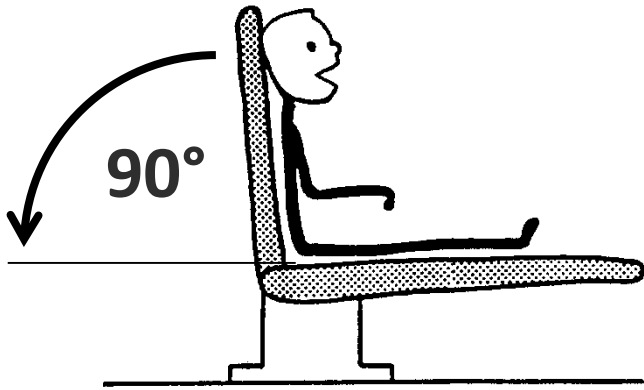
- Cause back and neck postures flexed to the side and forward



The inclination of the patient's chair backrest influences the angle of his mouth opening



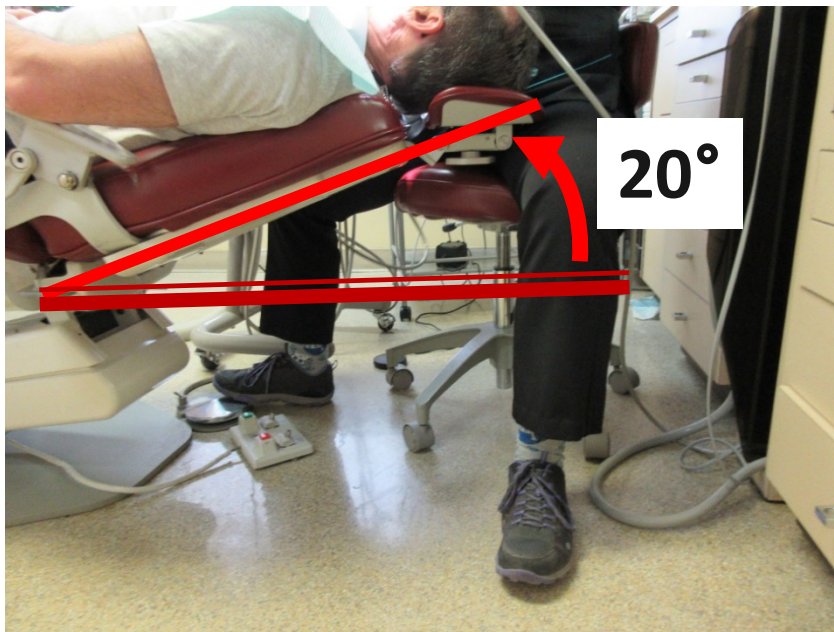
Sit the patient with the backrest already tilted at 30° to ↓ his reluctance to be lowered flat



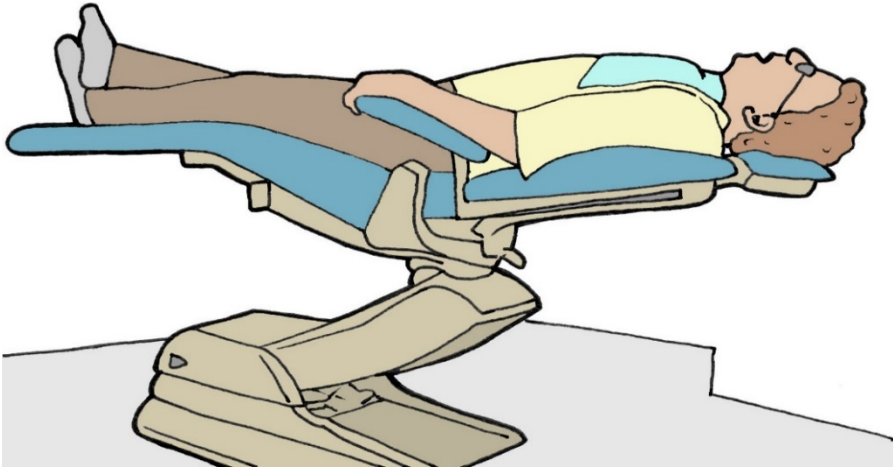
- The distance to be lowered is higher when he is sitting on a chair with a straight back (90° drop)
- The distance to be lowered is ↓ when he is sitting on a chair already tilted (30° drop)



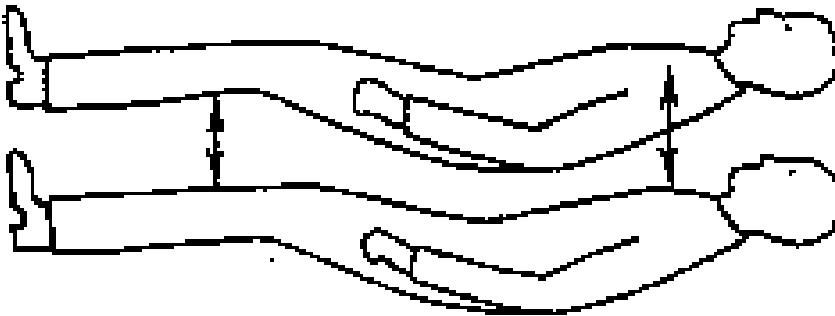
When the patient's chair is placed low and the backrest is raised, this leads the caregiver's legs to be wide apart



Patient in the correct flat position , horizontally



- Would be safer for the patient
- Deglutition reflex would be reduced



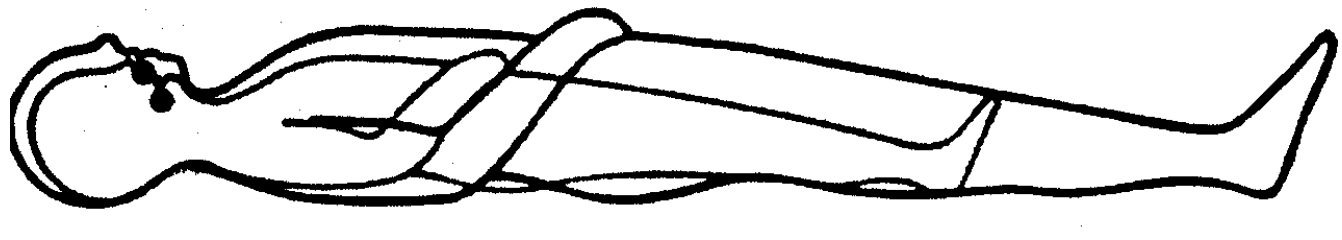
Adjust patient's chair flat



- The height of the whole chair has been raised
- The chairback is as flat as possible
- Adjust height of the patient's mouth to your mid-thorax

Bring the patient's head to the end of the headrest

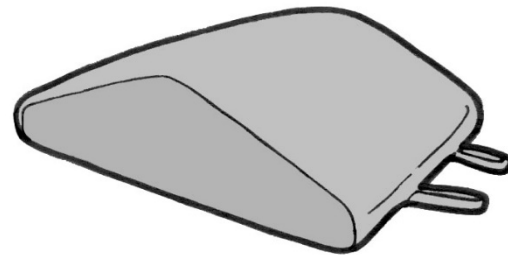
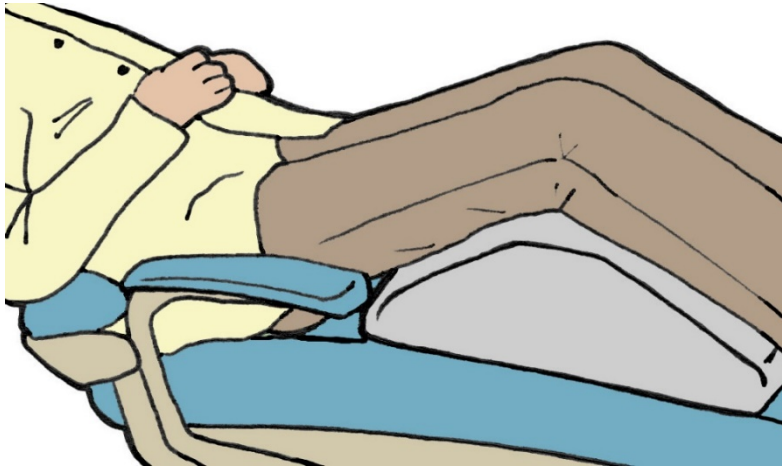
- Get closed to the edge of the headrest
- Adjust the length the headrest if possible
- Bring the patient up if the headrest is fixed



Position the patient more flat

For patient's comfort, use a triangle cushion to help position him at the end of the headrest

- Under the knees of an adult patient
- Under the buttocks of a child



- Straps to hang the cushion on the wall when not in use



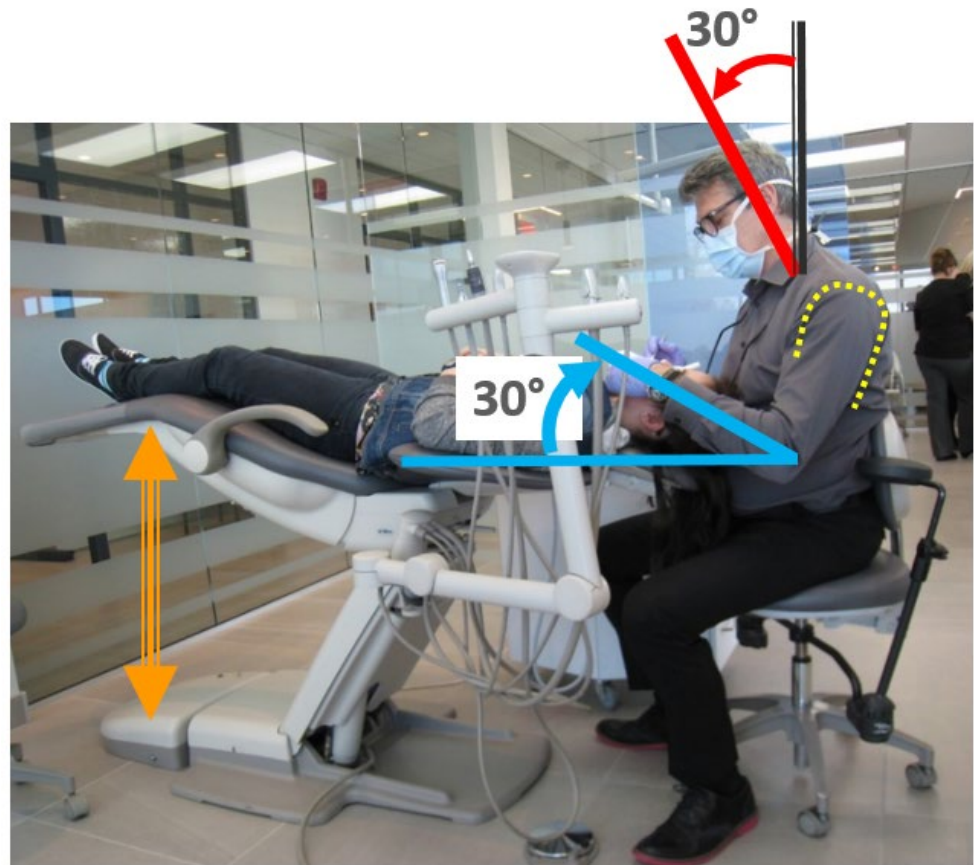
For small children comfort, use a round cushion

- Put a round cushion under the child's knees (eg buckwheat pods)
 - Stabilizes the position of the child on the chair
 - Allows to place him higher on backrest



Example of a patient's chair installed high and flat

- 30 ° neck flexion, back supported
- Arms raised 30 ° from the horizontal



PRECAUTION

- Slowly raise the back of the patient's chair (eg, in 2 steps) to avoid dizziness

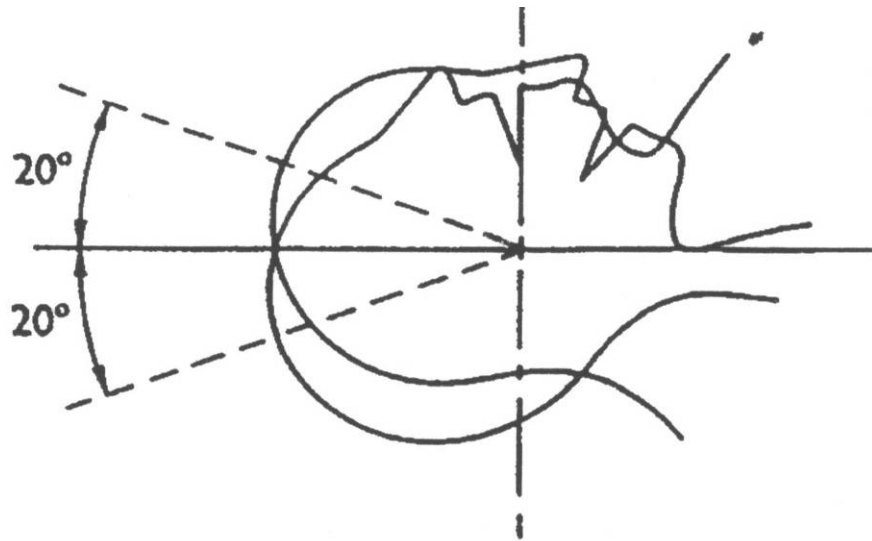


9. Solutions - Methods

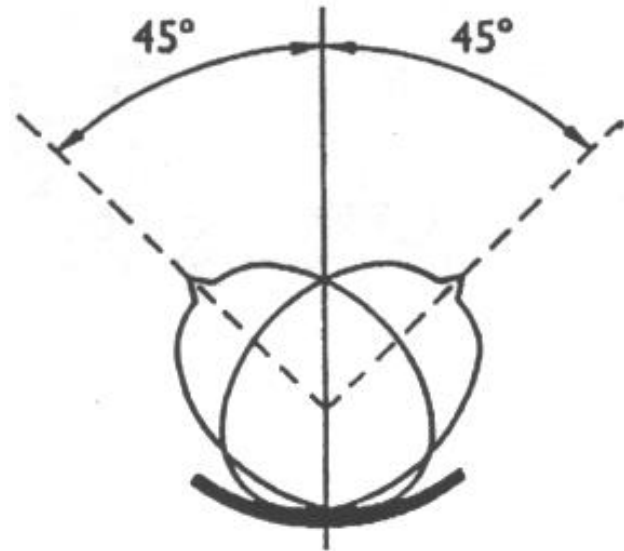
MOVE THE PATIENT'S HEAD SEVERAL TIMES



Move the patient's head several times



■ Up and down



■ From left to right

9. Solutions - Methods

TAKE SUPPORTS :

ON THE ZYGOMATIC ZONES INTRA AND EXTRA ORAL



Problem:
without support, pulling the mirror and suction
requires static efforts of the arm and left hand

In the abduction position of the left shoulder



Solution:

Rest the left hand (*non-dominant*) on the left patient's cheekbone (*zygomatic zone*)



Support on left zygomatic bone to reduce the efforts of:

- shoulder
- wrist
- hand pulling the mirror

Rest the left hand on the right zygomatic zone of the patient

- External support of the left hand on the right cheek to hold the mirror (quadrant 4)



Intra-oral and extra-oral support points for the hand holding the mirror when examining teeth



- Take an **intra-oral support** on the upper teeth, on the same side as the hand, to examine the teeth on the **opposite side**



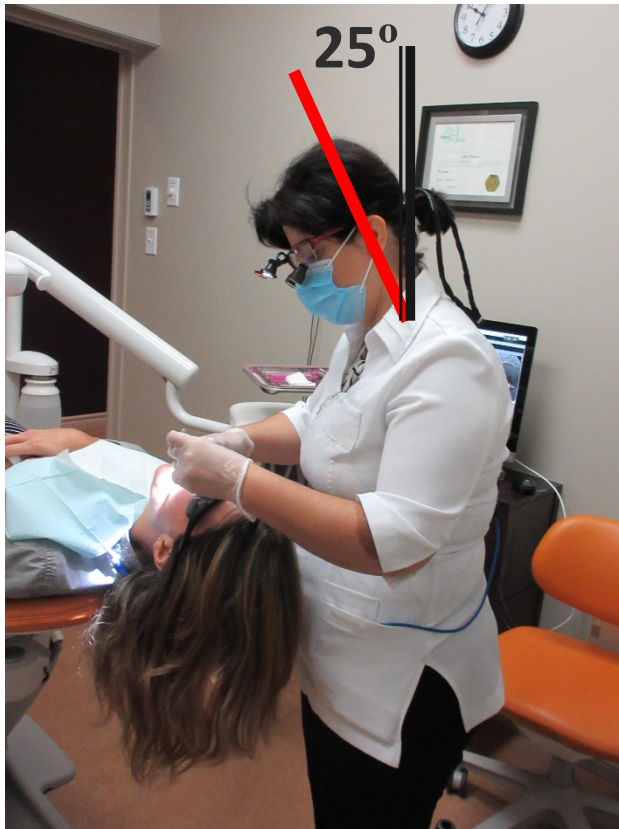
- Take an **extra-oral support** on the zygomatic zone on the same side as hand to examine the teeth on the **same side**

9. Solutions - Methods

**DO SOME ACTIVITIES STANDING TO VARY
THE POSTURES (*EG: DENTAL EXAMS*)**

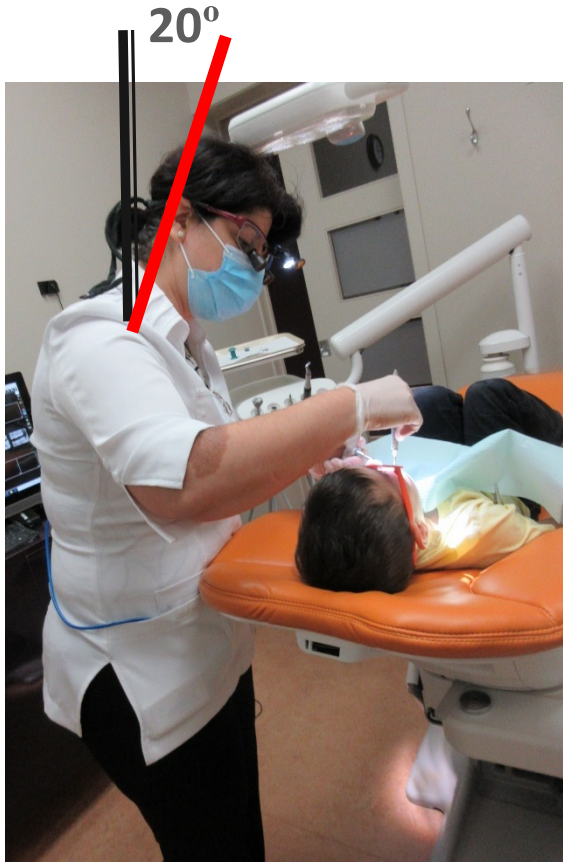


Do the dental exams standing to vary the postures

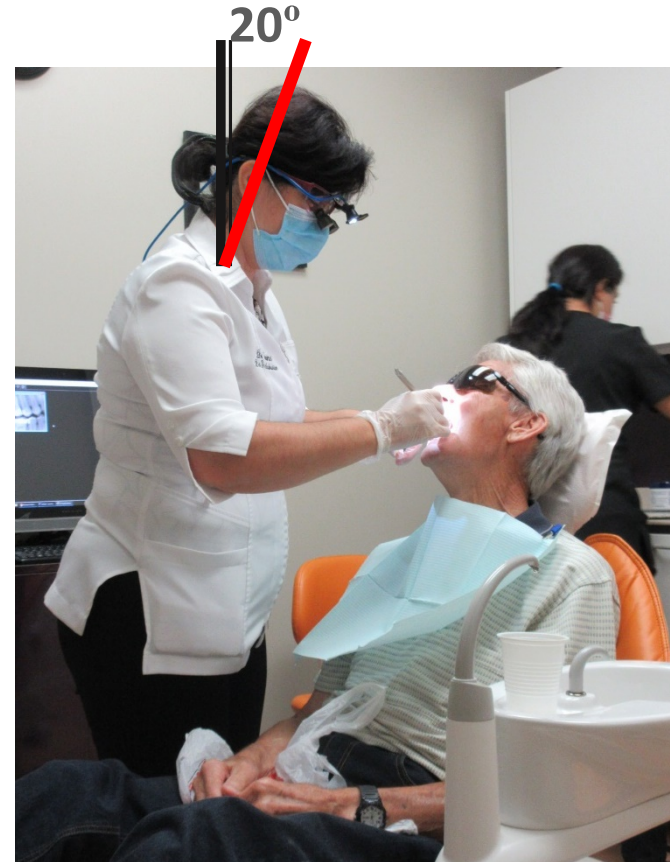


- Raise the chair to the maximum
- Lower the chairback
- Using of loupes help keep the neck straight

Perform some parts of the treatments standing



Eg: with a child, raise the chair and lower the backrest



Ex: with a senior, raise the backrest to the maximum



9. Solutions - Methods

**HAVE INSTRUMENTS WHOSE TUBING
DOES NOT PULL**



Prevent tubing to pull on instruments

- Replace turning tubing by straight tubing with no gravity
- Replace the straight wires that are
 - Too stiff
 - Too short



Have instruments whose tubing does not pull

↘ deviated postures of the wrists

+

↘ efforts

↓

↘ risks of MSDs
to elbows, wrists
and even shoulders



9. Solutions - Methods

**ASK THE PATIENT TO HOLD THE SUCTION
AND TUBING OF HEAVY INSTRUMENTS**



Poll 15

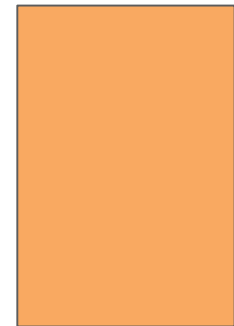
If you work alone, do you give suction to the patient?



YES



NO



Poll 15 - Answer

By giving suction to the patient,
bending of the left wrist is ↘



In a month, the epitrochleitis was gone!



Give suction control to the patient



- Leave your hand free for the mirror
- Avoid a lot of restrictive postures for the left wrist
- Allows you to adopt more neutral postures of
 - the left shoulder
 - the left elbow
 - the left wrist



For the patient: it is easier to handle the suction control with clip than with a round button



Show him how to activate the On-Off button

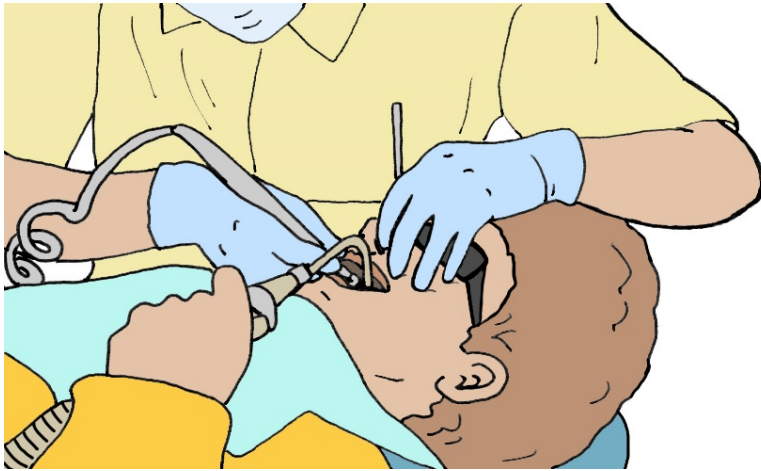


Install the saliva pump tips on the fast suction

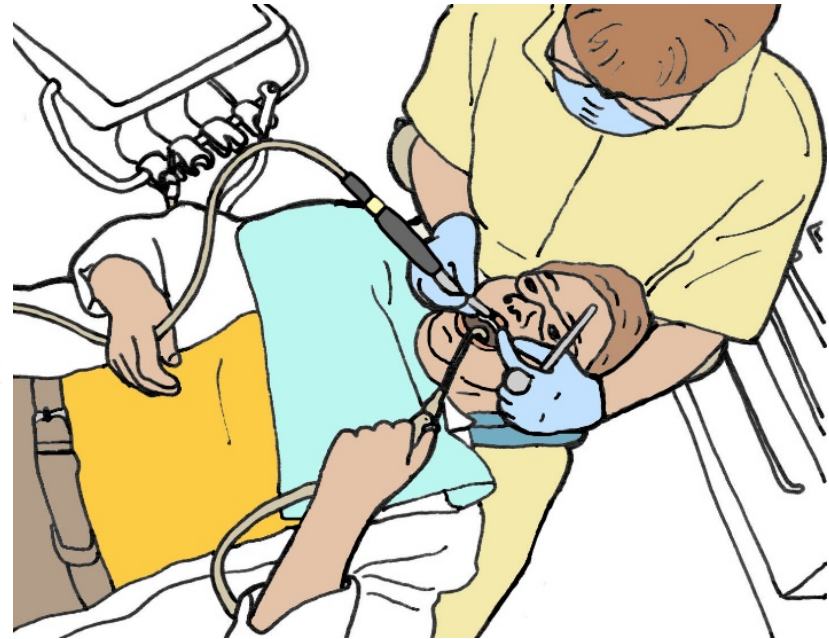
- **To be able to leave them in the mouth of the patient**
- **Have control to "clip" rather than a round button**
- **Increase the length of the wires if needed**
- **When possible, leave the suction tip in the corner of the patient's mouth**



Give suction control to the patient



Run the tube under the patient's armpit to stabilize it



The patient can also hold the tubing of other heavy instruments (handpiece, intra-oral camera)

Ask the patient to hold the tubing



- Handpiece
- Intra-oral camera
- Others?

Swirl tubing around your arm



Ultrasonic scaler tubing



Handpiece tube

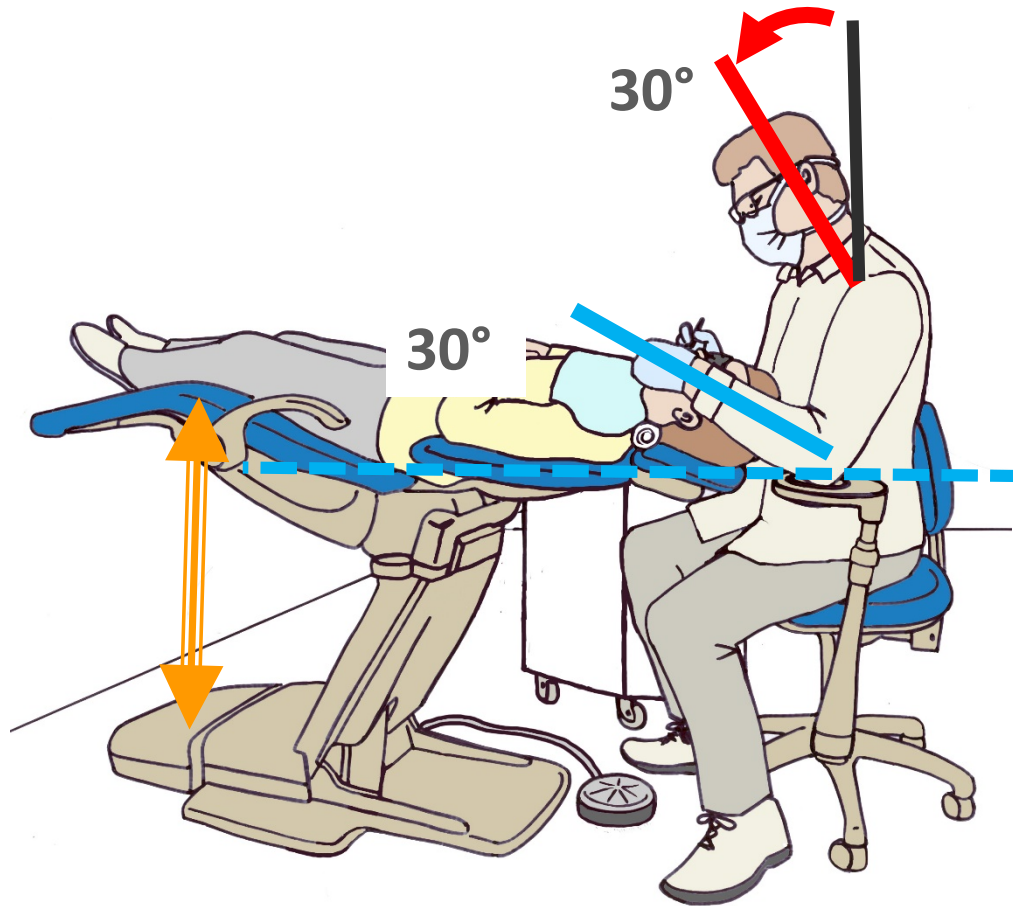


9. Solutions – Methods

METHODS FOR THE DENTAL ASSISTANT



Clear the space for the legs of the assistant

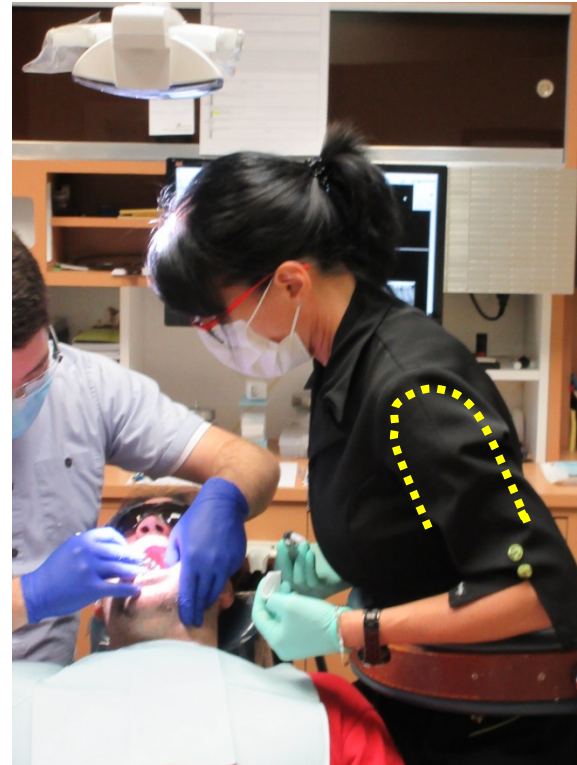


- Place the patient's chair high and its backrest flat to allow the assistant to keep her legs in front of her
- This position is also advantageous for the dentist

Does the assistant always have to see everything in the patient's mouth?



Even though the postures are very awkward



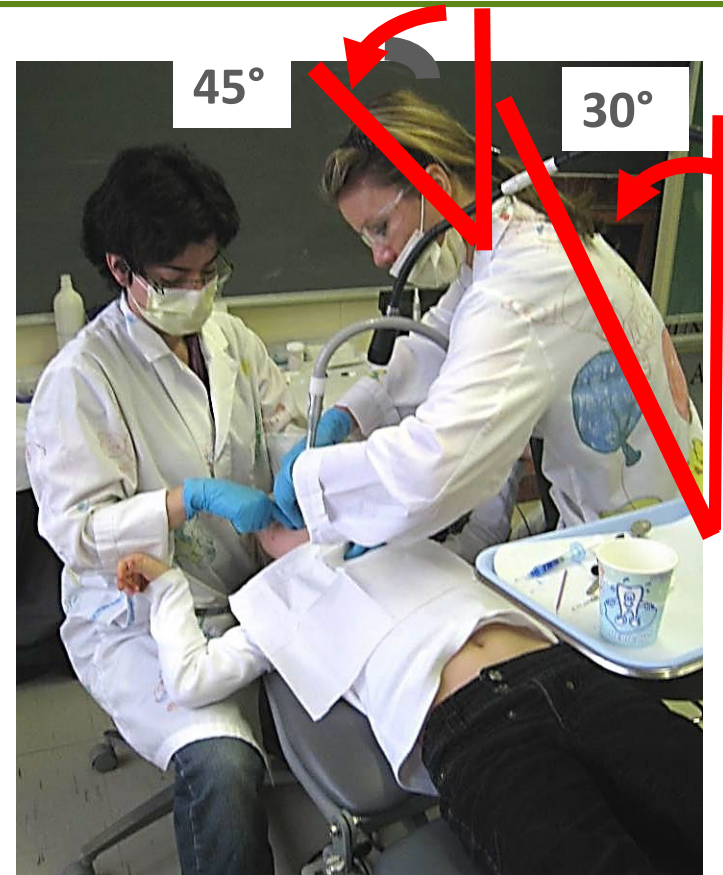
Even if she does not hold any instruments?



Position of the assistant a head higher than the dentist => constraints to shoulders, neck and back



Height of the assistant's tool at 24 in



Height of the patient' chair at 19 in

Working postures of the assistant after modifications



Height of the assistant's stool at 21 in (↘ 3 in)

Height of center of patient's chair at 22 in (↗ 3 in)



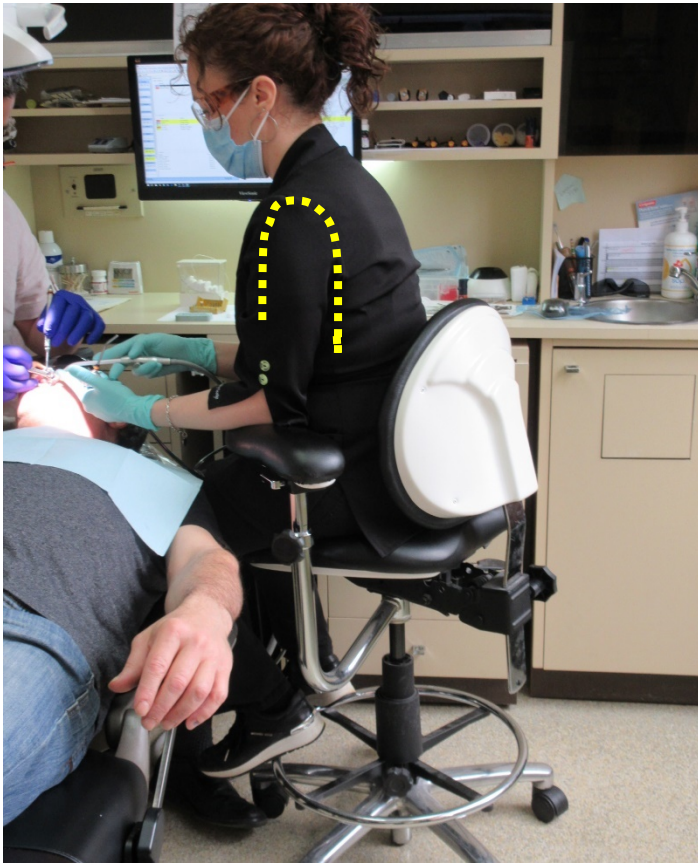
Distance assistant eye and patient's mouth ↘ 6 in

Safer working postures of the assistant when the height of her stool is lower



- Straighter neck
↳ **from 45° to 30°**
- Relaxed shoulders
- Straighter back
↳ **de 30° à 0°**

Means developed by an assistant, since 8 years, to have her neck and back straighter



1. She looks into the patient's mouth to visualize the work
2. She places her instruments
3. She memorizes the cavity and the position of the instruments
4. She straighten herself

Means developed by an assistant, since 8 years, to have her neck and back straighter

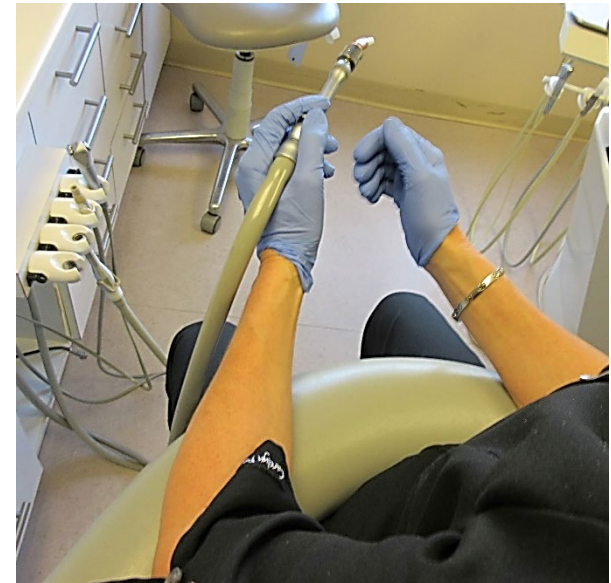
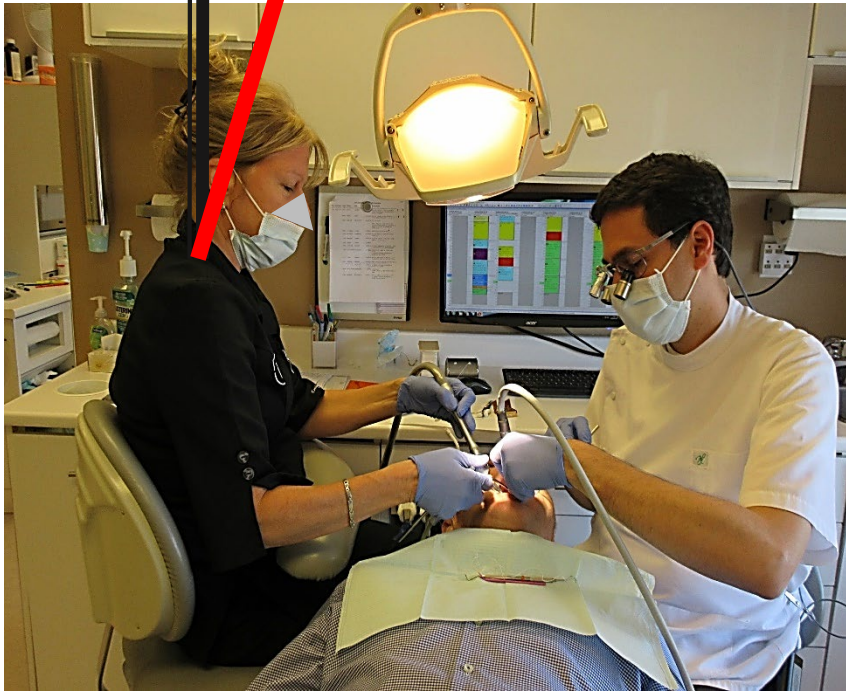


5. She maintains this position
6. She is able to sneak "blindly"
7. The dentist directs the instruments as needed

Dental assistant with straight head and back. She does not try to see details in the patient's mouth. Her lower back is well supported

15°

She likes to be a little higher than the dentist. "Everyone in his bubble"



She holds the suction with the left arm and has both arms resting on a large thoracic support

The dentist is satisfied with her work.
He works with his forearms raised.

Poll 16

What should be the safe viewing distance for the assistant?

Same as the dentist



Longer than the dentist

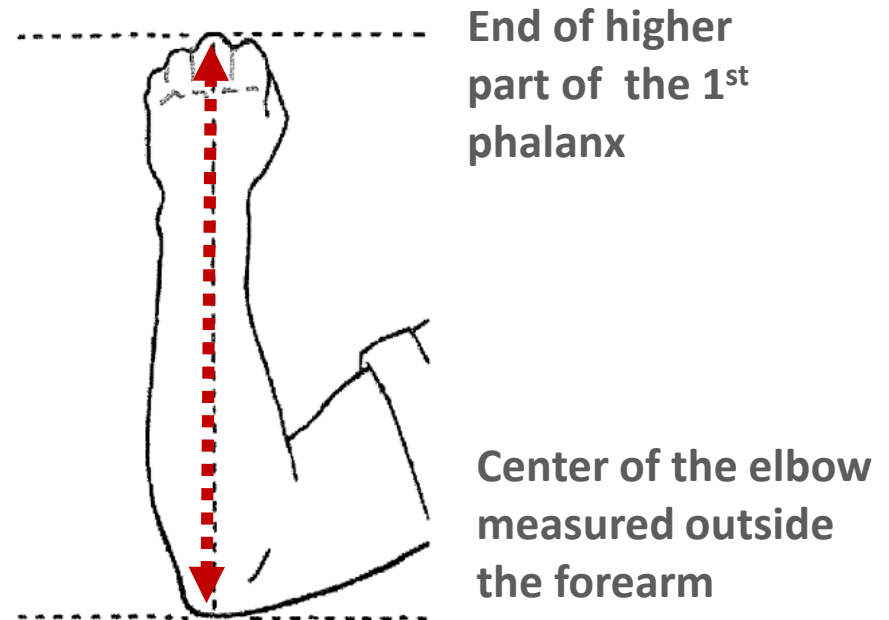


Reference for a good eye-task distance : reading distance

- Reading distance = Hamon distance (*length of the forearm*)*

Average reading distances

	Cm	In
Women	35	14
Men	45 à 50	18 à 20



Precision requirements are higher for dentists than for assistants

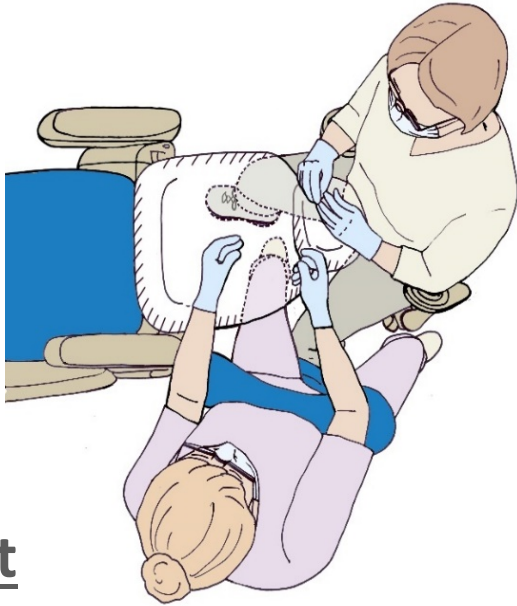
*Référence : Dr Jean-Pierre Lagacé, optometrist
Lagacé, 2012, p. 6

Assistant stool



- Set the height of the assistant's stool at about 15cm (6 in.) higher
- Dentist and assistant can interpose their knees to allow the assistant to get closer to the patient's mouth
- Their knees are not at the same height, so less feeling of intrusion

Leg positions of the dentist and the assistant, when the patient's chair is placed in the high position, with the backrest flat



Dentist

- Legs slightly apart under the backrest



Assistant

- One leg under the backrest
- The other leg towards the counter

If necessary, the dentist and the assistant interpose a leg to:

- ✓ keep their backs and necks straight
- ✓ move closer to the patient's mouth

Assistant stool with *wide figure 8 elbow and torso support*, and lumbar support



Heights of seat and supports are adjustable



- The assistant keeps her elbows resting on the *wide elbow and torso support* when her instruments are in the client's mouth
- The dentist can turn her stool to be positioned at 12 o'clock without disturbing her assistant
- The assistant can then adjust her position by :
 - moving her legs a little
 - turning her stool a little

Wrap the tubing of the fast suction around your forearm

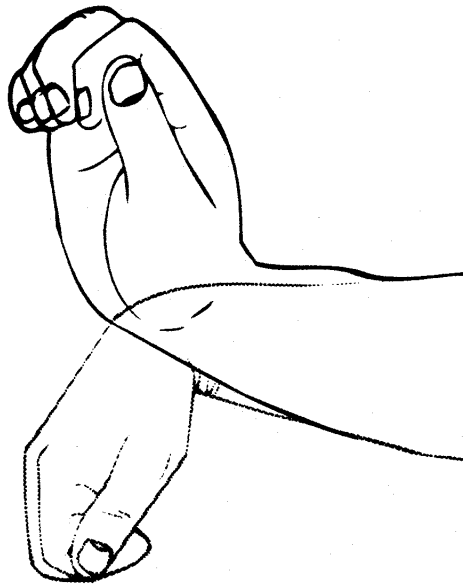


↘ wrist efforts to hold the tubing of fast suction

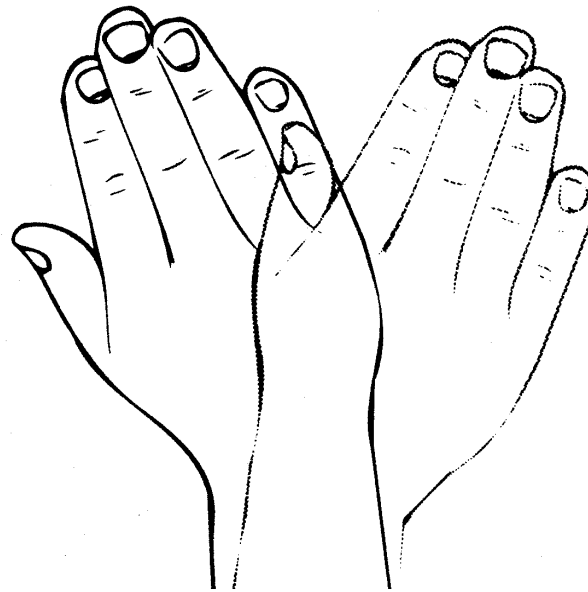
10. RISK FACTORS OF MSDs TO ELBOWS, WRISTS AND HANDS



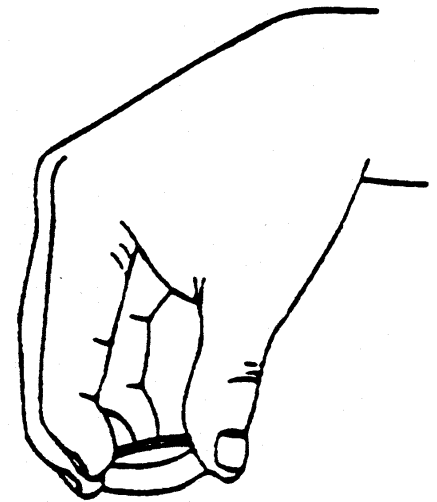
Movements and activities that ↗ the risks of MSDs:



**Flexions and /
or extensions
of the hand**

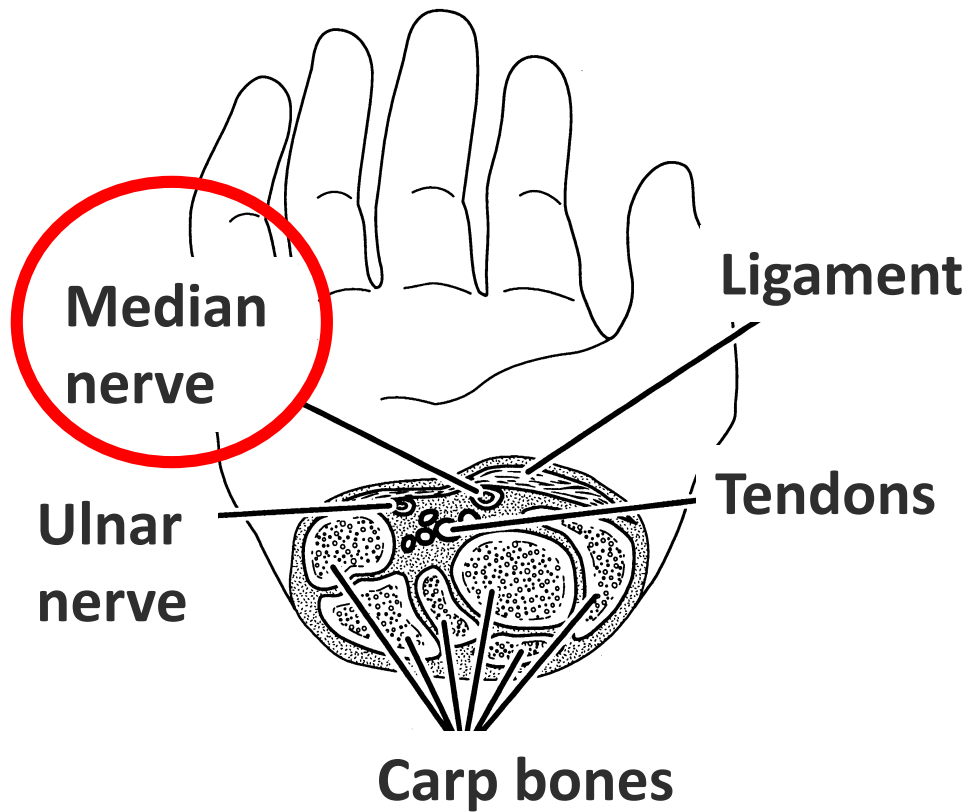


**Repeated or
continuous
deviations**



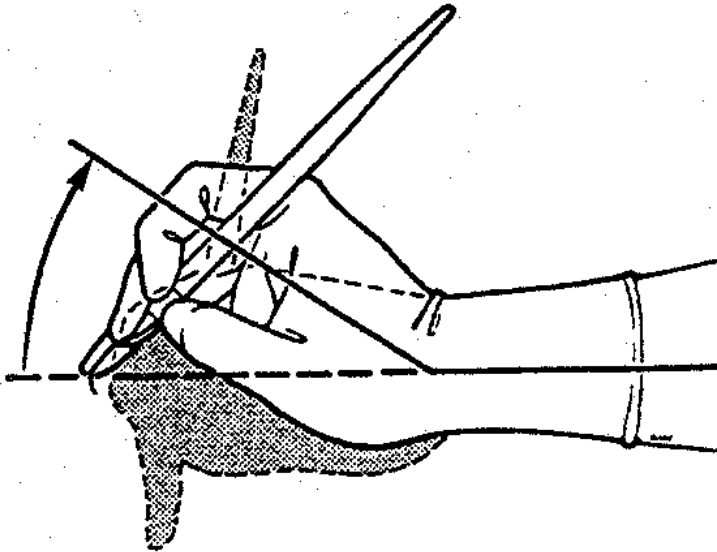
**Forceful
pinch grip**

Wrist structure

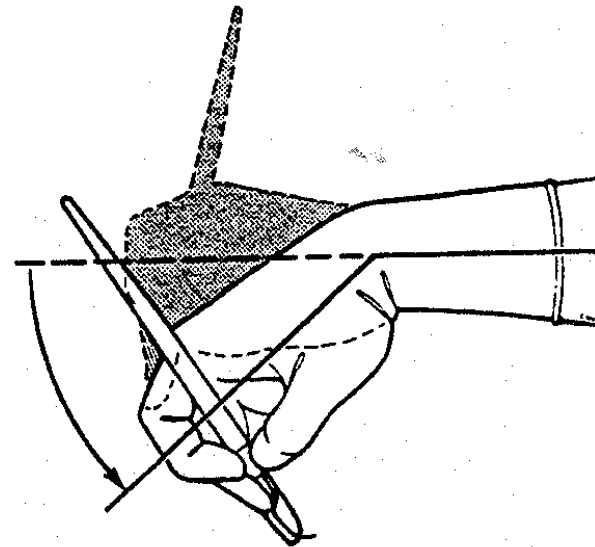


- The 10 tendons of the flexor muscles of the fingers and thumb pass through the carpal tunnel (*restricted space of 3 cm*)
- The median nerve is in the middle
- If the flexors tendons are swollen, they compress the **median nerve**

Movements and activities that ↑ the risks of MSDs: extensions and flexions of the hand

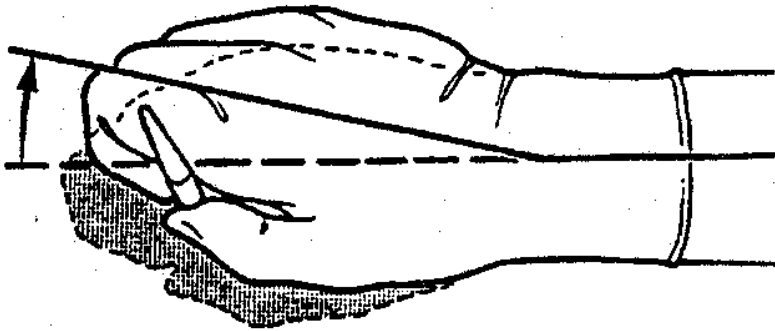


Extensions:
towards the top
of the hand

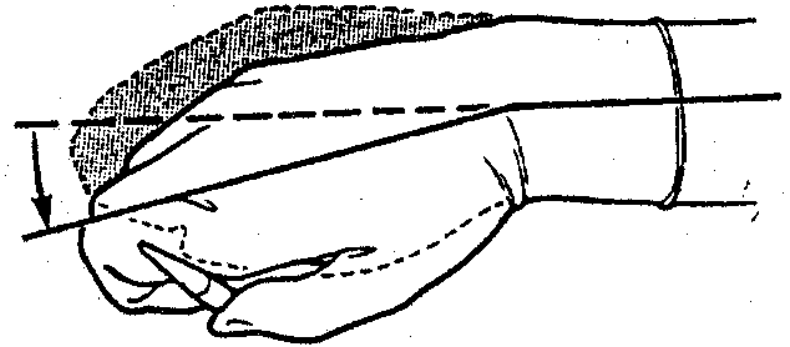


Flexions:
towards the palm
of the hand

Movements and activities that **↑** the risks of MSDs of the hand: **radiale and cubital deviations**

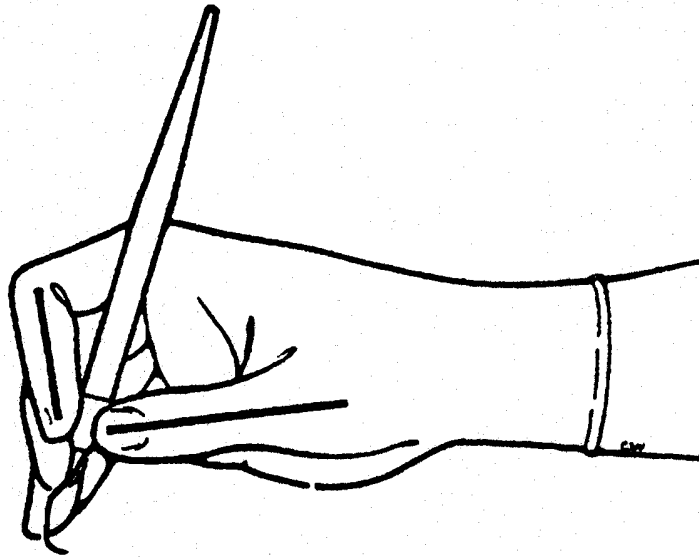


**Radial deviations
(towards the thumb)**

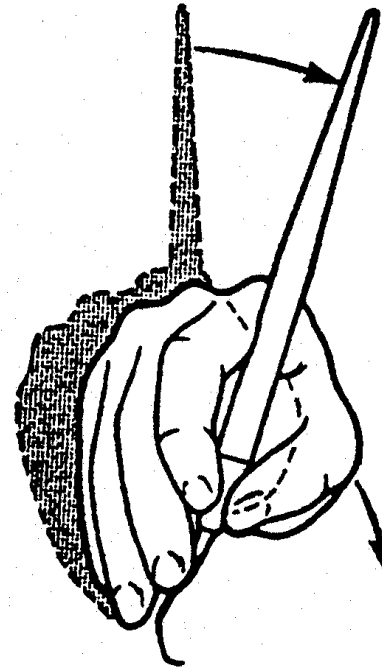


**Cubital deviations
(towards the little finger)**

Movements and activities that \nearrow the risks risk of MSDs

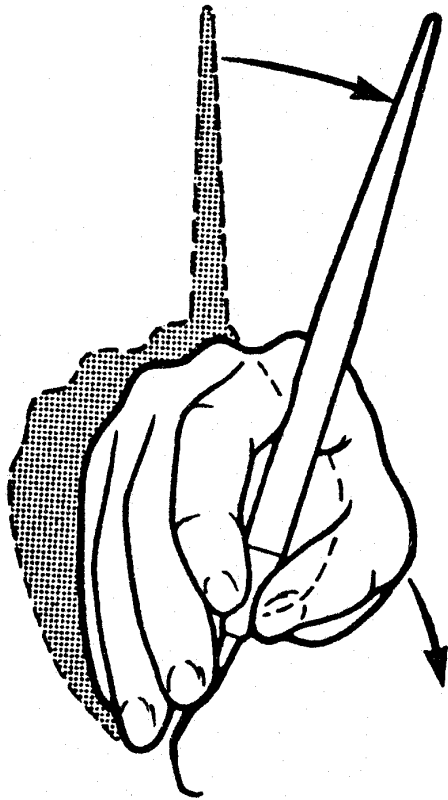


Forceful pinch grip



Rotations

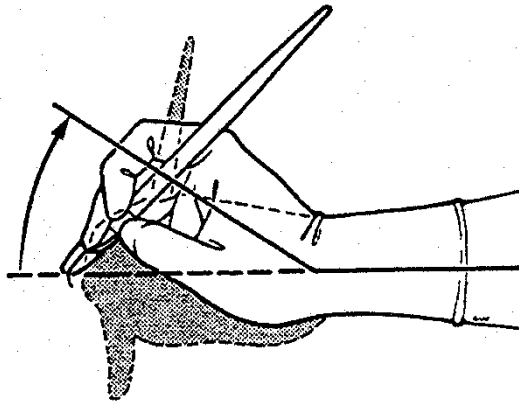
Repetition



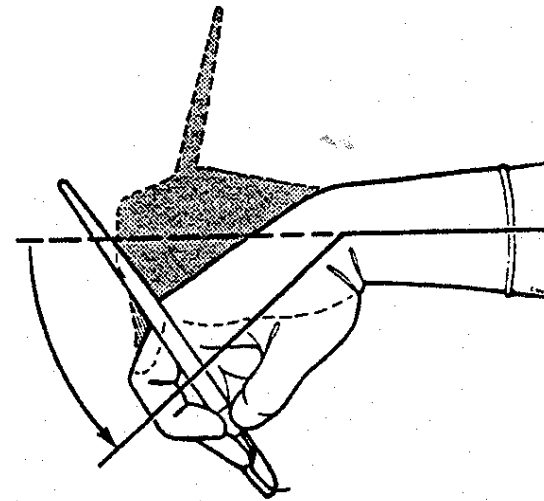
- Often involves the use of a small group of muscles
- In manual curettage: rotations, flexions or rotations are repeated from 10 to 45 times / minute
- Combined deviation and rotation movements

Efforts with instruments in dental work with flexions, extensions and deviations

Ex. Movements with the curette



**+ Extensions
of the wrist**

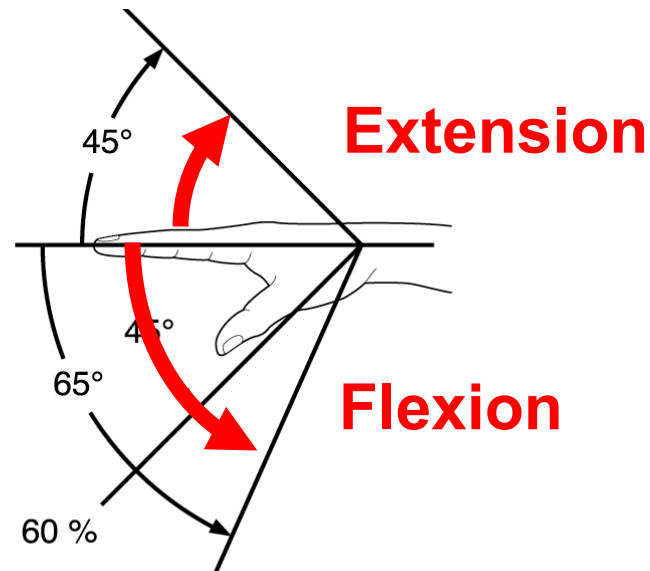


**+ Flexions
of the wrist**

Awkward postures ↘ wrist strenght in forceful movements

45° ⇔ 75 %
of the strenght

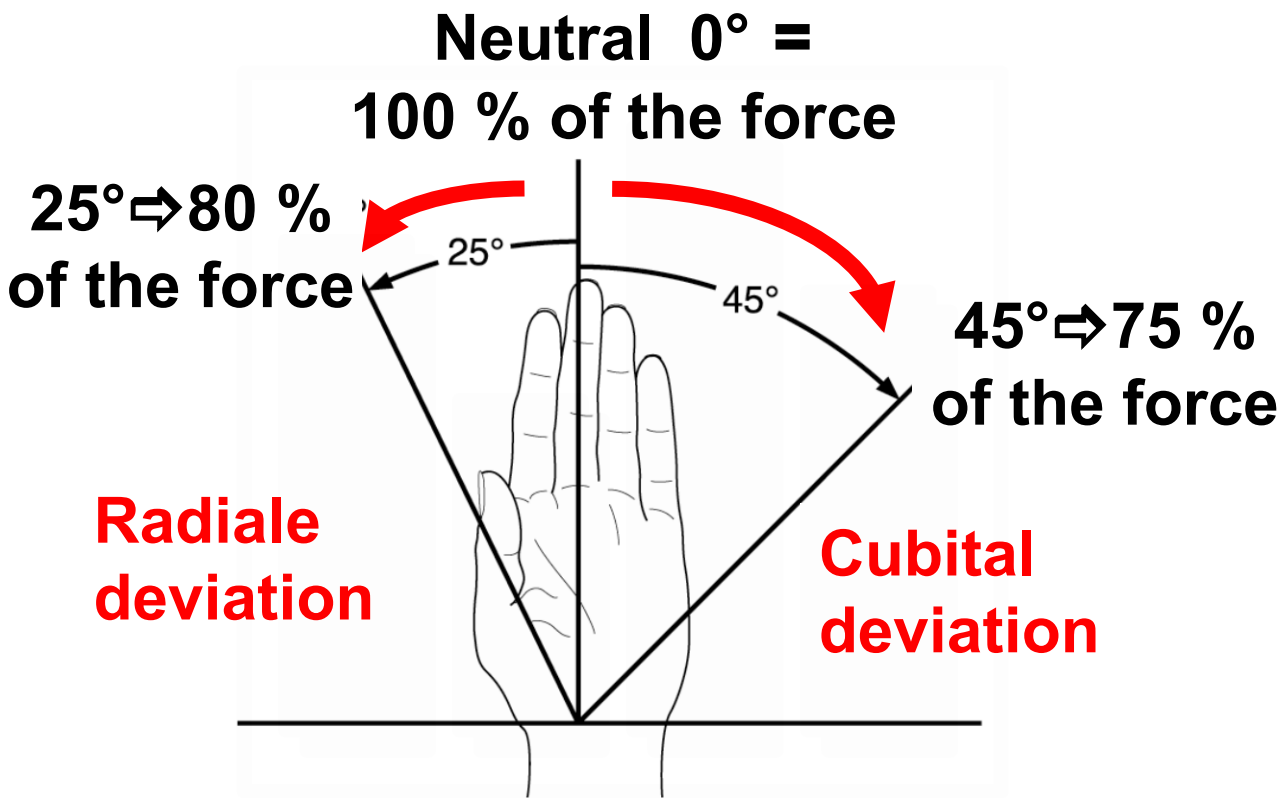
Neutral,
0° = 100 %
of the
strenght



60° ⇔ 45 %
of the strenght

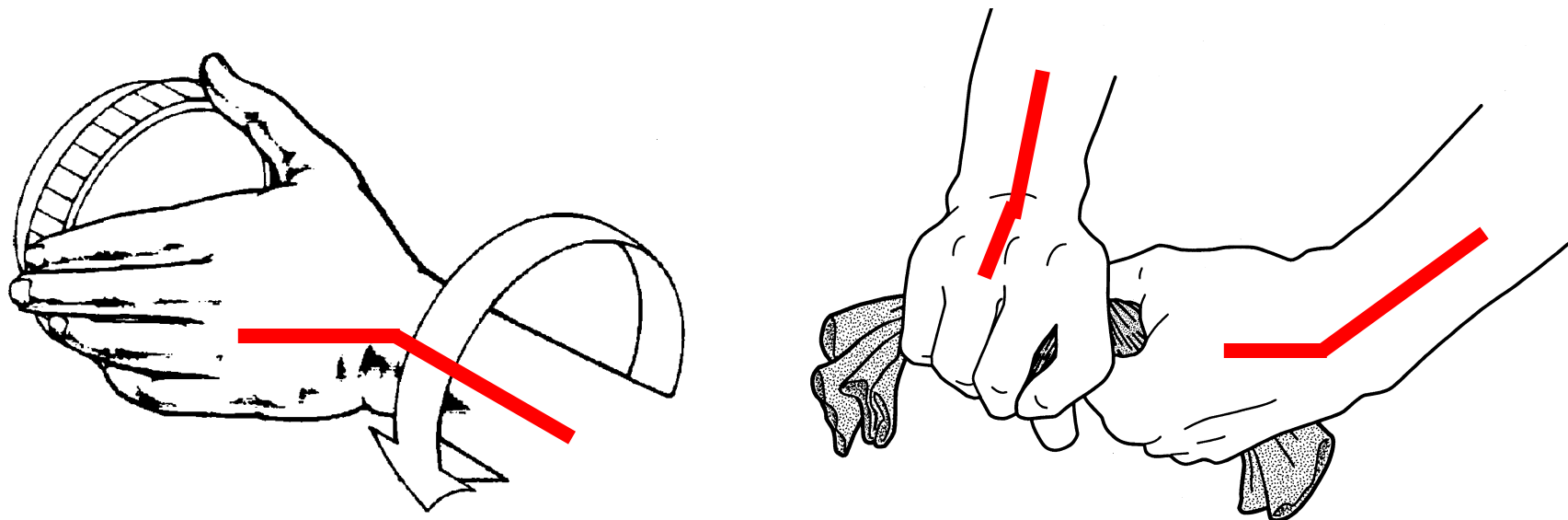
- The largest force is in the neutral position
- She ↘ with extension to the top of the hand
- She ↘ with flexion to the palm of the hand

Awkward postures ↘ wrist strenght in forceful movements



- The largest force is in the neutral position
- She ↘ with radial deviation (toward the thumb)
- She ↘ with cubital deviation (toward the small finger)

Movements at risk for the wrist especially if force is required

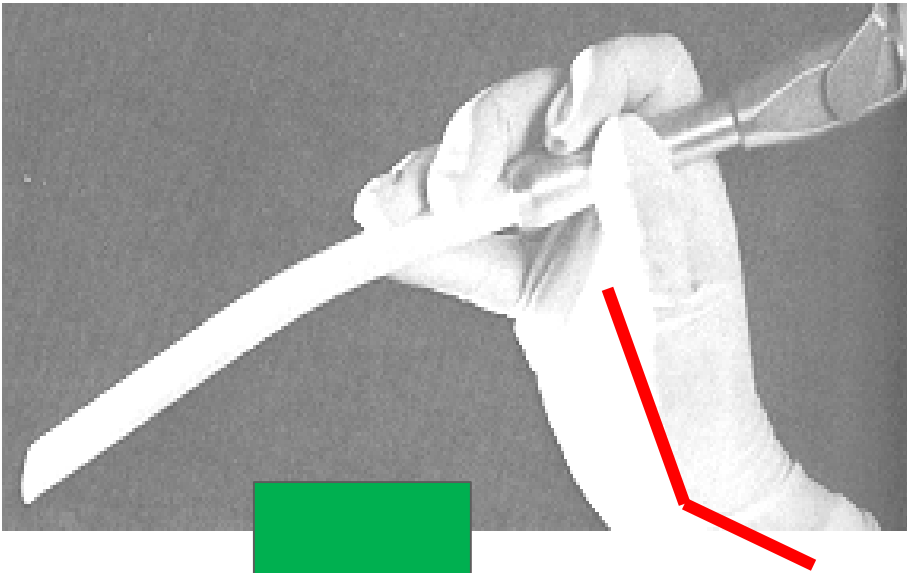


- **Combinations of hand twisting, wringing (“washerwoman’s sprain”)**
- **Forceful gripping**

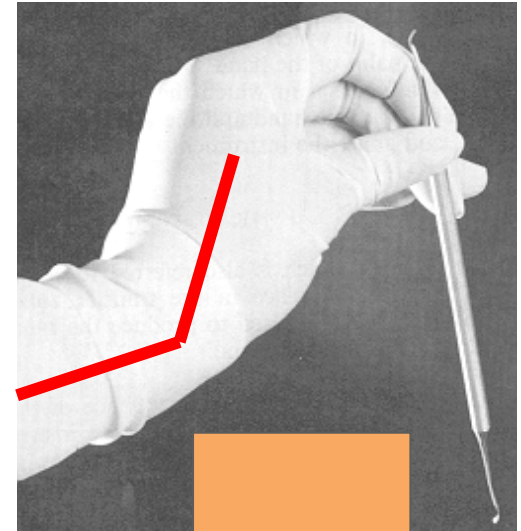
Poll 17

Which posture is most at risk of MSD?

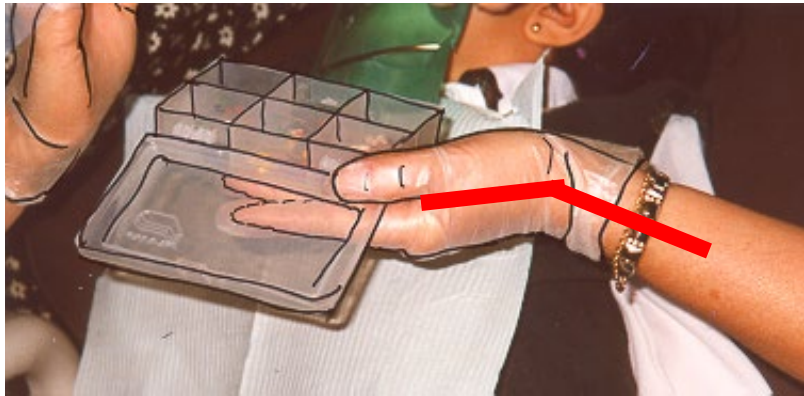
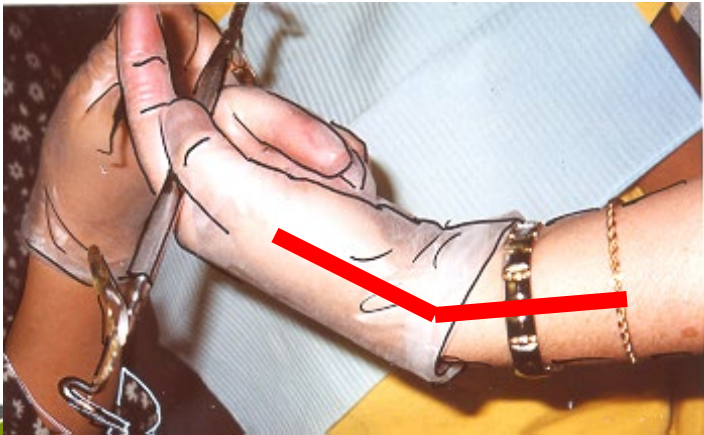
Wrist extensions
to hold suction



Wrist extensions
to pass instruments



Numerous rotation movements of assistant's arm

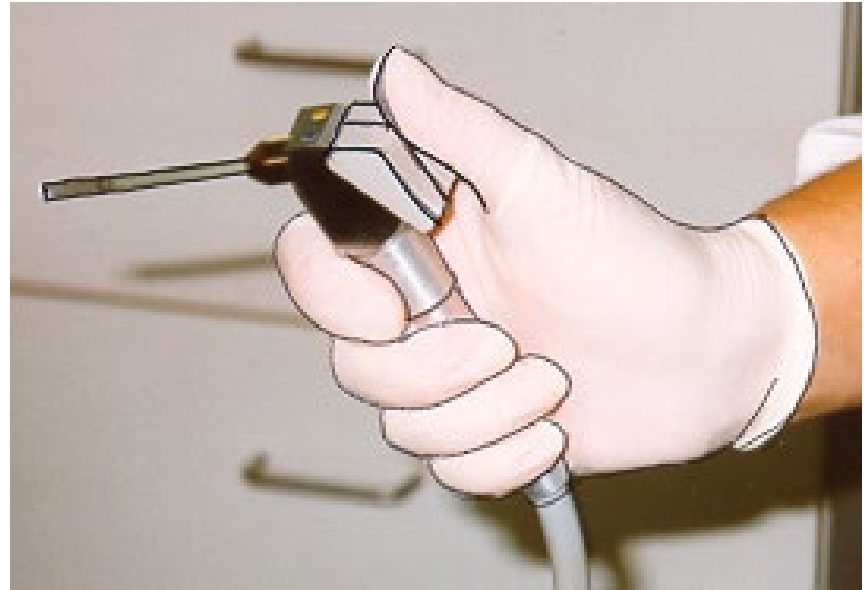
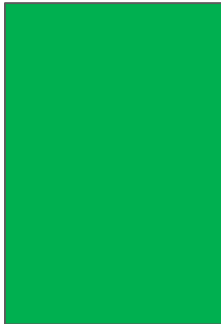


Flexions and extensions to hold children still



Poll 18

Shape of air and water syringes controls.
Which one is the safest for the thumb?

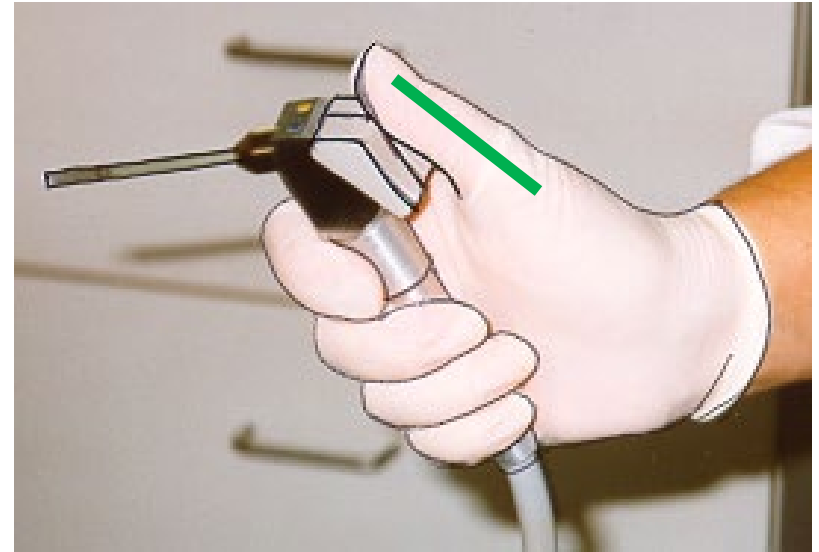


Poll 18 - Answer

Bigger and flat controls are safer for the thumb

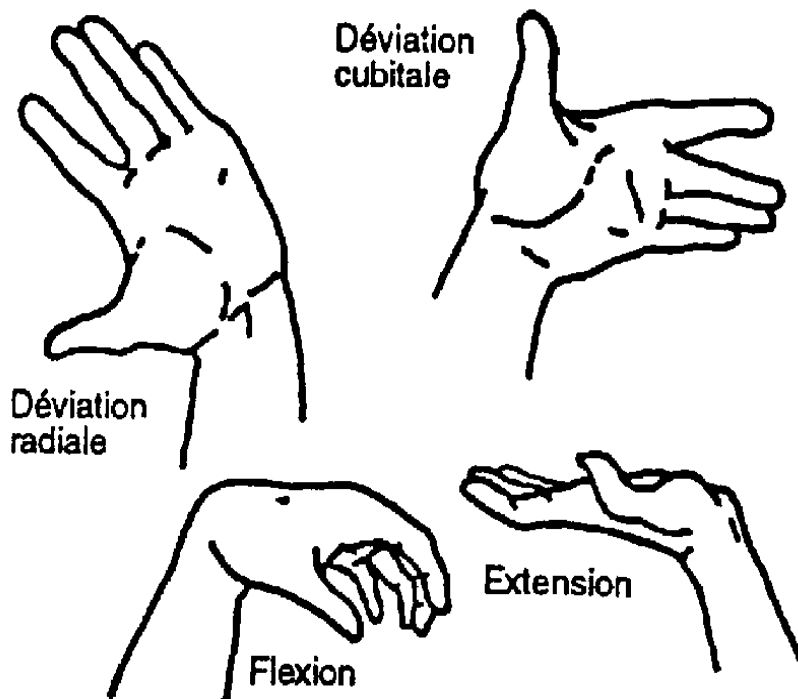


- Small "snaps type" buttons require more strength from the thumb
- The force is exercised in posture of limit of flexion of the thumb
- Risk factor for De Quervain's Tenosynovitis)



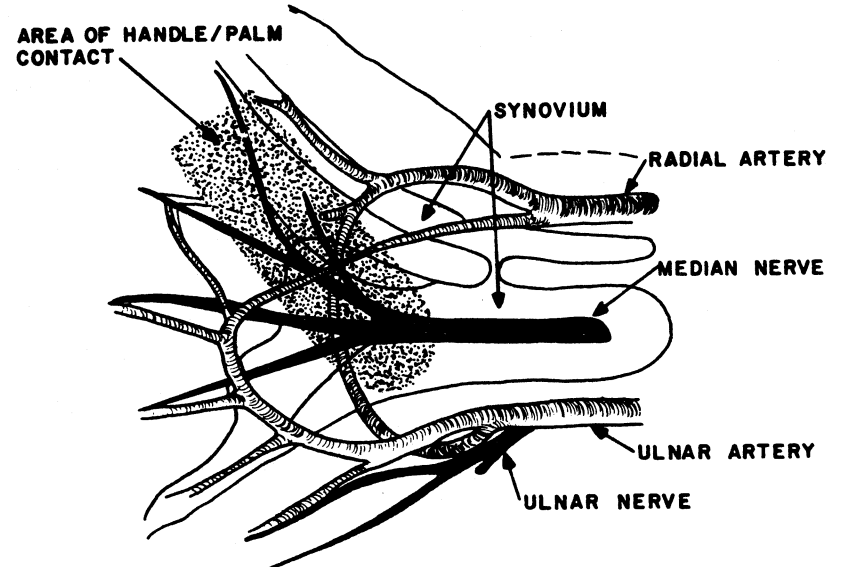
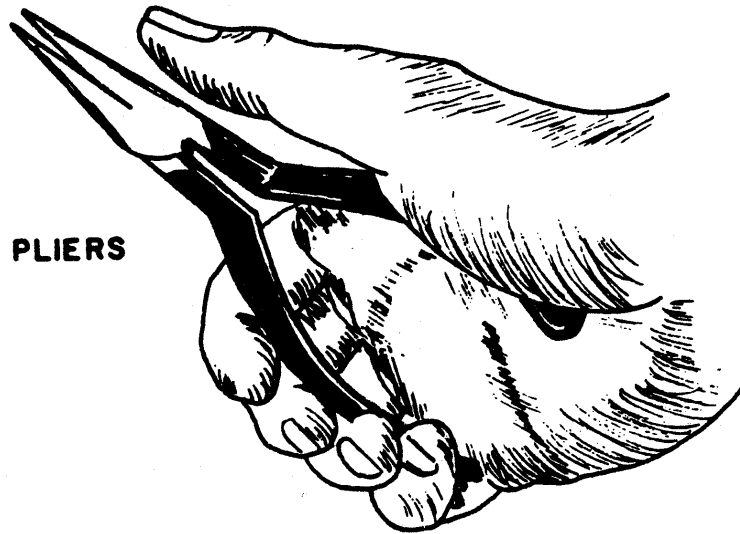
Wide, flat controls are safest because the thumb is straight

↘ angulations of the wrists

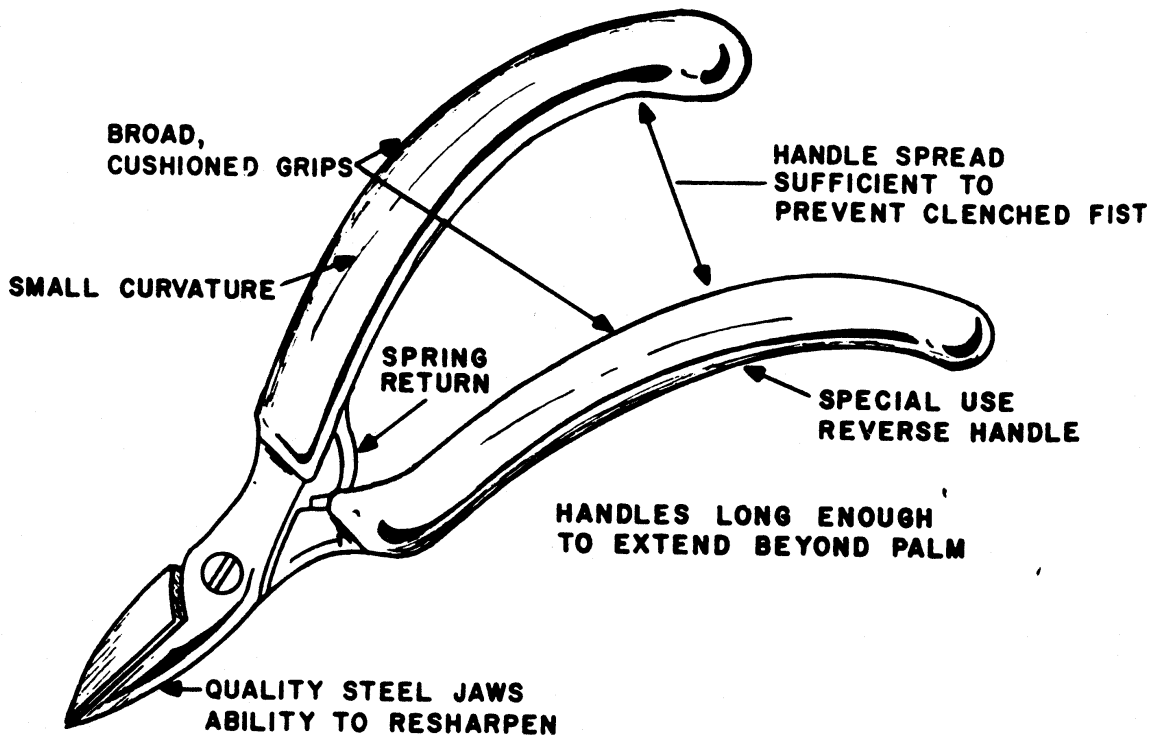


- **Recognize movements at the limit of mobility**
- **Search for ways to be able to work with wrists in neutral positions**
- **Exchange tricks between colleagues**

Pressure of instrument handles

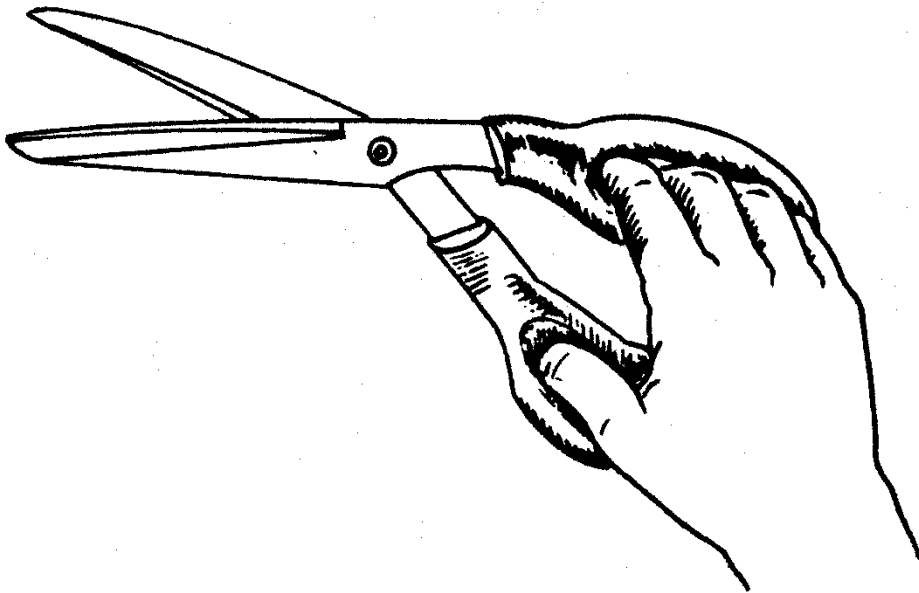


Use pliers with longer handles and ergonomic curvatures



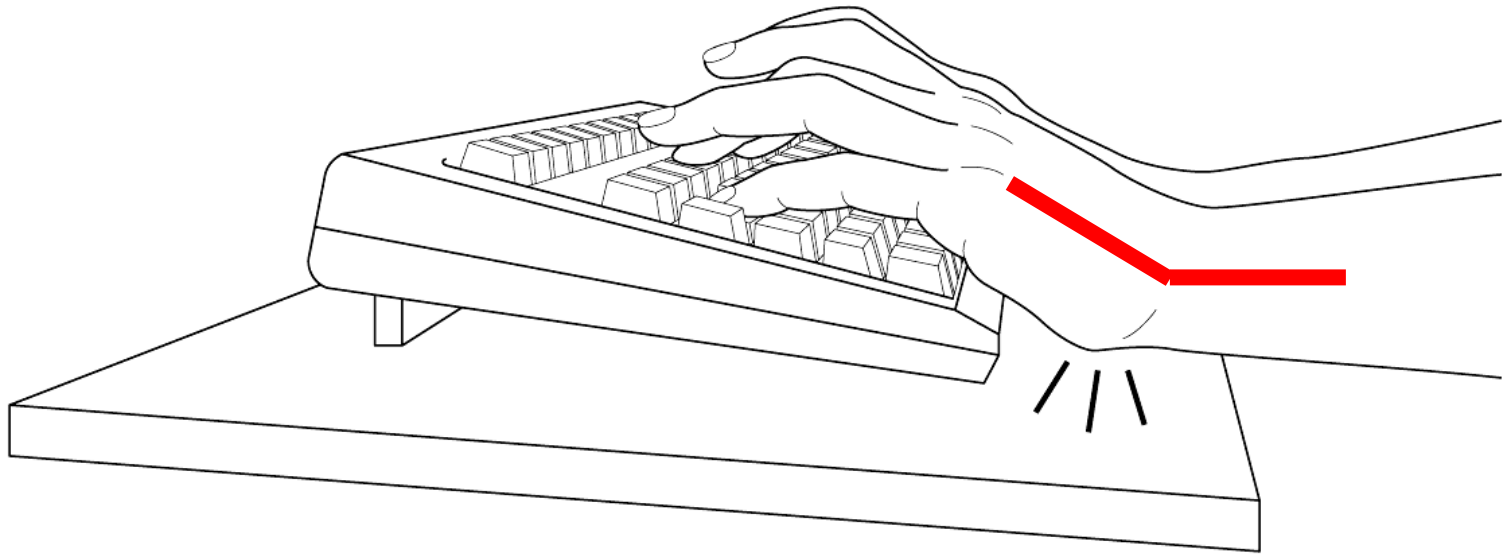
- Handles long enough to extend beyond palm
- Longer handles to
➤ compression in the center of the hand
- Small curvatures help keep the wrist straight

Scissors handles with ergonomic curvatures



The curvatures of the handles should help keep the wrist straight

Local pressure + awkward posture in computer work

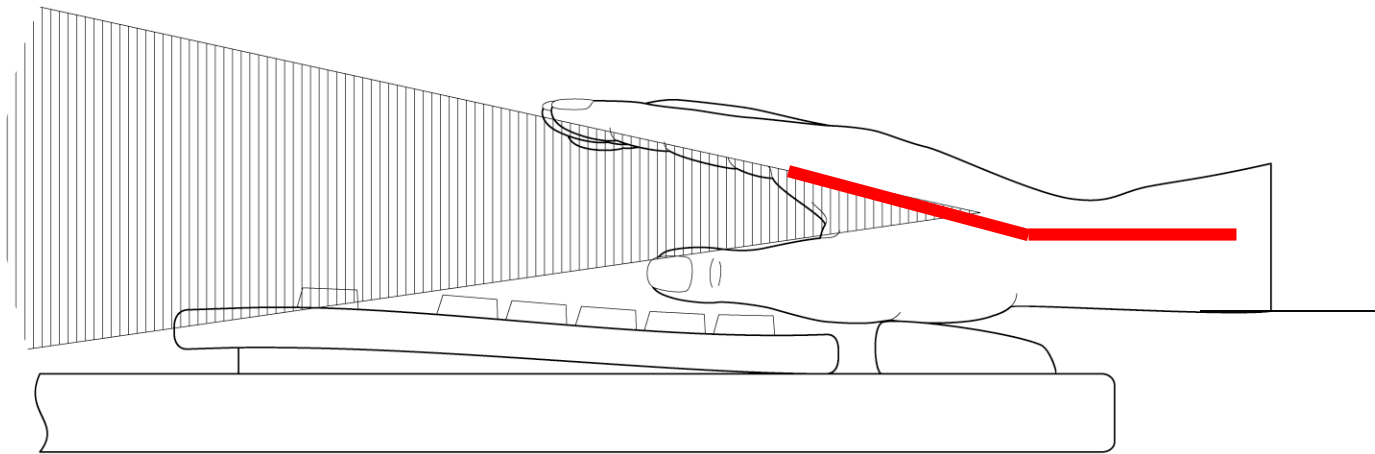


Extension and compression of the wrist
Solutions ?

Villeneuve et al., 2012, p. 35

Guide *Ergonomie du bureau*, ASSTSAS, www.asstsas.qc.ca/GP67

Solution : soft wrist rest for the keyboard and the mouse*



- extension of the wrist
- local pressure

Gel wrist rests for keyboard and mouse



For keyboard :
price from 20 \$ to 40 \$



For mouse :
price from 12 \$ to 40 \$

10. Risk factors for elbows, wrists and hands

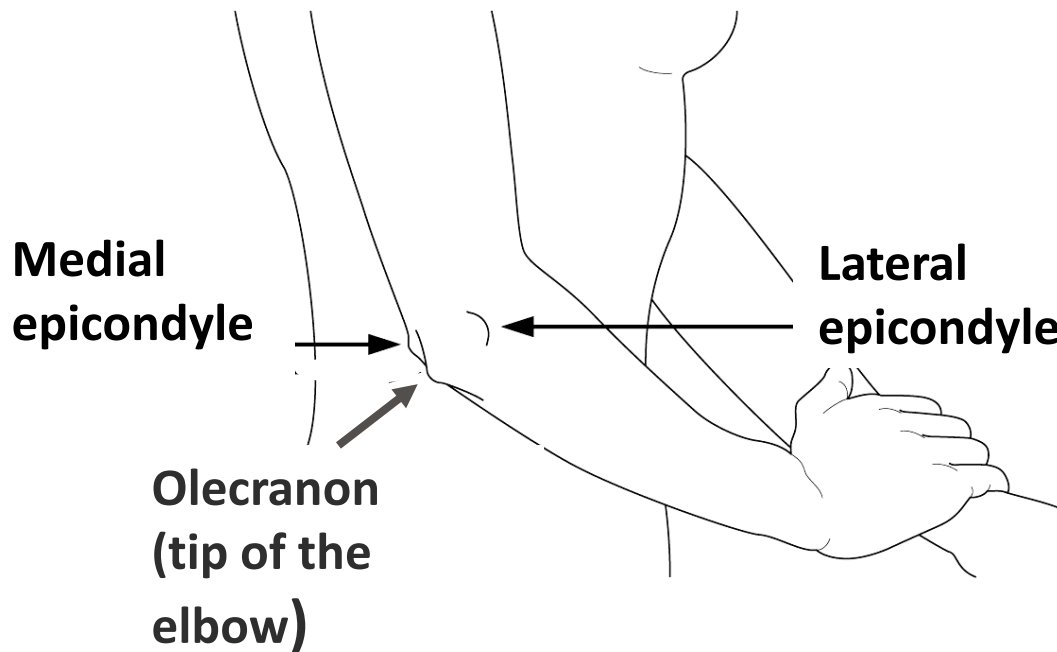
RISK FACTORS AND MSDs AT THE ELBOWS:

EPICONDYLITIS (LATERAL)

EPITROCHLEITIS (MEDIAL)



Elbow structure



➤ **Lateral epicondyle:**

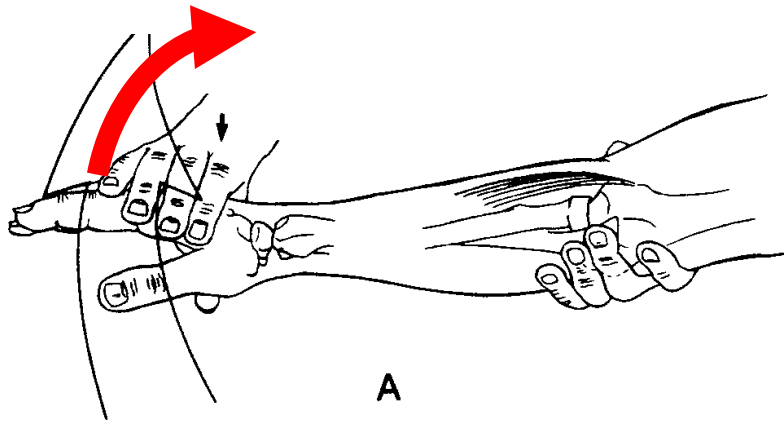
- over the elbow
- tendons of the extensor muscles of the hand

➤ **Medial epicondyle (epitrochlea):**

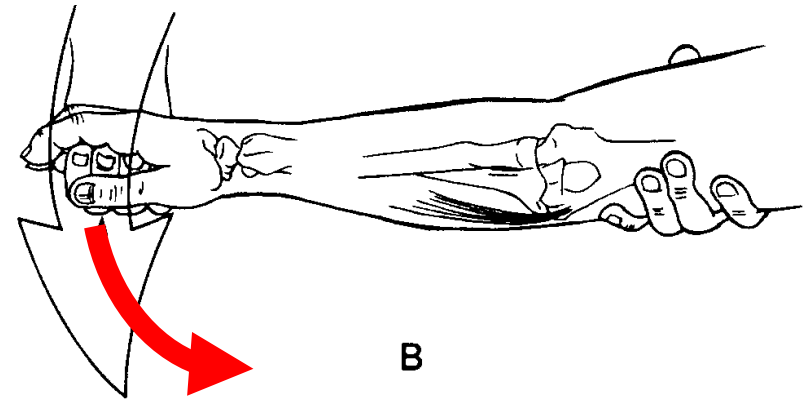
- under the elbow
- tendons of the flexor muscles of the hand



Action of the muscles attached to the elbow

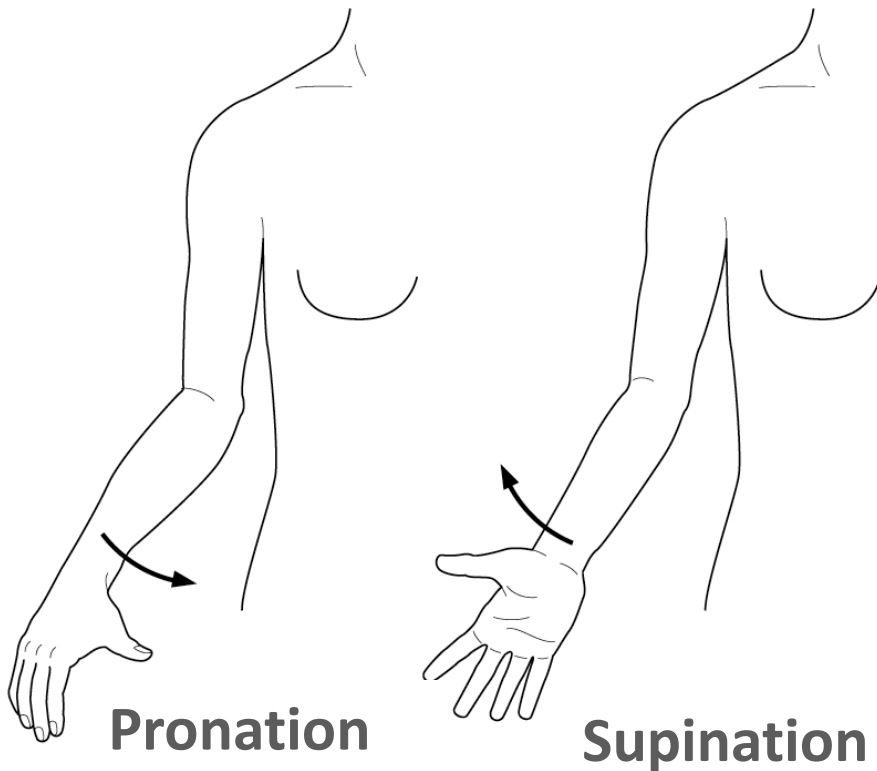


**A. Extensor muscles
attached above
the elbow**



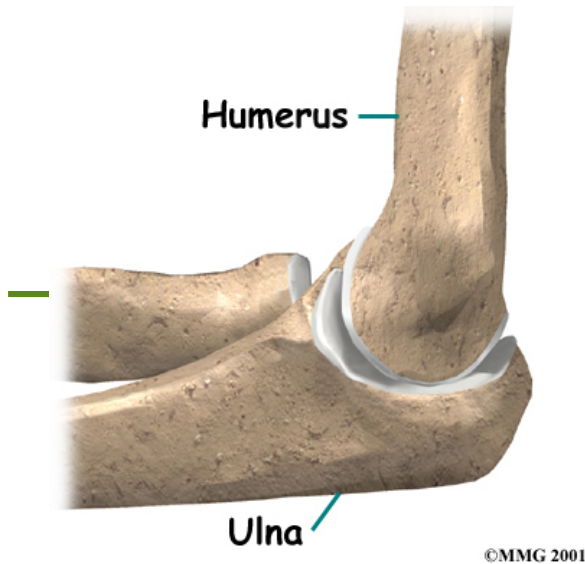
**B. Flexor muscles
attached under
the elbow**

Lateral epicondyle

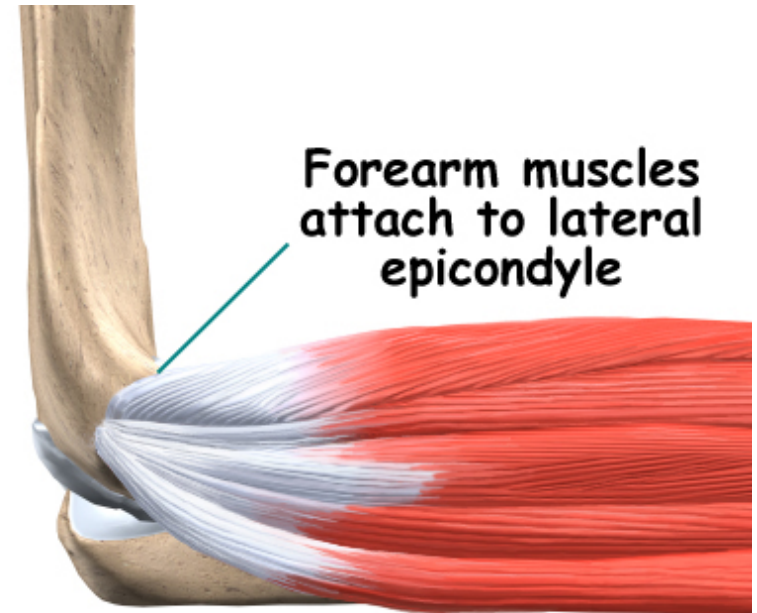
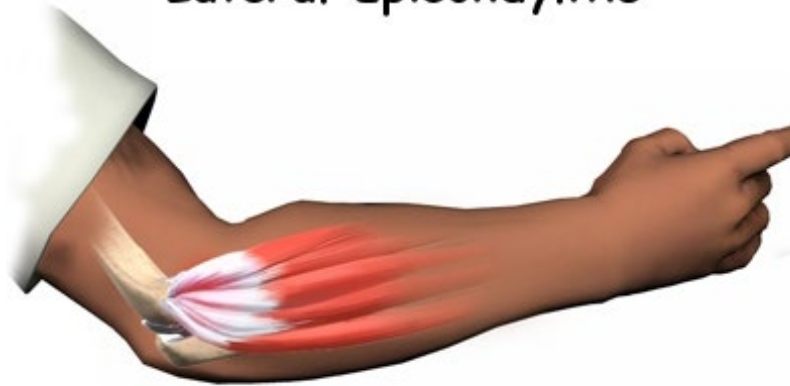


- **Extensor muscles of the fingers attached to the epicondyle**
(on the top of the elbow, on the thumb side)
- **Are responsible for the movements**
 - **Extension of the hand**
 - **Rotation of the hand**

Epicondyle on the side and above the elbow



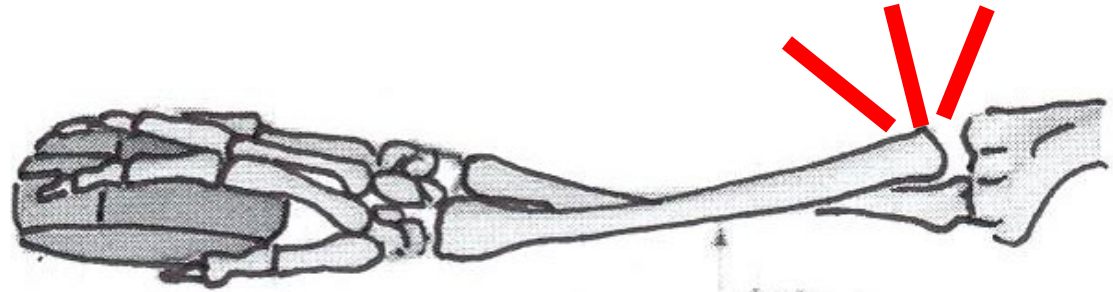
Lateral Epicondylitis



Points of attachment of the extensor muscles of the hands

The rotation of the forearm solicits the extensor muscles (eg flat mouse)

Flat mouse



The radius turns on the ulna ⇒ traction on the tendons of the extensor muscles

Vertical mouse



The radius does not turn ↘ the pulls on the tendons of the extensor muscles

Wide hand grip with extension

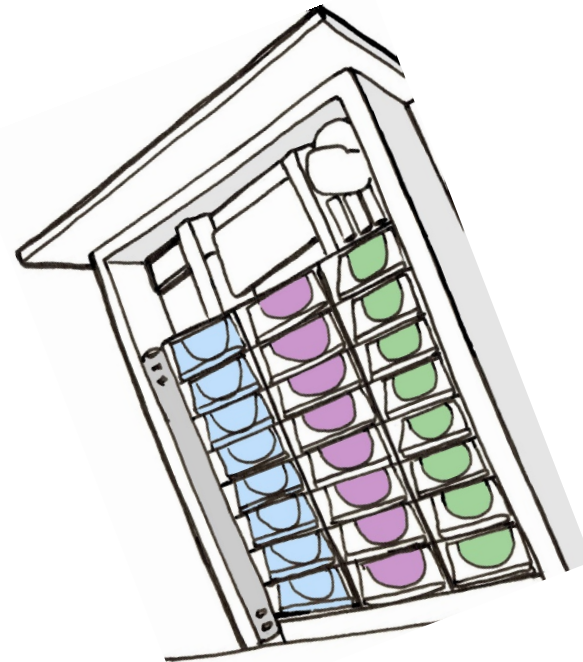
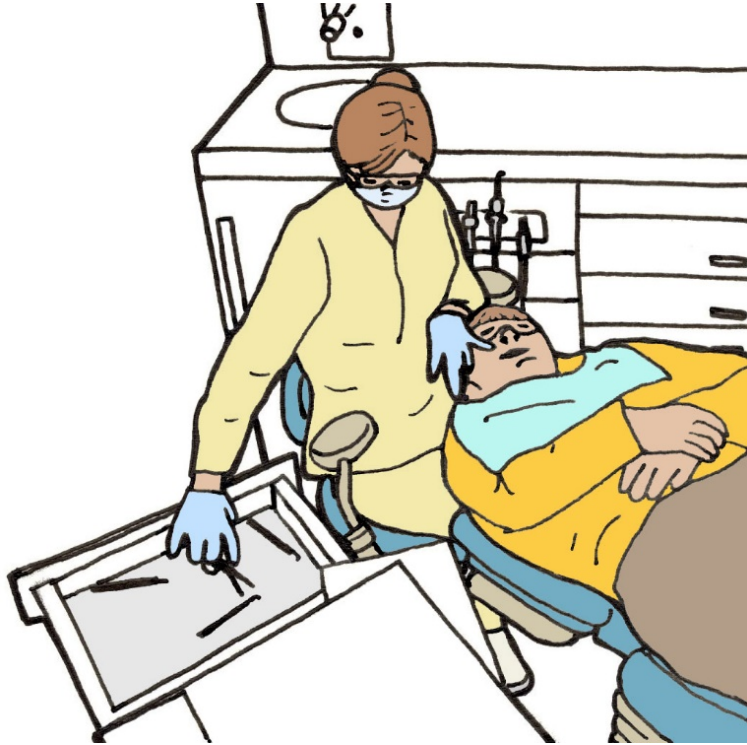


To take a large box holding dental wires in orthodontics



- Extensions of the hand
- Wide grip with effort
- Grip similar as holding a large dictionary

Solution: add a mobile unit to the right with drawers and dividers



Store the wires in individual envelopes in a drawer with dividers

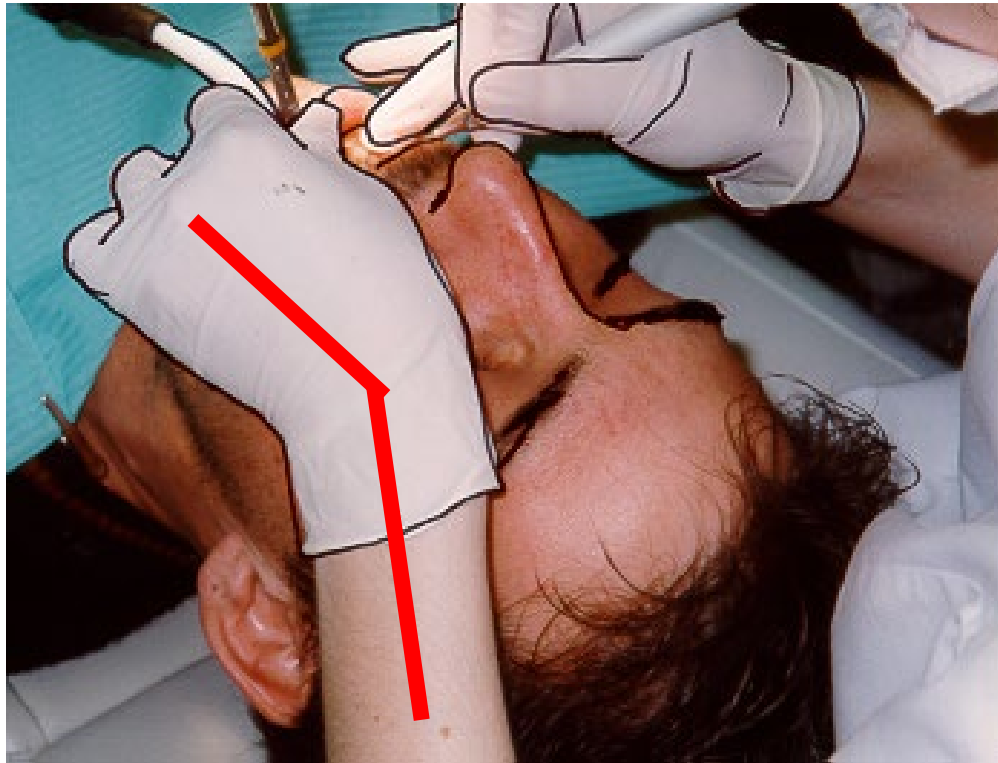


Movements that ↗ risks of MSDs for medial epicondylitis (*epitrochleiteitis*)

- Fingers flexor muscles attached to the epitrochlea (under the elbow, on the side of the little finger)
- Responsible for hand flexion movements



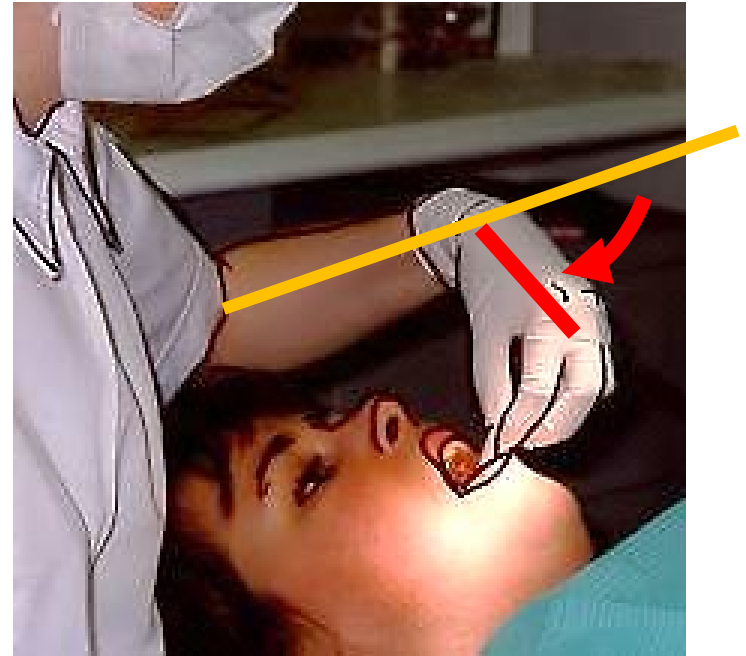
Deviated wrist position while holding suction and mirror at the same time



Solutions ?



Wrist flexion = strain on the flexed muscles



Flexed left wrist posture causing medial epicondylitis (epitrochleteitis - *golf elbow*) to the left elbow



**By giving the patient suction,
the flexion of the left wrist is ↘**



In a month, the epitrochleitis was gone!



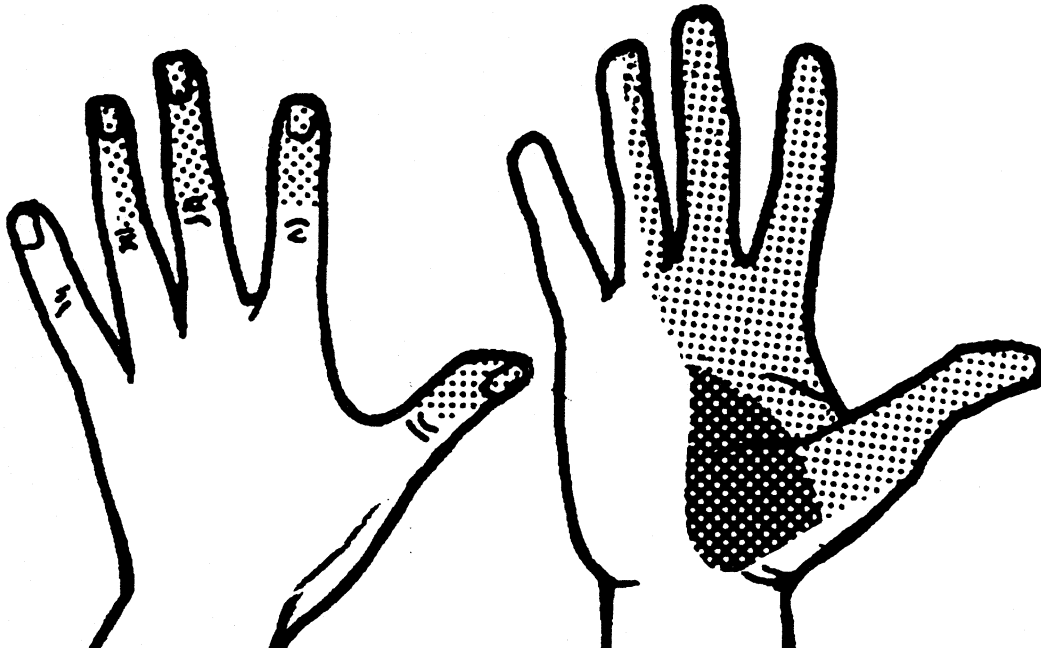
MSDs to wrists and hands

CARPAL TUNNEL SYNDROME (CTS)

DE QUERVAIN'S DISEASE (TENOSYNOVITIS)

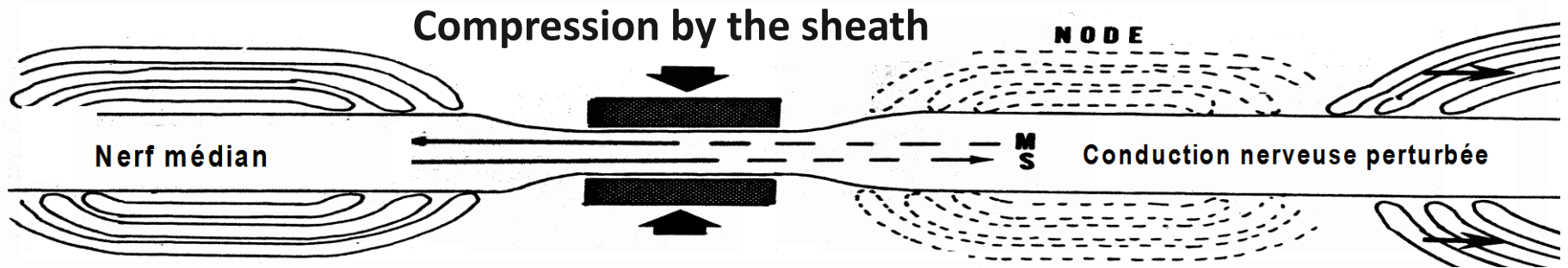


Carpal Tunnel Syndrome (CTS)



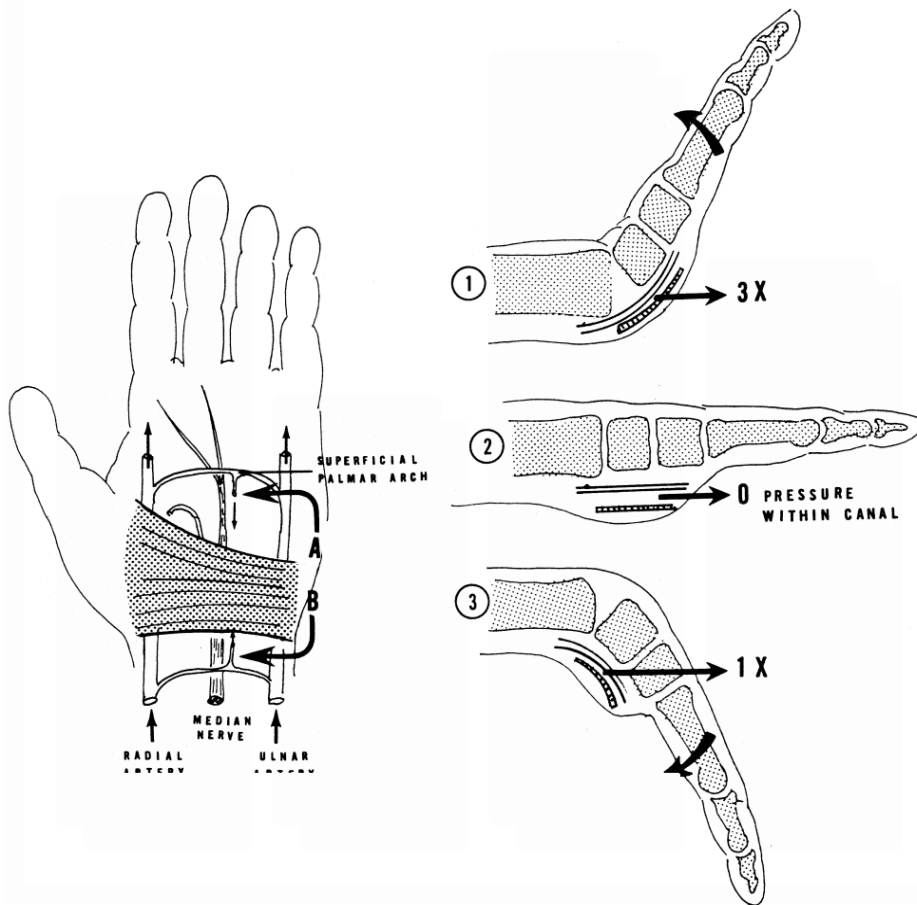
- **Innervations of median nerve :**
 - ✓ Sensitive (grey)
 - ✓ Motor
- **Symptoms :**
pins and needles, pain, burning sensations, etc.

The median nerve is compressed by the sheath



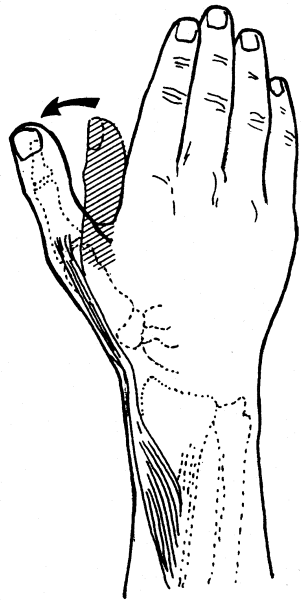
**Nerve conduction is modified
sensitive (S) and motor (M)**

Movements effects on the pressure in the carpal canal (mm of Hg (mercury))

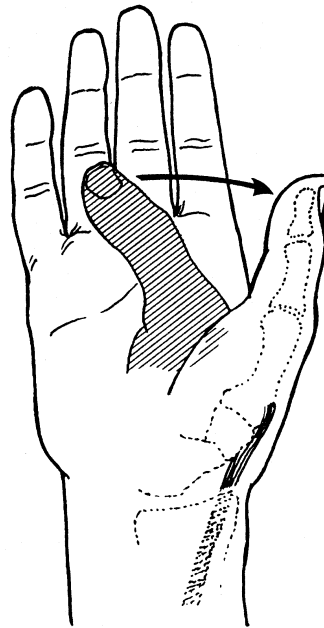


<u>Normal</u>	<u>If CTS</u>
12 X (30 mm)	44 X (100 mm)
2,5 mm	12 X 32 mm
12 X (30 mm)	38 X (94 mm)

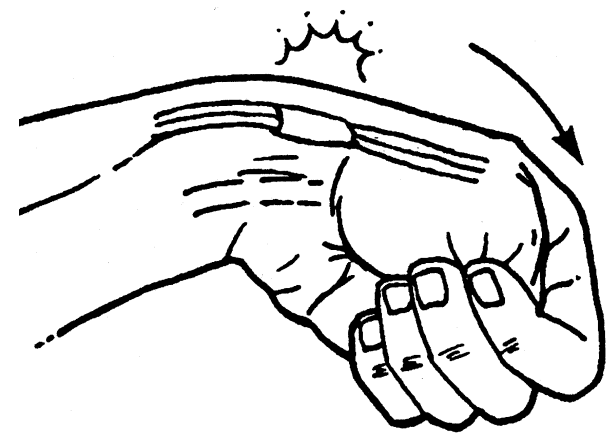
De Quervain's disease (tenosynovitis)



- **Long abductor tendon**



- **Short extensor tendon**



Diagnostic test

Poll 19

The following factors ↗ the risk of developing De Quervain's disease. Of how much ?

Repetition



3 X

6 X

Force



3 X

6 X

Force + repetition



9 X

29 X

Poll 19 - Answer

The following factors ↗ the risk of developing De Quervain's disease

Répétition



3 X

Force



6 X

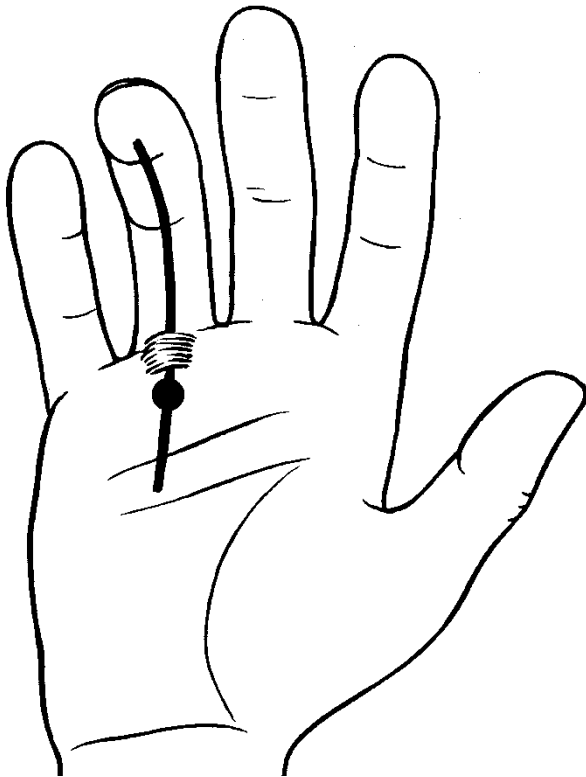
Force + répétition



29 X

Exponential effects

Nodular tenosynovitis of the deep flexors of the fingers



- To the middle and ring finger of a dental hygienist

Writer's cramp

- **Caused by forceful pinch grip**
- **Involves involuntary contraction of the muscles of the forearm on dominant side (*R for right hand*)**
- **Right hand bent involuntarily inward**
- **Need the use of left hand to bring the right hand straight**



11. SOLUTIONS FOR MSDs TO ELBOWS, WRISTS AND HANDS

Decrease deviated wrists postures

Use cures with larger diameter handles

Make a wider use of ultrasonic scalers or piezoscalers

**Have larger, more comfortable contoured suction tips
for the patient**



EXERCICE

Shake the hand of your neighbour

- **This is the most natural posture with a slight inward rotation**
- **This is the reference posture when one wonders how one should hold an instrument or an object**



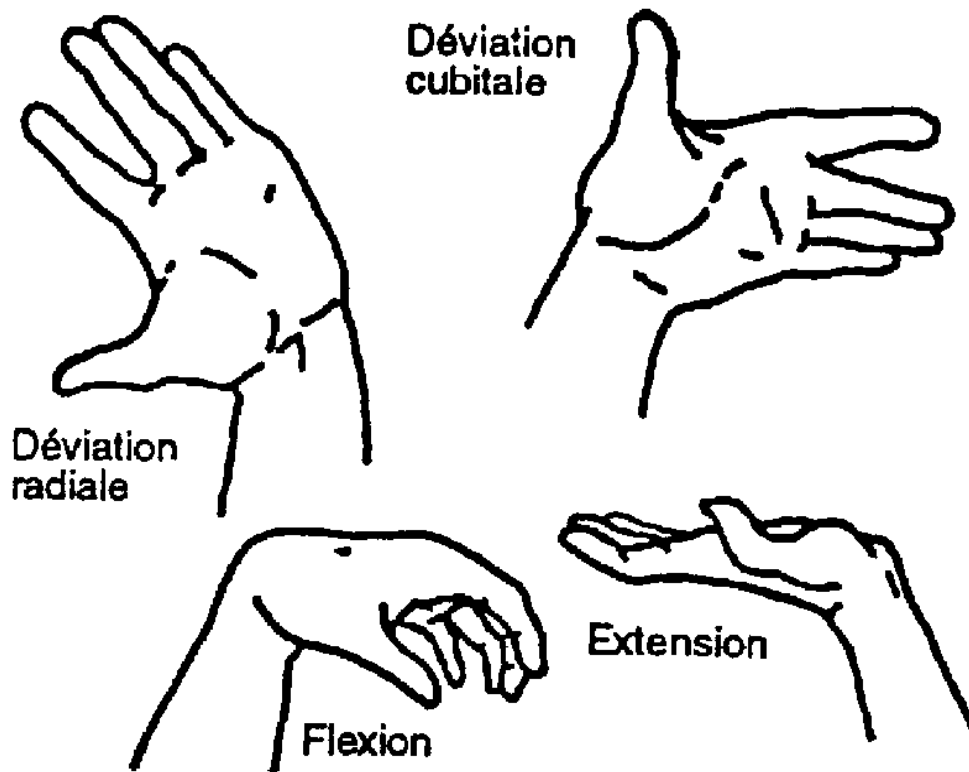
EXERCISE

Perform small rotations
and wrist flexions of his / her neighbor)

- Is it comfortable?
- Even small rotations or bents create discomfort



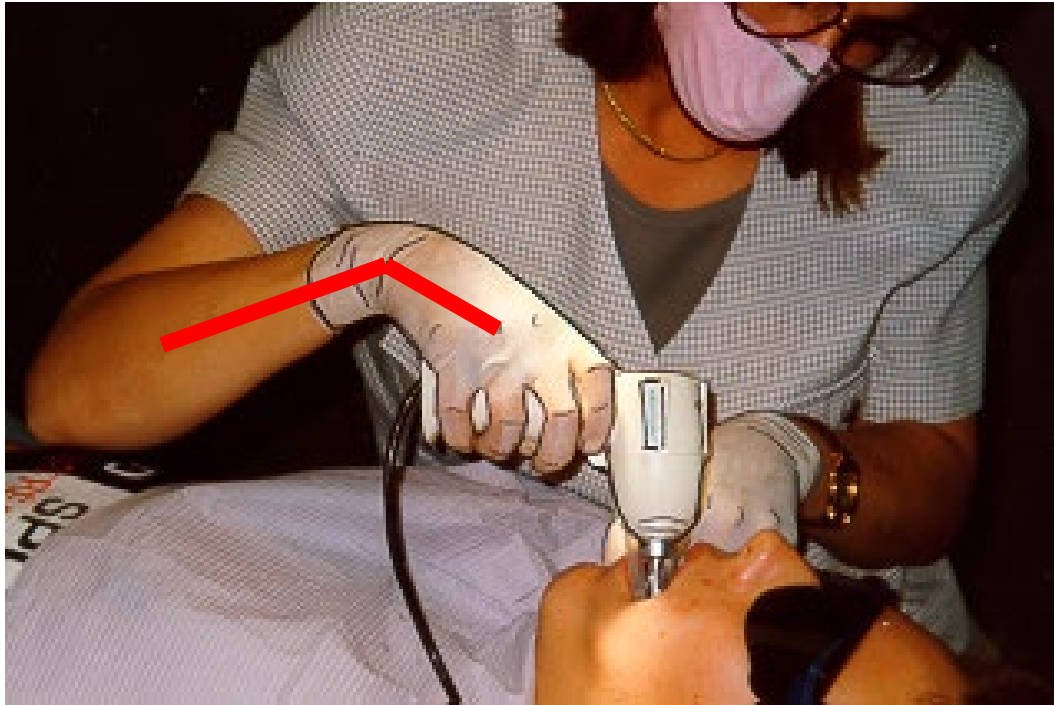
Keep the wrists in a neutral position (avoid bending angles and deviations)



- Recognize extreme movements
- Find ways to work with your wrists in a neutral position
- Exchange with colleagues



Check the posture to hold the polymerising lamp



Find ways to keep left wrist in neutral position



Wrist in neutral position, change hand if easier



Compact and lightweight polymerizing light *SmartLite maX L.E.D. Curing Light*



Hold the high volume evacuation with left hand



- **With elbow supported**
- **Wrist straighter than if hold by the right hand**

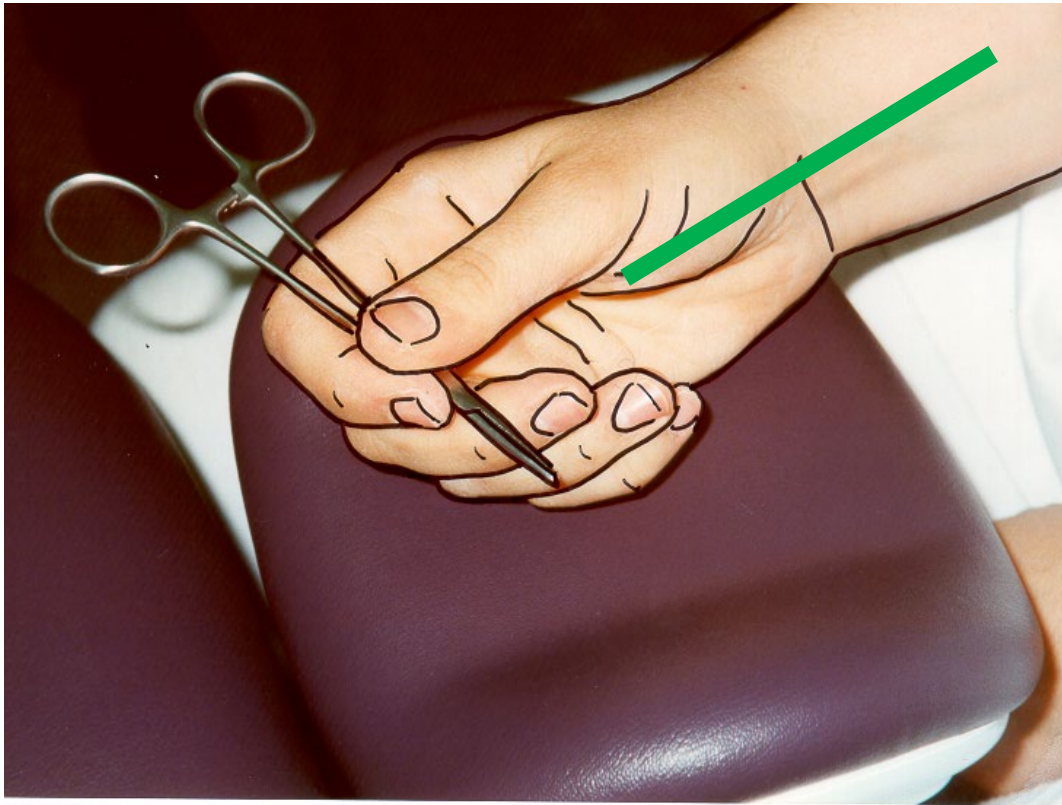
Holding hemostatic pliers



- ❖ Flexion and deviations of the wrist
- ❖ Solution(s) ?



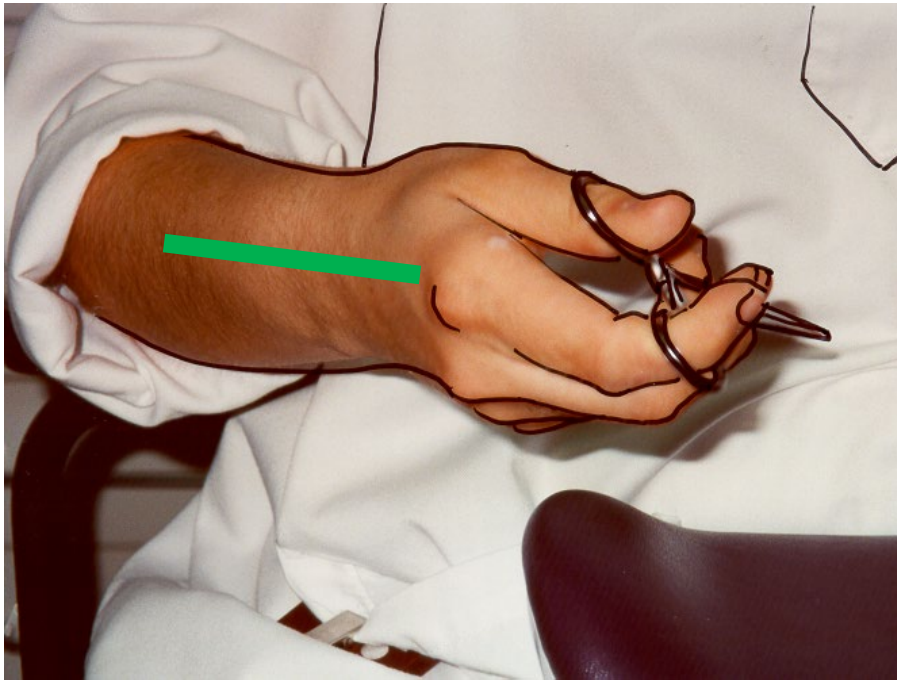
Different hold of the pliers



- ✓ **Wrist in neutral position**
- ✓ **Gives out more strengt**



Hold with straighter wrists by changing the grip



■ **Thumb-index grip**



■ **Thumb-middle finger grip**

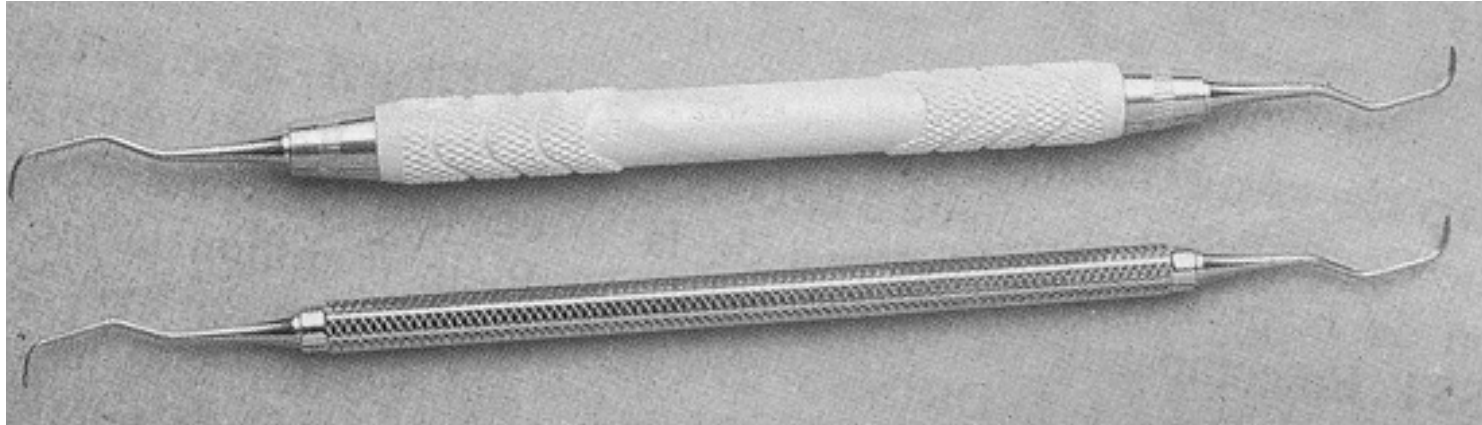


Large diameter mirror handle

- One face
- Two faces :
 - access to indirect vision (Hu-Friedy)



Use large diameter curettes



- To **↓** contraction force of the muscle doing the forceful pinch grip
- Diameter 15 mm recommended
- Antislip surface handle



Use well sharpened curets

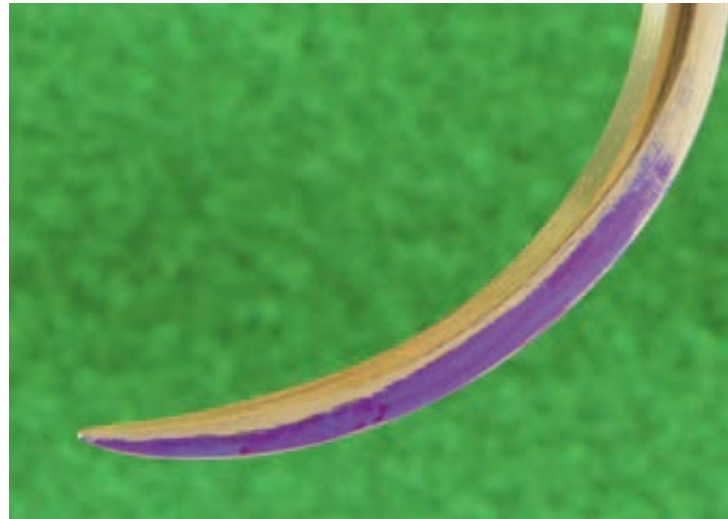
- **Sharpen them often**
- **Change curets as soon as the cutting edge is less effective, otherwise:**
 - **effort is ↗**
 - **obligation to hold tighter**
 - **obligation to pass several times**
 - **can ↘ the quality of treatment**
- **Replace currettes that are too worn**
- **Have time reserved for sharpening at least 2 times / week.**



A sharpening guide helps maintain the right angles and prolongs the life of curettes



Color the area to sharpen with a felt pen



This makes it possible to check the efficiency of sharpening and gives feedback



Device for sharpening curettes

- **Eg. *Perisotar, Cie Kir***
- **All the curettes are sharpened in the same way**
 - **Very effective**
 - **Quick**
 - **Cost: about \$ 1,600**
- **Would cause faster wearing of the tips?**



11. Solutions for elbows, wrists and hands

MAKE A WIDER USE OF ULTRASONIC SCALERS OR PIEZOSCALERS

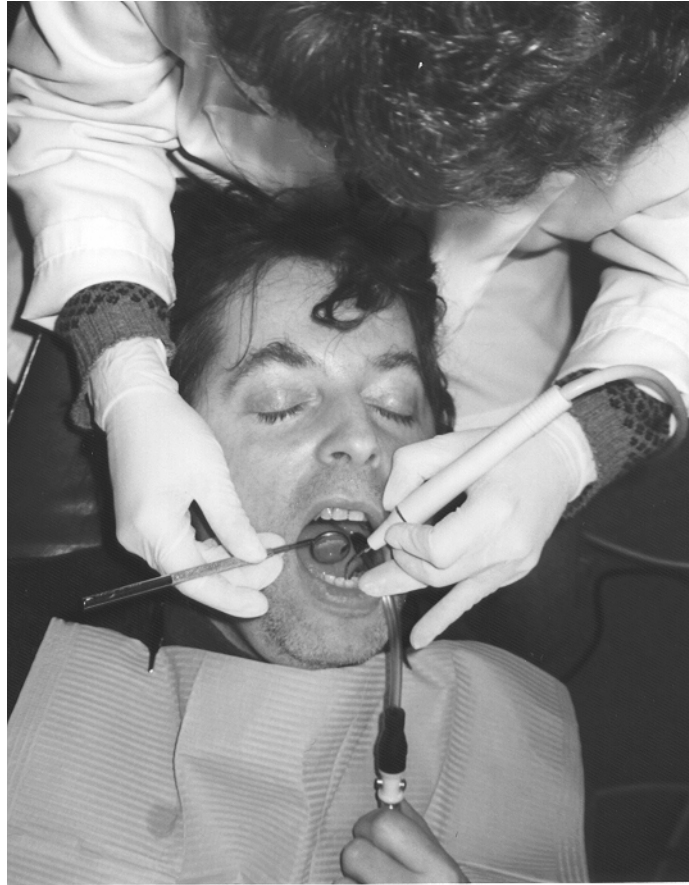


Make a wider use of ultrasonic scalers or piezoscalers

- ❖ **Sonic (2 000 à 6 000 cycles / sec)**
- ❖ **Ultrasonic by magnetostriction :
(25 000 à 30 000 cycles / sec)**
- ❖ **Ultrasonic by piezoelectric : quartz crystal
(29 000 à 40 000 cycles / sec)**
 - All use a cooling water jet



Wrists in neutral position (straight) with ultrasounds scalers (use chin support)



↘ of efforts, repetitive movements and awkward postures with ultrasounds

Curettes

- Tight grip to keep curette from turning
- Force required to dislodge tartar
- Repetitive movements of the wrists and fingers (10-45/min)
- Placement of curette tip under deposits
- Position of wrist and arm depends on the direction of force to be applied

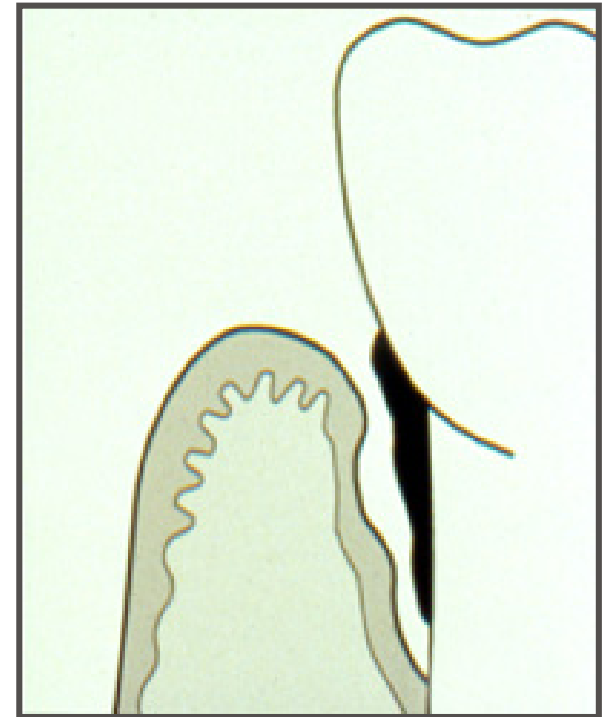
Ultrasonic scalers

- Gentle grip (similar to probe)
- Little force required
- Light continuous “brushing” or “erasing” movements
- Positioning of ultrasound tip similar to probe
- More relaxed arm and wrist positions



Clinical advantage of using ultrasounds

- **Improved access**
- **Less tissues dilatation**
- **Possibility to use antimicrobials :**
 - ✓ Bactericide due to cavitationnal effect
- **Irrigation benefits**
 - ✓ Improve healing
 - ✓ Cleaner site



Curved tips (to the right and to the left)

- **Especially for deep pockets**
- **Interproximal posterior surfaces**
Bifurcations
- **Tight contacts**
- **Poorly positioned molars**
- **Concave surfaces**



Tip wear can cause loss of scaling efficiency

↘ 1 mm of wear:

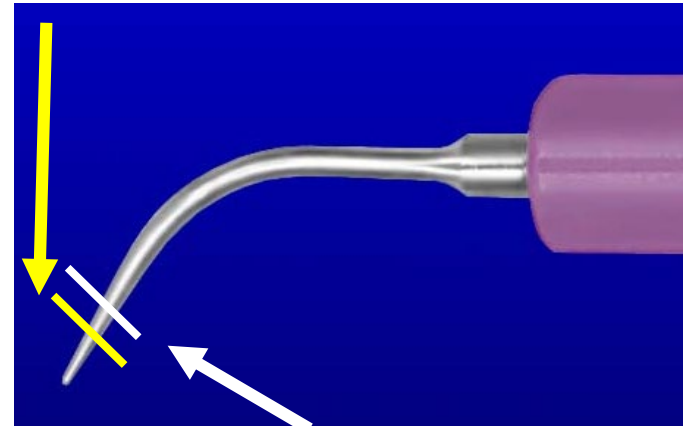
Can results in ↘ of efficiency of approximately 25%

↘ 2 mm of wear:

can results in ↘ of efficiency of approximately 50%

Wear Guide of Hu-Friedy*:

- Tip wear of 2 mm should be discarded
- Thin tips wear more quickly than standard tips, therefore, avoid the use of thin perio inserts for heavy debris in order to maximize their life expectancy



*Hu-Friedy, *Wear guide*

Inconvenients of ultrasounds

Problems :

- Reflex contraction of forearm muscles
- New working methods
- Aérosols production

Solutions :

- Often relax the hand (micro-pauses) to restore blood circulation
- Take training session
- Persevere
- Anti-microbial rinsing before the procedure
- Use rapid suction



Production of aerosols of small dimensions by ultrasounds

- Ultrasonic and piezo scaler promotes the generation of small aerosols that can reach the respiratory tree*
- These aerosols may stay in the air for up to 30 minutes after treatment **
- Saliva pumps remove water in the floor of the mouth of the patient, rather than aerosols in the air **

PREVENTION

Have a rapid suction canula with a wide opening (8 mm or +)**

*Duchaine & Dutil (2006), p. 6-7

**Veena et al (2015), p. 260-265

11. Solutions for elbows, wrists and hands

**HAVE LARGER, MORE COMFORTABLE
CONTOURED SUCTION TIPS FOR THE PATIENT**



New fast suction cannula with larger edge on the bottom in shape of "U" (*ailette en « U »*)

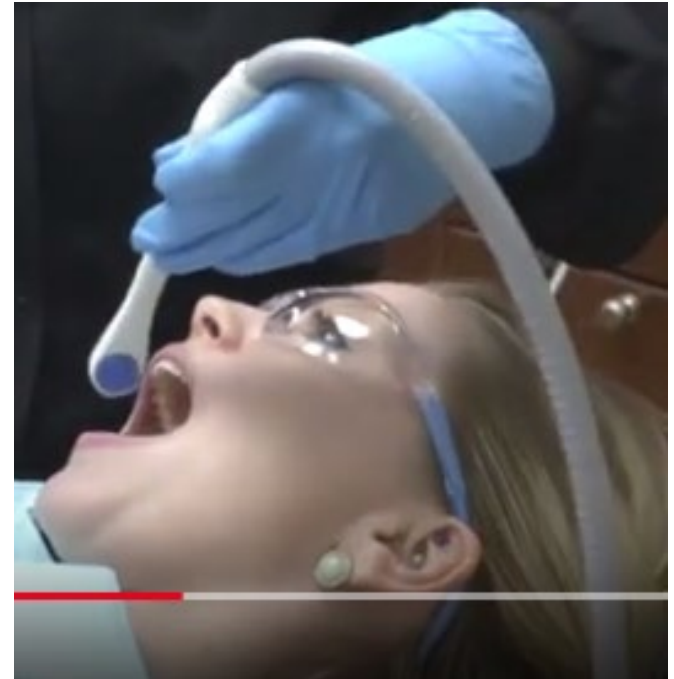


- Decreases the constraints for the left arm
- Is easier to locate precisely
- Avoids inadvertent soft tissue aspiration
- Reusable, it can be autoclaved
- In use in Europe for 10 years
- Product *Pelotte plus*

Fast suction cannula with large oval opening and a flat side to spread cheek and / or tongue



Rounded and smooth edges to facilitate the retraction of the lips and cheek



Opposite side to the opening of the suction is flat

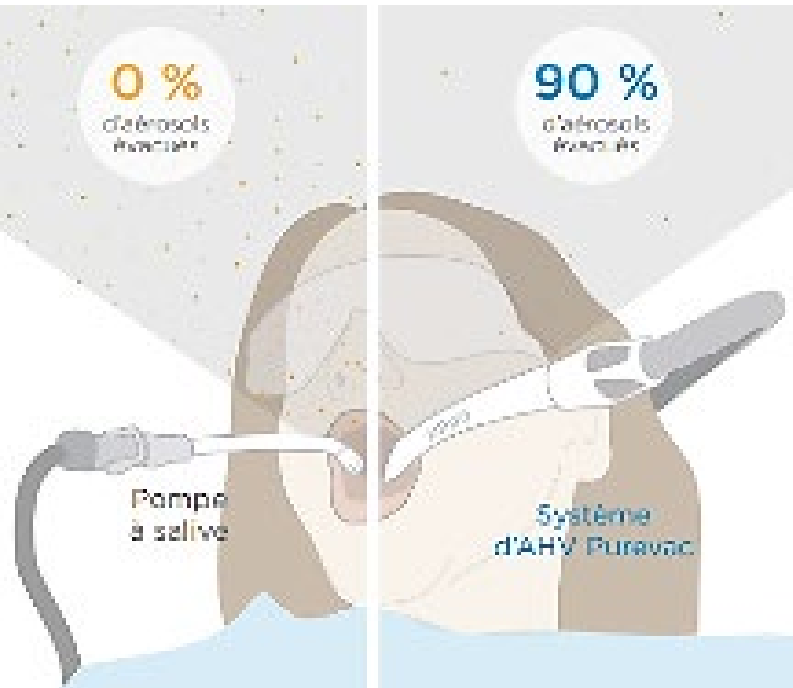


Wide opening oval suction cannula that sucks 90% of the aerosols produced by ultrasounds (According to Product Data Sheets)

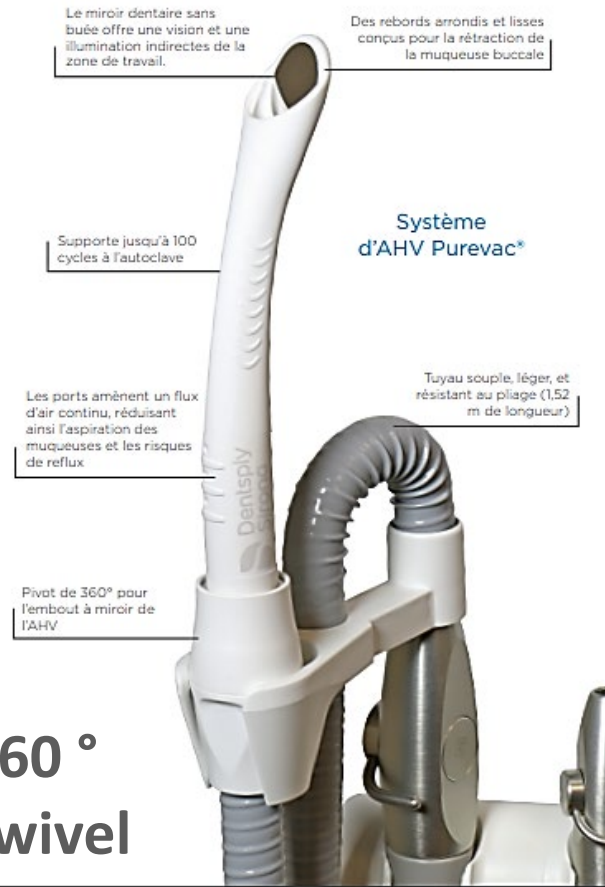
- Small surface that reflects the light
- 360° swivel
- Basic kit of high velocity suction system, with 3 tips: approx. \$200
- Kits of 12 tips available
- Tolerate 100 disinfection cycles



Wide opening oval fast suction cannula that sucks 90% of the aerosols produced by ultrasounds (According to Product Data Sheets)



Saliva pump does not catch aerosols



360° swivel

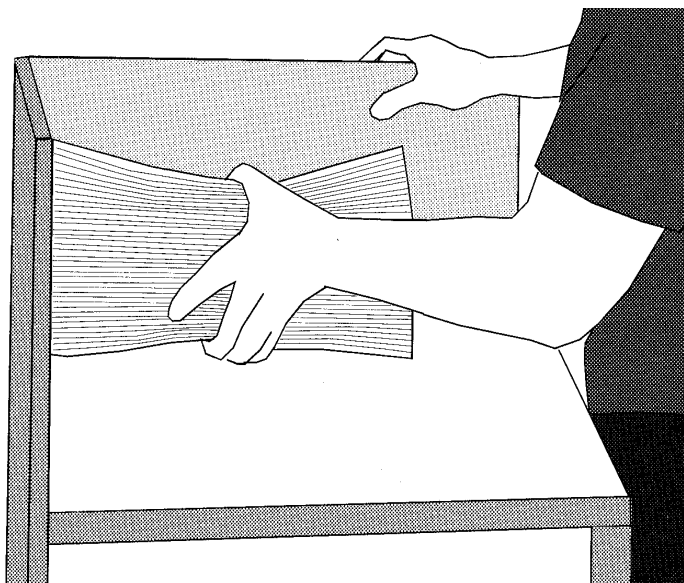


11. Solutions for elbows, wrists and hands

➡ **TIGHT GRIP WITH THE THUMB**



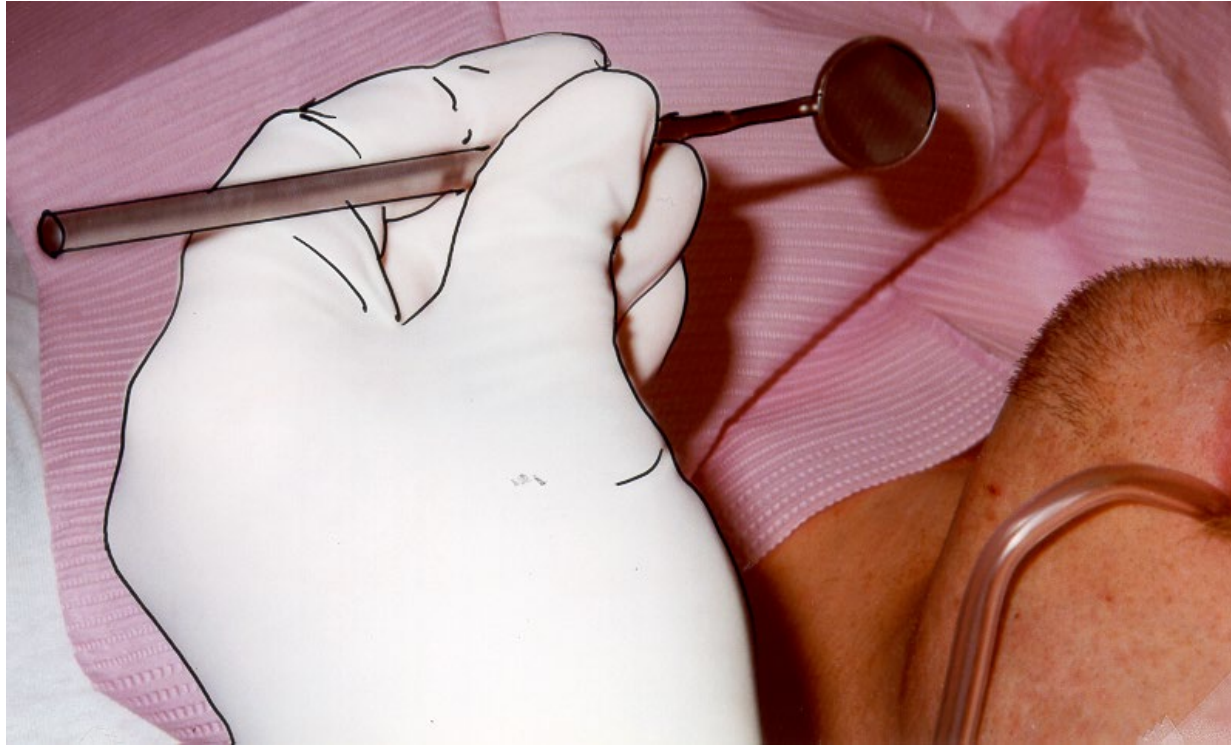
Avoid large one hand load



Use both hands



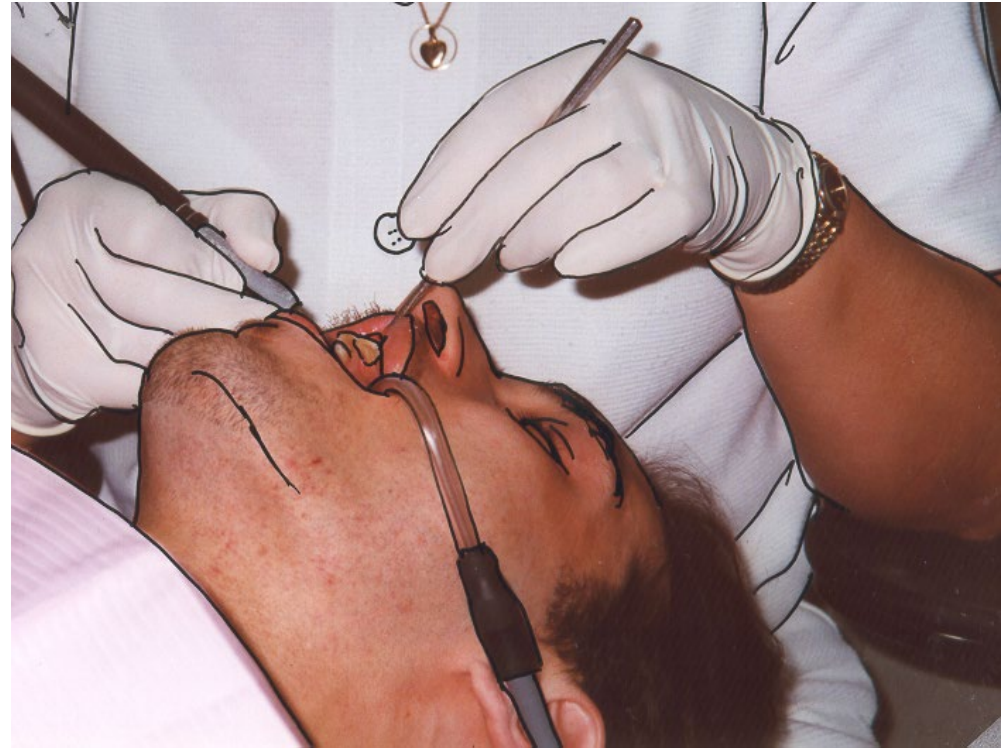
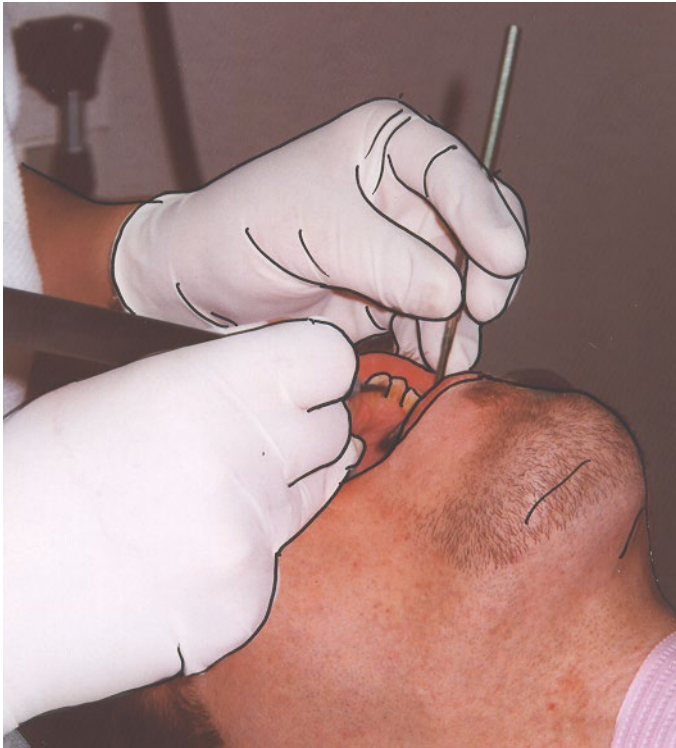
➤ forceful pinch grip of the left thumb



Standard grip of mirror = pinch grip



Modified grip on the mirror

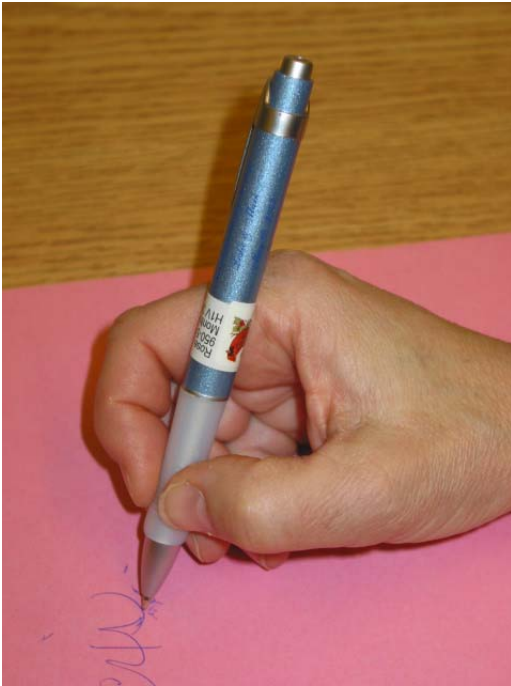


Large diameter pen to ↘ forceful grip

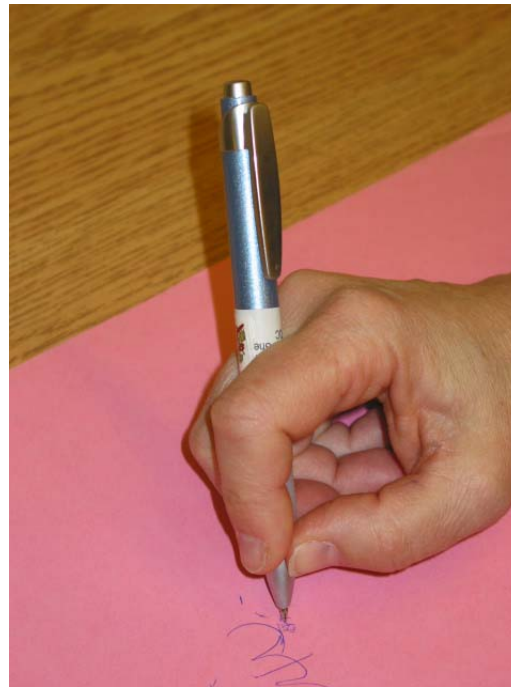


- If experiencing pain while writing
- Usefull if symptoms of :
 - De Quervain's disease
 - Writer's cramp

Modified pen grip if experiencing pain while writing



Normal pen grip

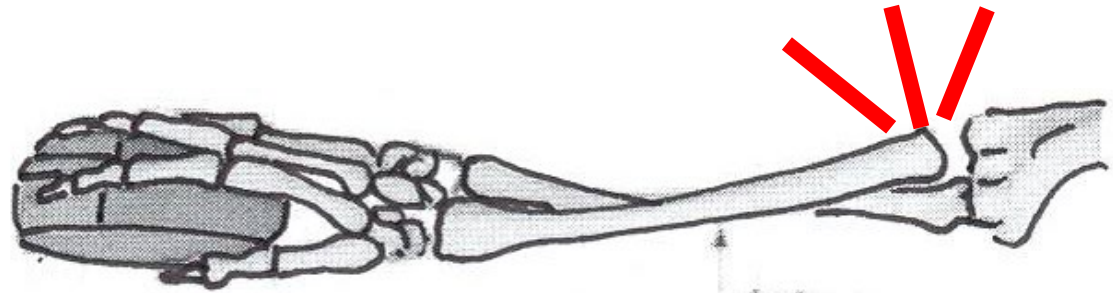


Pen between index and middle finger



The rotation of the forearm solicits the extensor muscles (eg flat mouse)

Flat mouse



The radius turns on the ulna ⇒ traction on the tendons of the extensor muscles

Vertical mouse



The radius does not turn ↘ the pulls on the tendons of the extensor muscles

Vertical mouse promotes good forearm and wrist positions



- ↘ deviations of the forearm
- ↘ risks of epicondylitis

11. Solutions for elbows, wrists and hands

REDUCE EFFORTS AT THE SOURCE BY EQUIPPING THE PATIENT



Accessories to help clients who have difficulty flossing



- Very useful when the teeth are tight
- Many periodontics clinics give some of them to their patients



To solve at the source: electric toothbrush



- **To help patients who have difficulty brushing their teeth**
- **Some periodontal clinics include it in the cost of treatment to all their patients**



11. Solutions for elbows, wrists and hands

REDUCE ACTIVITIES AT RISK FOR THE THUMB OUTSIDE OF WORK



Reduce activities at risk for the thumb outside of work

✚ the pains are important:

- ✚ as much as possible the restrictive postures
- ✚ wrist and thumb efforts

Exemples :

- electric toothbrushes
- pints of 1 liter milk or take with 2 hands
- light dishes, pots and pans
- adaptations for arthritic people



12. SOLUTIONS – EQUIPMENTS

FOR ALL BODY REGIONS AT RISK OF MSDs

Have positioning cushions to facilitate the tilt of the client's head

Characteristics of a good dental stool

Stool with *Free-Motion Elbow Supports* (2003)

Stool with improved *Free-Motion Elbow Supports* (2011)

Assistant's stool with *wide figure 8 elbow and torso support* and lumbar support (2006)

Saddle stool with *Free Motion Elbow-Supports* and lumbar support (2015)

Front lights and magnifying glasses



Have a cervical cushion to facilitate positioning and positional variations of the patient's head



12. Solutions - Equipment for all body regions at risk of MSDs

CHARACTERISTICS OF GOOD DENTAL STOOLS



1997-2002

Many hygienists use assistant's stools



- Without armrests
- Without lumbar support
- Do not move or rotate well



Caractéristiques d'un bon tabouret dentaire

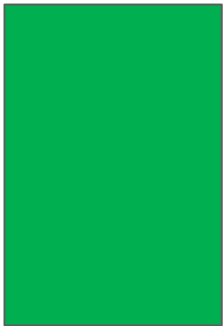


- Lumbar support that moves forward independently of the seat
- Seat angle adjustable
- Roll easily « *turn on a dime*”
- 5 wheels

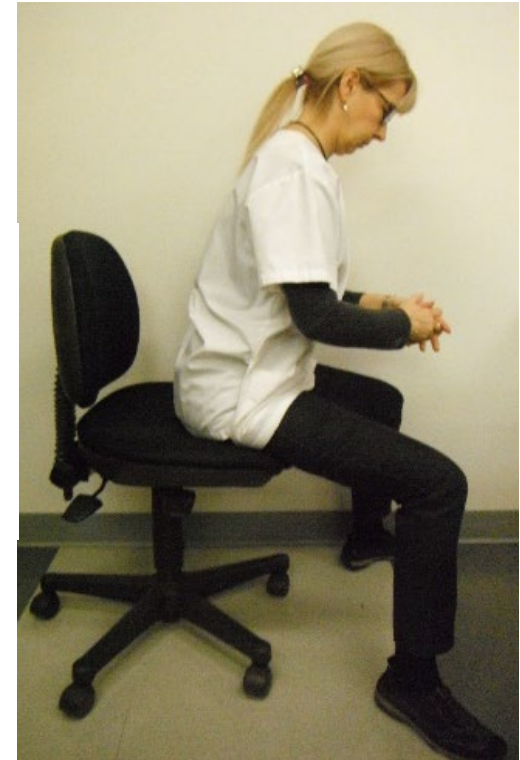
Poll 20

When working in the patient's mouth, what is your most common sitting position?

Resting on the lumbar support of your stool



■ At the edge of your chair



The lumbar support, down to the seat, is too low to support the lumbar curve



The lumbar support is at the height of the buttocks



Lumbar support too low / too far (*not used*)



Adjusting the height of the lumbar support

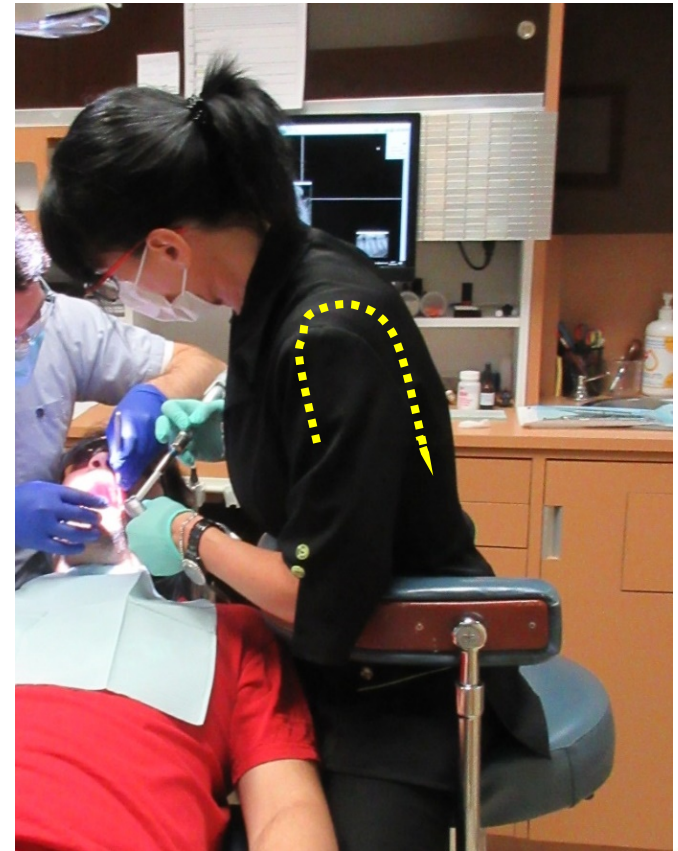
**Too low,
If it touches the seat**



**OK, if it is up to the
hollow of the back**



Assistant stool without backrest



Exercise :

with the right hand (*or dominant*)

With the end of a closed pen, pretend that you are removing nail polish from your left thumb nail (*similar to cutting tartar with the curet*)

1st time:

- Arms away from your body
- Neck bent
- Press hard, do rapid movements to remove only 1/2 mm of nail polish at a time
- Do it 30 seconds to 1 minute



Observe tension in your neck and upper back

Exercise :

with the right (R) hand (*or dominant*)

2nd time :

- **Cross your R leg over your left leg**
(same side as the hand)
- **Place R elbow on your R thigh and apply pressure on the thigh**
- Press hard on the thumb nail, do rapid movements **to remove only 1/2 mm of nail polish at a time**
- **Do it for 30 seconds to 1 minute**



Observe tension in your neck and upper back

Exercise :

with left (L) hand (*or non dominant*)

- **Hold pen straight with all fingers**
(like a dental mirror)
- **Pull on the pen with 2 curved fingers of right hand**
(simulating a tight cheek)

1st time :

- **Both arms away from your body**
- **Neck bent**
- **Hold for 30 seconds to 1 minute**



*Observe tension in your
neck and upper back*



Exercise :

with left (L) hand (*or non dominant*)

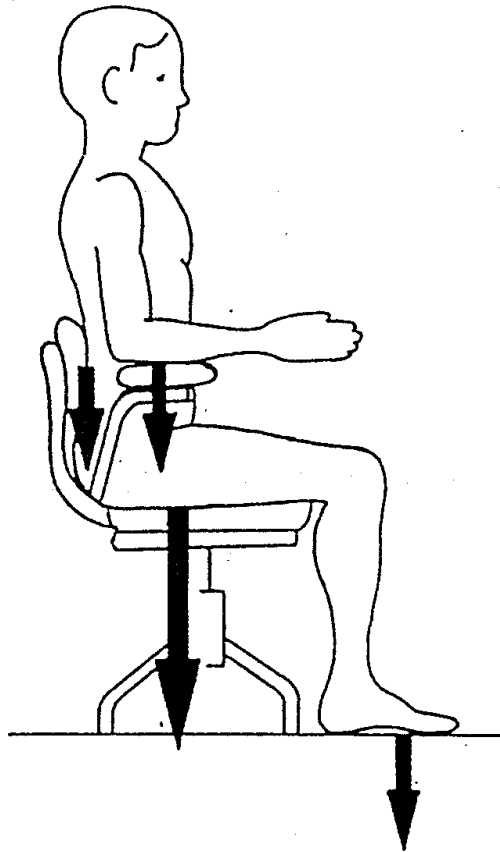
2nd time :

- **Cross your L thigh (*same side as the hand*) over your R thigh**
- **Place L elbow on L thigh and apply pressure on the thigh**
 - Spread your R arm up
 - Bent your neck
 - Pull with the bottom of the pen on 2 curved fingers of the right hand (simulating a tight cheek)
- **Hold for 30 seconds to 1 minute**



Observe tension in your neck and upper back

Chairs with armrests



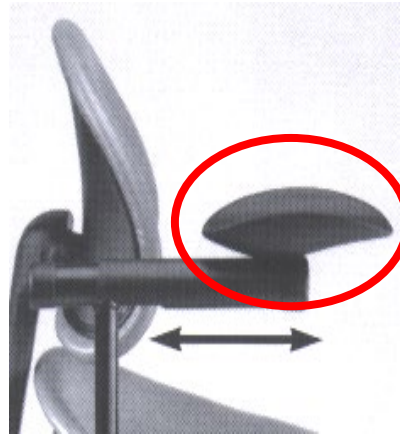
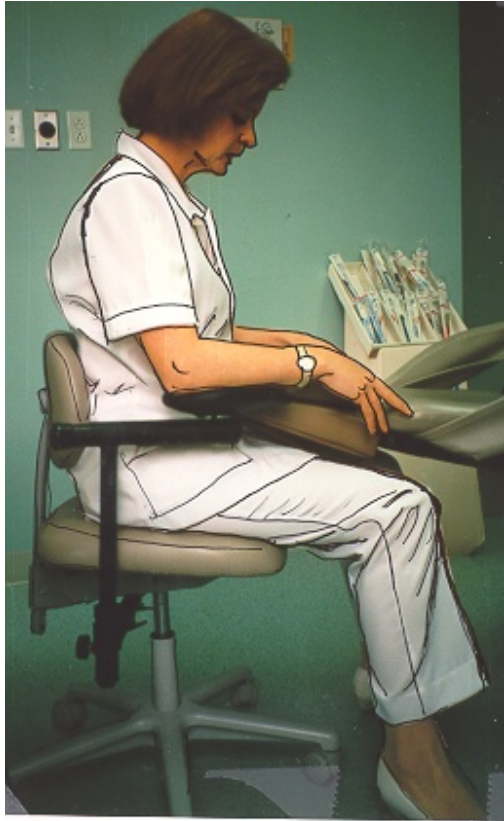
- Preventive measures to **↓** static load of shoulders
- Divide the weight of the body
- Preventive measure to **↓** back pain
- It is not possible to use standard fixed armrests in dental work

Back to 1997 - During the internship (UQAM)

- Tests of all armrests available on the market
- No satisfactory existing model
- To have elbow supports "acceptable", need to appeal to 3 different suppliers:
 - ✓ One for a good stool
 - ✓ One for sliding armrests modified as elbow-rests
 - ✓ One to weld the sliding elbow-rests supports under the center of the chair



1997- Search for stools with elbow supports adapted for dental work



Construction of a stool

- with telescopic and swivel armrests that allow movement of the arms on a horizontal axis
- Armrests had to be padded to be used as elbow-rests



Advantages to use elbow supports

- We quickly realized that our arms are held in the air
- Postures are improved
- Supports help find different ways to do the work

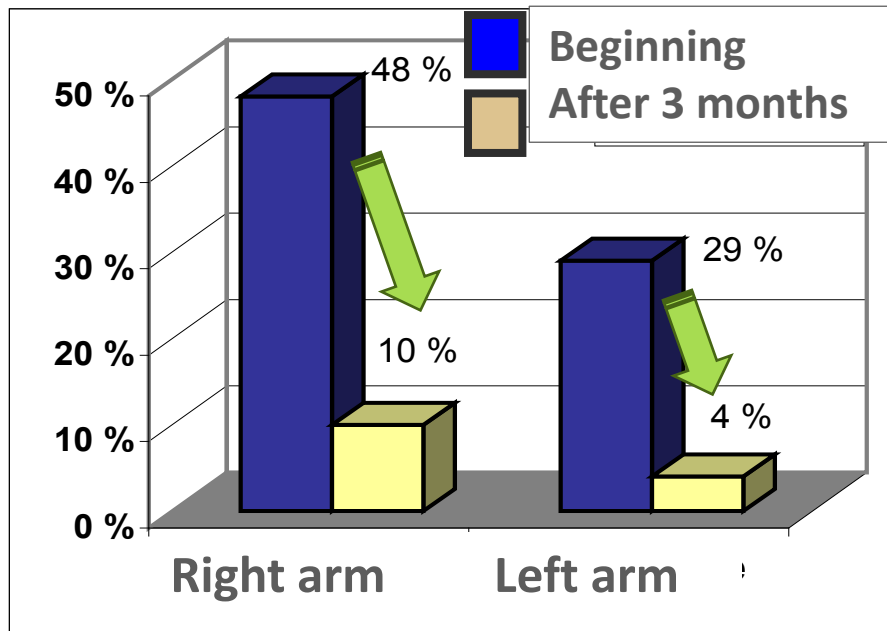


Impact of padded Swivel Telescopic Armrests (STA)

6 treatments by 3 hygienists, before and after 3 months of use

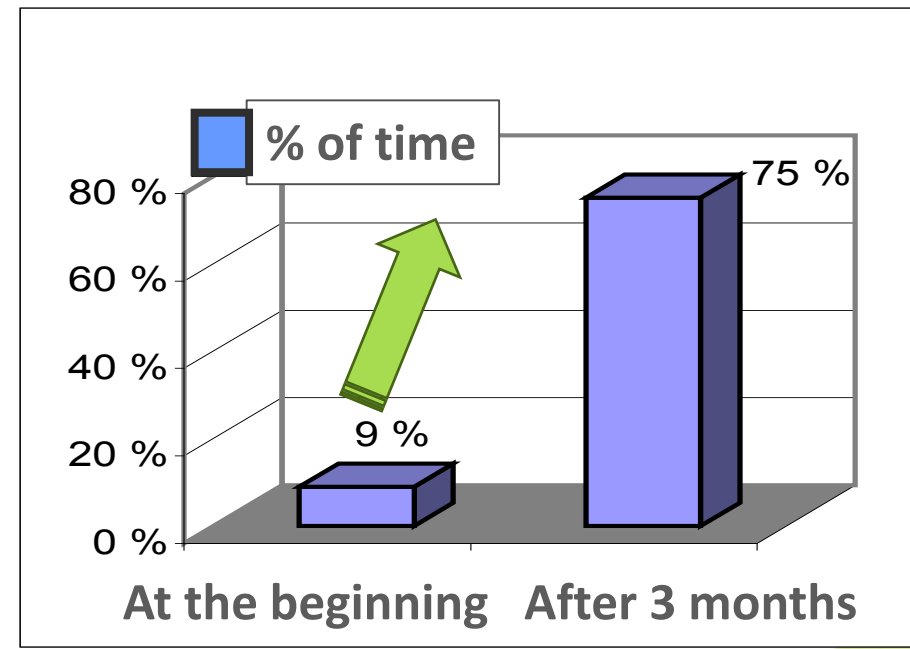
Average time with the arms in abduction of more than 40°

- at the beginning (48% and 29%)
- after 3 months of use (10% and 4%)



Average time spent behind the patient's head (11 am or 12 pm)

- at the beginning (9%)
- after 3 months of use (75%)



Measurement of the muscular activity of a hygienist by electromyography (EMG)

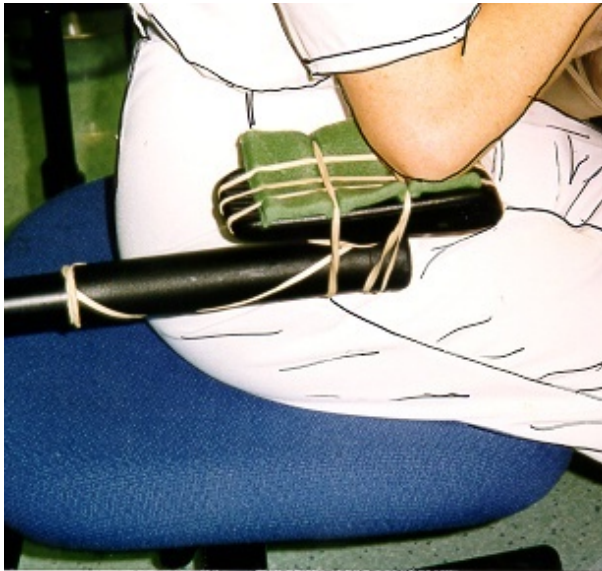


- Each person makes a maximum effort for each muscle
- In action, the activity of each muscle is measured
- The activity of each muscle is then compared to the maximum value obtained during the maximum effort test



1st exploratory study (1998)

EMG results : mean percentage of maximum voluntary contraction (%MVC) of upper trapezius of a **hygienist**, in a real work situation, with Telescopic and Swivel Armrests



- Without support:
work at 10% of maximum strength = **unsafe**
- With support:
work at 5% of maximum strength = **safe**

Problems found with Telescopic and Swivel Armrests (3 suppliers)

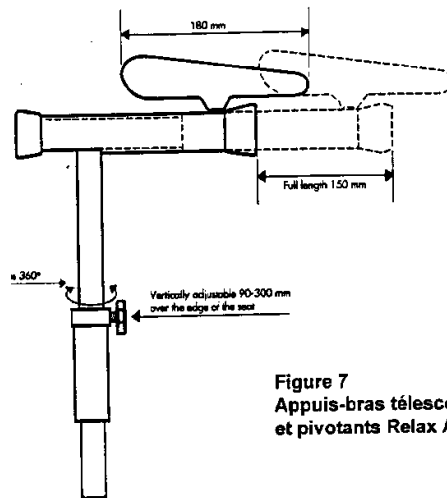
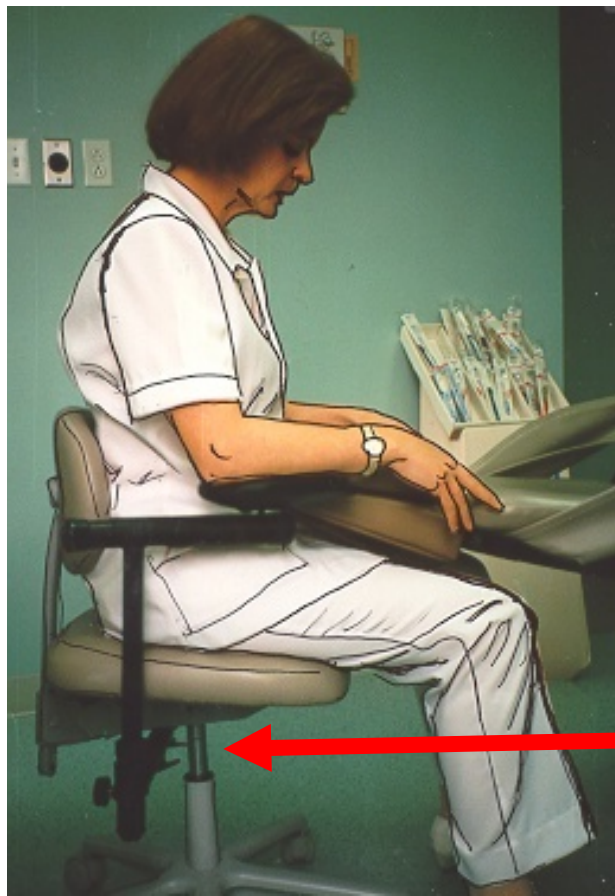
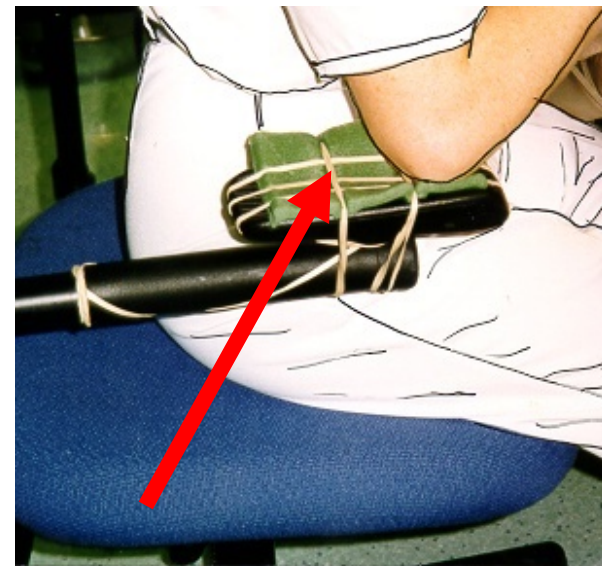


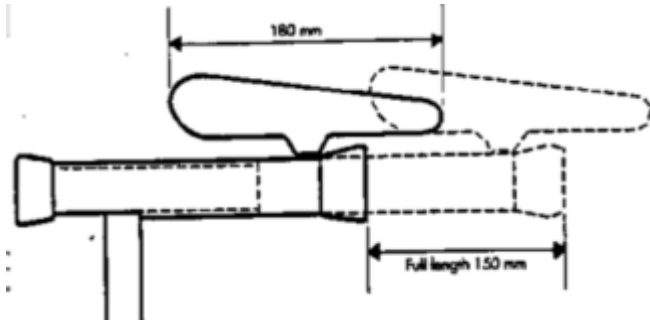
Figure 7
Appuis-bras télescopiques et pivotants Relax Ar



- The supports do not go forward enough, it is necessary to weld the supports in the center of the chair

To use the elbow supports, it is necessary to add cushioning

Telescopic and Swivel Armrests are not stable enough to ensure accuracy



- The sliding of the support on the stem is more or less stable depending on the location of the support where the elbow rests during work
- The hollow support of the forearm rests on a centered stem whose tension varies according to the place where the elbow rests
- Depending on where the elbow is resting on the support, it pivots and needs to be repositioned, with a gloved hand



ARM-rests vs ELBOW-rests ?

- Pivoting telescopic **armrests** gives mobility of the arms only on a **horizontal level**
- **Elbow rests** offer supports with a mobility of the forearm **in many directions**
- **Elbow rests** need to be **well cushioned**, otherwise, cubital nerve can be compressed and that can cause discomfort



1998 – Technological Development Agreement

- This agreement aims to develop
 - Elbow supports suitable for dental work
 - Padded and comfortable elbow supports
 - An easy and predictable mechanism of movement
- Invention realized by the industrial designer Lyne Noiseux
- She became the manufacturer of Posiflex



12. Solutions - Equipment for all body regions at risk of MSDs

**STOOL WITH FREE-MOTION ELBOW SUPPORTS
(2003)**

IMPROVED FREE-MOTION ELBOW SUPPORTS (2011)

**SADDLE STOOL WITH FREE-MOTION ELBOW
SUPPORTS AND LUMBAR SUPPORT (2015)**



Results of Technological Development Agreement

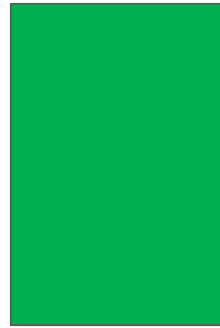
Free motion elbow-supports



Poll 21

Do you use a stool with free-motion elbow supports?

YES



NO



Free motion elbow-supports (round and flat)

- Soft pads are flat, round and stable even on the side (*don't turn*)
- Attached to a rod with a ball joint that allows horizontal movements on an axis
- Adjustable tension, so, it is possible:
 - To move the arms without effort
 - Stays in place if we move the arms up
- Adjustable height



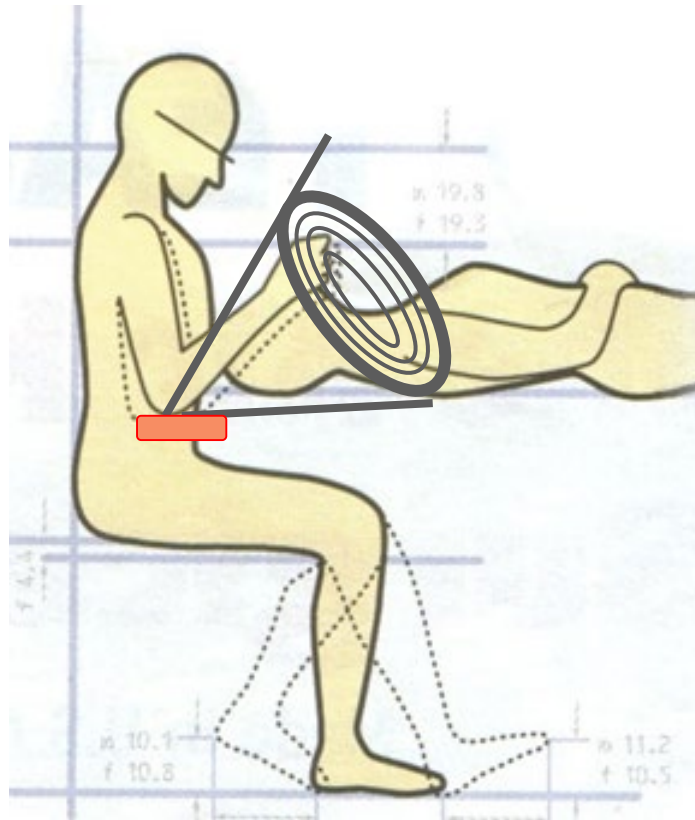
Result : Free motion elbow-supports



Adjustment
of tension
« ball joint »

- Elbow supports move on an horizontal axis
- Adjustable tension allows the supports to follow easily the movements of the arms

The elbow supports allow freedom of movement of the arms and forearms



- Good range of motion for the forearms
- Elbow supports allow movements
 - Forward
 - Backward
 - On the sides

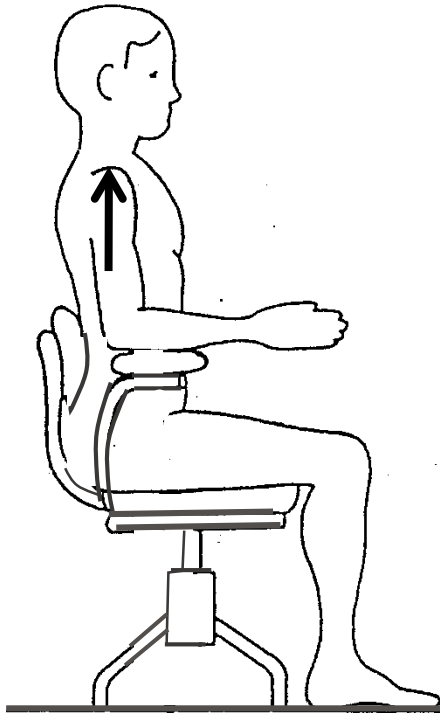
Free motion elbow-supports



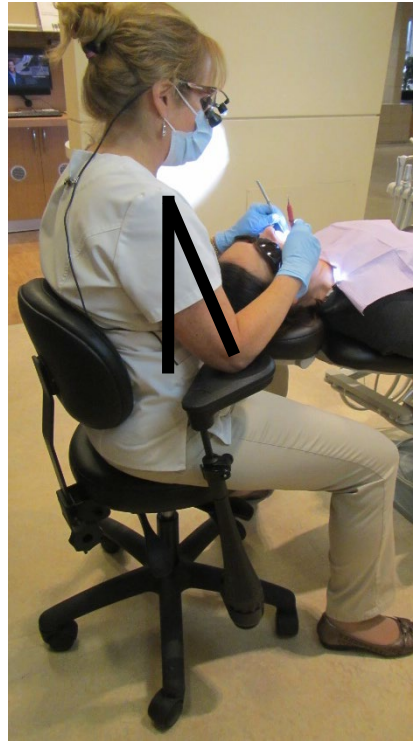
- Follow movements but stay in place when dentist or hygienist raises an arm
- Lumbar support
- Rolls well for movement around the patient's head



Ask for help to adjust the height of the elbow supports



1 - 2 - 3



4 - 5

1. Arms placed along the body, lift your shoulders a little
2. Raise the forearms upwards
3. Have someone fix the height of the elbow supports at the tip of your elbow, in the center of the cushion
4. Bring your elbows forward
5. Your shoulders should be relaxed and supported
6. If you feel tension in the shoulders, lower the supports a little

Research project to evaluate the effects of *free motion elbow supports* in real work situations (2000)

Funded by the Institute for Research in Occupational Health and Safety (IRSST) and ASSTSAS

- Research directed by Dr Denis Marchand, Ph.D. in motor activity (Université de Montréal)
- Teacher at the department of “kinanthropology” at l’Université du Québec à Montréal (UQAM)
- Videos on 3 plans taken simultaneously
- 8 muscles evaluated
 - No side effects on forearms muscles



Research project to evaluate the effects of *free motion elbow supports* in real work situations (2000)

1st measurement day:

- **EMG measurements** with current equipment and methods, observations, videos, teaching (*guide and videos*)

One month loan of stool

- to become familiar with the use of elbow-supports

2nd measurement day, 1 month later :

- **EMG measurements** with free-motion elbows-supports, observations, videos



Measures taken during 72 cleaning treatments by 10 hygienists (*duration 20 days*)

Treatments varying from ½ hr to 1 hr

- **35 without support**
(about 4 treatments per hygienist)
- One month to get used to the use of supports
(free-motion elbow-supports)
- **37 with support**
(about 4 treatments per hygienist)



Safe thresholds for Percentage of Maximum of Voluntary Contraction (%MVC), in static work

- Safe value for vascularization of muscles, during static work, over long periods, is at thresholds **<5%** *
- Significant muscular **ischemia problems** (*partial obstruction to blood circulation*) is at thresholds **>10%** **
- With a lower maximum force (2/3 of men), **the thresholds of 5% or 10% are more easily reached by women**

* Bjorksyen et Johnson, 1997, p. 23-27

** Sjogaard *et al.*, 1986

RESULTS for statics contractions of the superior trapezius (*upper back*)

Without support:
average %MVC of 10%
(at risk of MSDs)

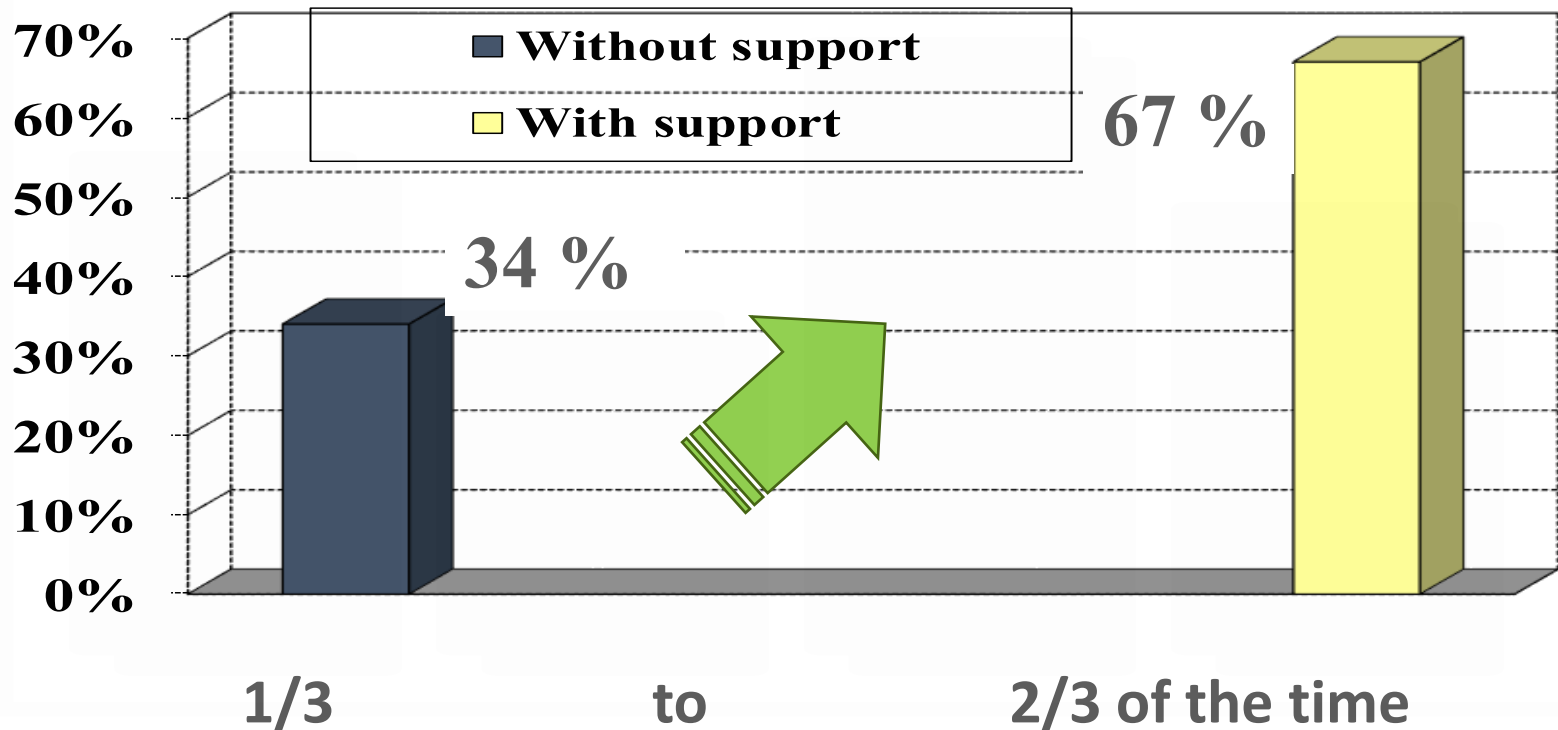


With free-motion elbow-supports:
average %MVC of 5%
(Safe level)



RESULTS – Methods

In 1 month, the use of elbow supports, allowed a doubling of the time spent working behind the patient's head*



72 treatments – 37 with support and 35 without support
(*Statistically significant : $p < 0.05$)

Proteau & Marchand (2001), p. 3

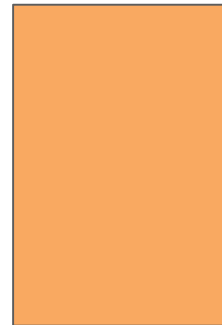
Poll 22

What percentage of your work time should you have your elbows supported to feel the effects?

50% of the time



75% of the time



Poll 22 - Answer

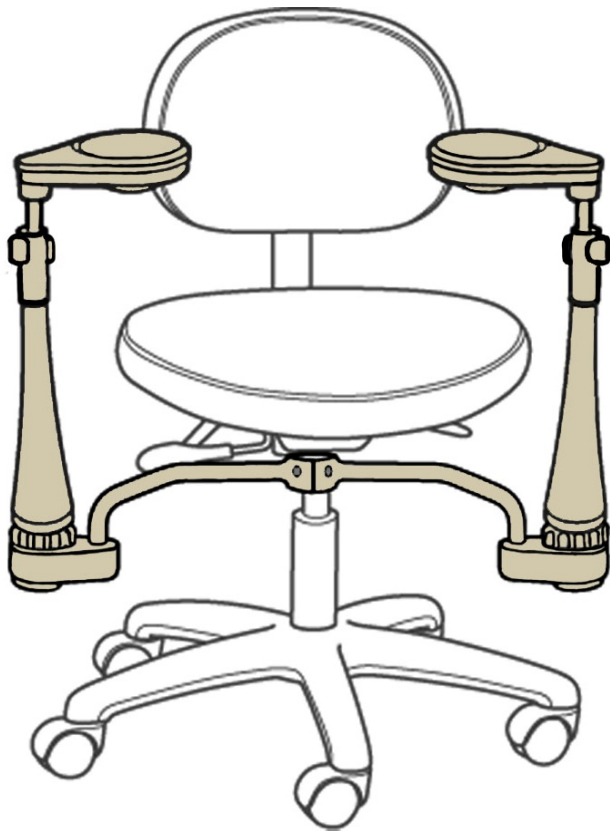
Percentage of your work time should you have your elbows supported to feel the effects

There has been no studies done to this effect

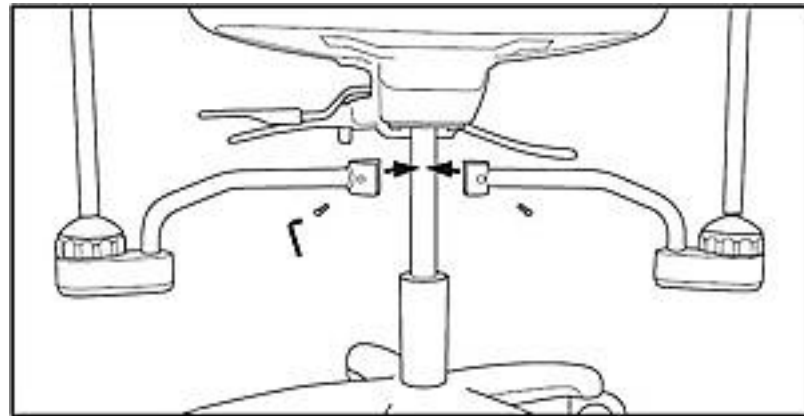
In real work situation, it was observed that the dentist and hygienist who used the supports **at least 50% of the time**, realized a significant relief in their discomfort and pain



Free motion elbow-supports can be added to a stool with cylinder



- Adapters to add 1 or 2 elbows-supports



- Cylinders available at different heights
 - From 46 to 66 cm (18'' to 26'')



Adaptation to *free motion elbow-supports*

Problems

- Congestion of space
- Can cause angulation of the wrists
- Height adjustment difficult to achieve alone

Means to facilitate

- Make sure you have enough room
- Do not try to be supported at all times
- Get help to adjust the elbow supports as low as possible so that the support follows the elbow and the shoulders remain relaxed.



Free motion elbow-supports used by a dentist

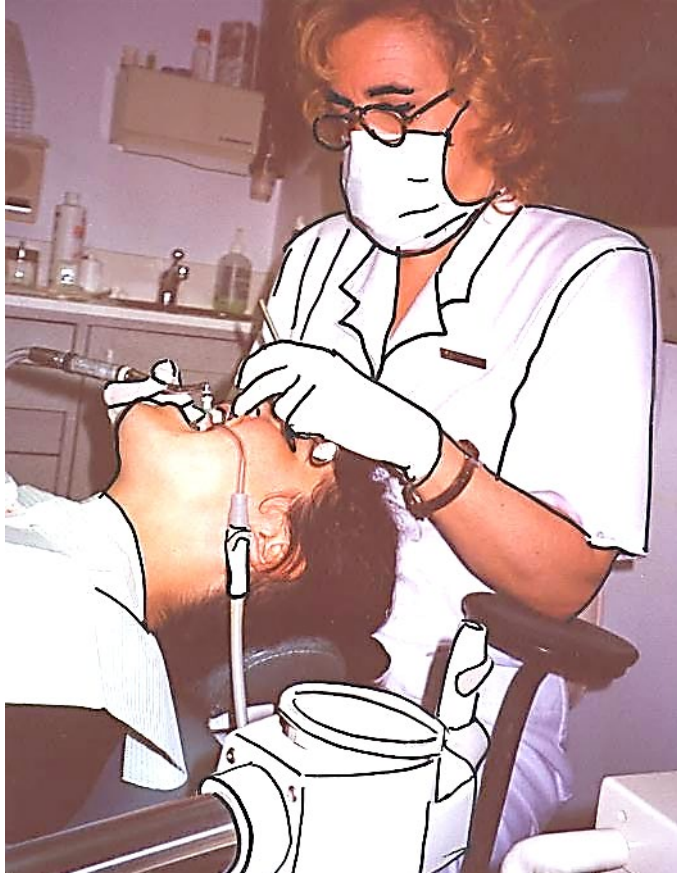
Right arm supported



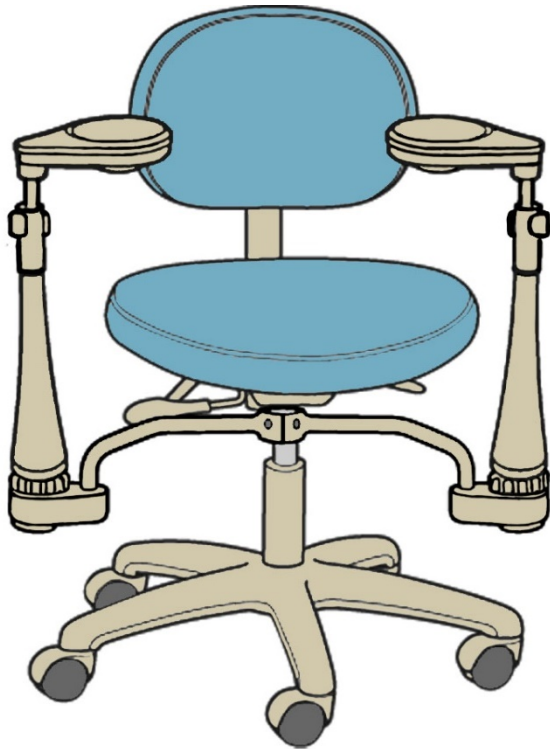
Left arm supported



Use by a hygienist (*patient placed higher*)



Improved free-motion elbow-supports (2011)



- Collaboration with the *National Council of Investigation of Materials of Canada*
- Comfort and ease of use
- 3 different textures on the support
- Scale of graduation on the stem for height adjustment



Cushions with 3 different textures



- Progression: from a firmer perimeter to as soft center
- Molds well the elbow
- Comfortable

Graduated rod for easy height adjustment of elbow-rests



Graduated rod to register and recall the height of your elbow supports

Tightening ring to adjust the height

Knob to adjust tension under the base of the elbow support



Adjustment of the elbow-rest tension



Tension
adjustment
handle

- To ↻ tension: turn the wheel anticlockwise
- To ↻ tension: turn the wheel clockwise
- Turning the wheel, a little at a time, adjust the tension of the elbow rests to the minimum, so that:
 - ✓ the elbow rest, effortlessly, follows the movements of the elbow
 - ✓ while staying in place when you raise your elbow
- After lifting your elbow, you should be able to press it again, without having to replace the elbow support

Frequent observations :

Many adjust the tension too tight

CAUTION

Do not lean on the elbow supports to get up or sit down

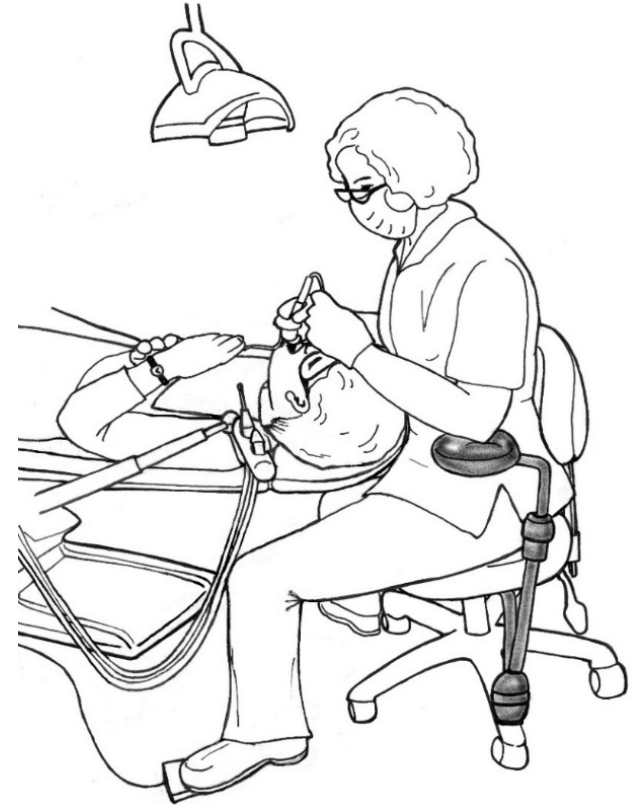


The chair is on wheels and the elbows supports are movable
The chair and / or supports could move if you push on it
Instead, sit and get up by pushing on your knees



The use of free-motion elbow-supports facilitates the learning of safe methods

- Work behind the patient's head
- Raise the patient's chair and lower the backrest to reduce flexion of the neck



Poll 23

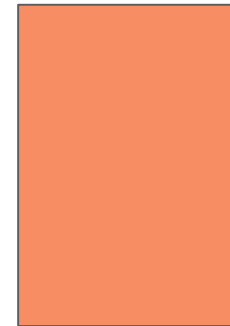
This dentist has a standard stool, with lumbar support and *free motion elbow-supports*.
Are her working postures safe?



YES

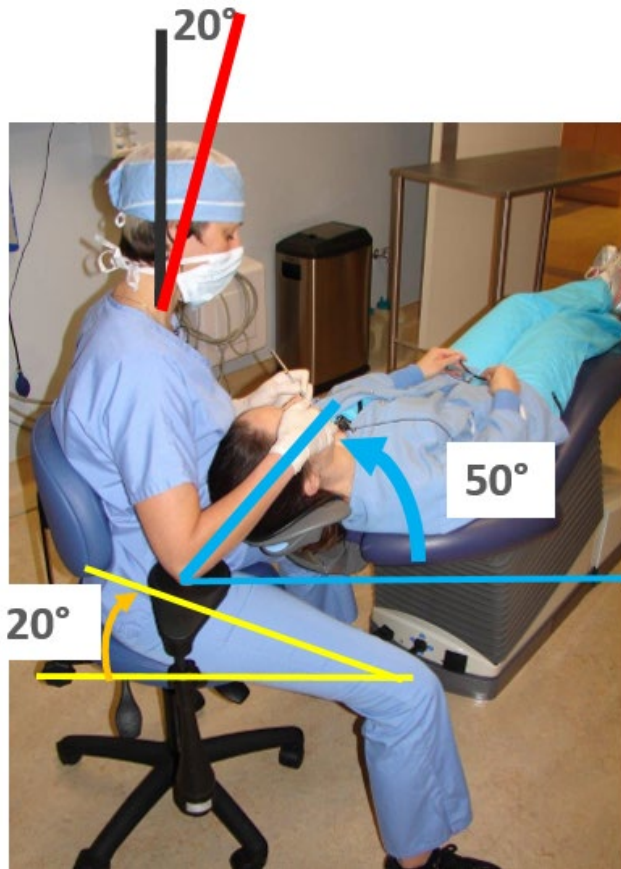


NO



Poll 23 -Answer

Dentist positions with a standard stool with lumbar support and *free motion elbow-supports* are safe

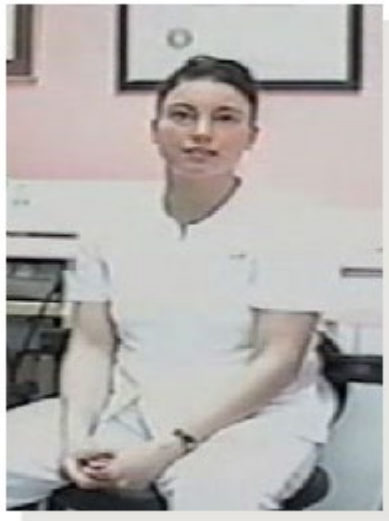


- Neck straight at 20° (*without magnifying glasses*)
- Back straight
- Back resting on the lumbar support
- Forearms raised to 50°



Testimonial video – Use of *free motion elbow-supports* and working methods of a hygienist (*French, available with English sub-titles*)

Janick Chechipe



(4 min)

- She applies all the methods presented today

Testimonial video – Use of *free motion elbow-supports* and working methods of a hygienist (*French, available with English sub-titles*)

Sylvie Trudeau



(6 min 46 s)

- Shows how she succeeds in scaling all areas of the mouth while staying behind the patient's head
- She demonstrates the positions for all quadrants of the mouth

Testimonials videos - 2 dentists and 1 assistant

- Positions of dentists
- Position of dentist and assistant working together

D^r Alain Aubé
(6 min 46 s)



D^{re} Ginette St-Rock
(3 min 4 s)



Mélanie Doré
(5 min 40 s)



12. Solutions - Equipment for all areas at risk of MSDs

SADDLE STOOL WITH *FREE MOTION ELBOW-SUPPORTS* AND LUMBAR SUPPORT (2015)



Poll 24

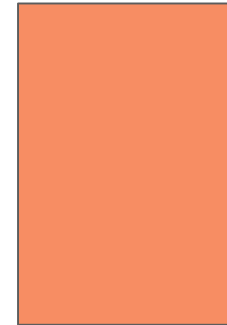
**This dentist works with a saddle stool, lumbar support and magnifying glasses.
Are his working postures safe?**



YES

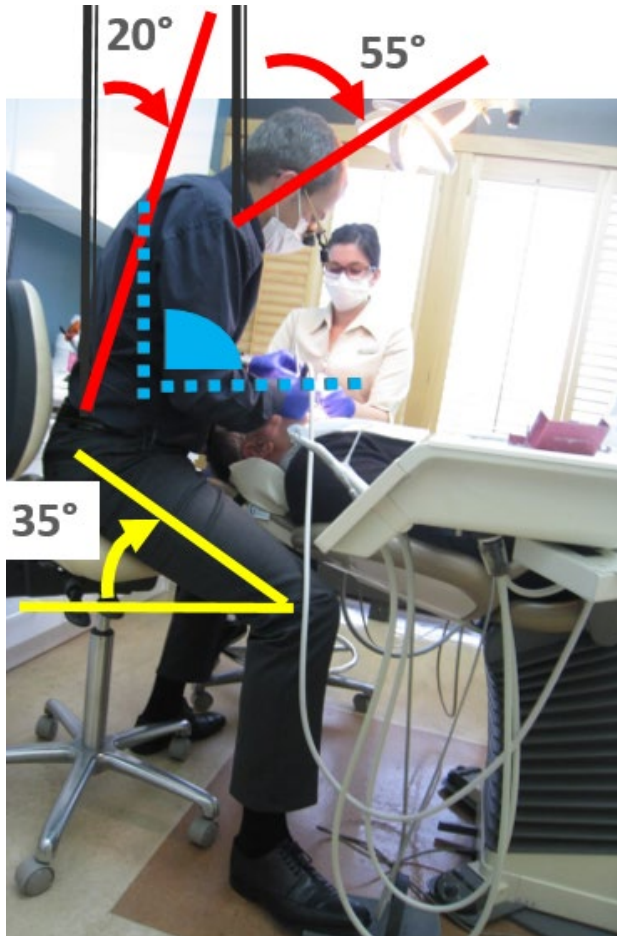


NO



Poll 24 - Answer

Dentist's postures with saddle stool, lumbar support and magnifying glasses



- Forward flexion of trunk: 20°
- Forward flexion of the neck: 55°
- No contact with lumbar support
- Elbows at 90°

Saddle stool *free motion elbow-supports* and lumbar support

- Hollow front in the shape of the seat
- Designed for the comfort of men



- Narrow width of the seat
- Allows women's comfort

- Free-motion elbow-supports help as on standard seats
- Tolerance to design of the saddle seat varies from one person to another (*angle of opening of the legs and points of support on the pelvis*)



Saddle stool with *free motion elbow-supports* and lumbar support



- Prevents sitting on the edge of the chair
- Facilitates keeping in touch with lumbar support
- Sitting-standing position
- Narrow seat
- Legs a little less spread
- Suitable for different morphologies



Saddle stool with *free motion elbow-supports* and lumbar support



- Allows standing-sitting position
- Helps to sit at the back of the chair
- Sitting-standing position
- Helps stay in contact with the lumbar support
- For use with safe methods

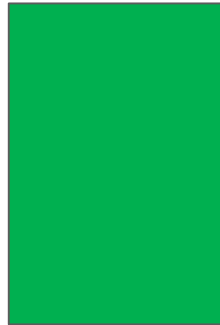


Poll 25

This hygienist uses a saddle stool with *free motion elbow-supports and lumbar support*. Safe postures ?



YES

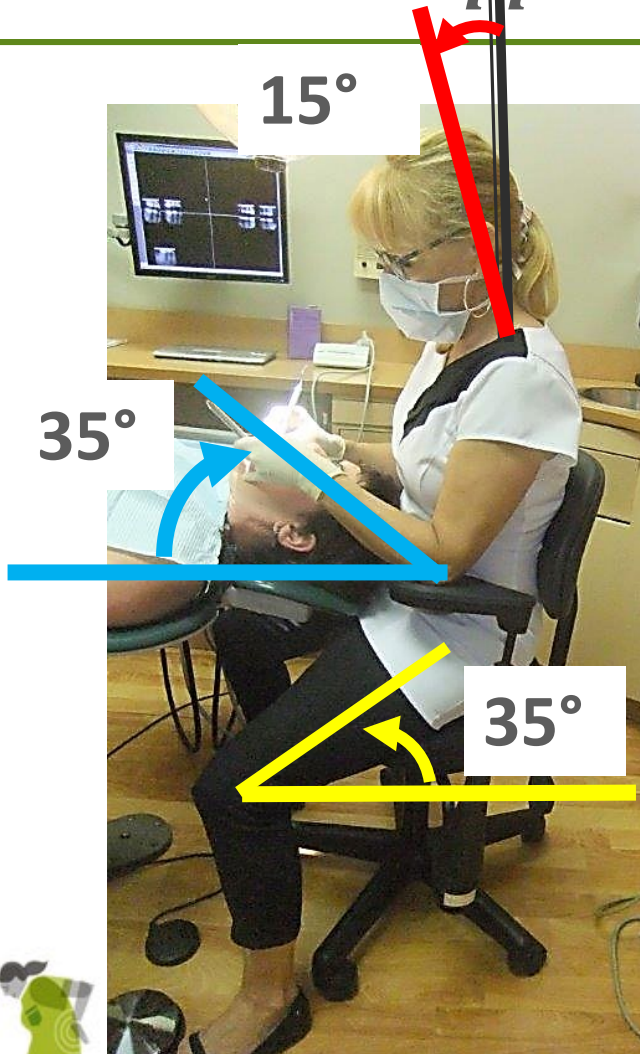


NO



Poll 25 - Answer

Hygienist postures with a saddle stool with *free motion elbow-supports* and lumbar support are safe

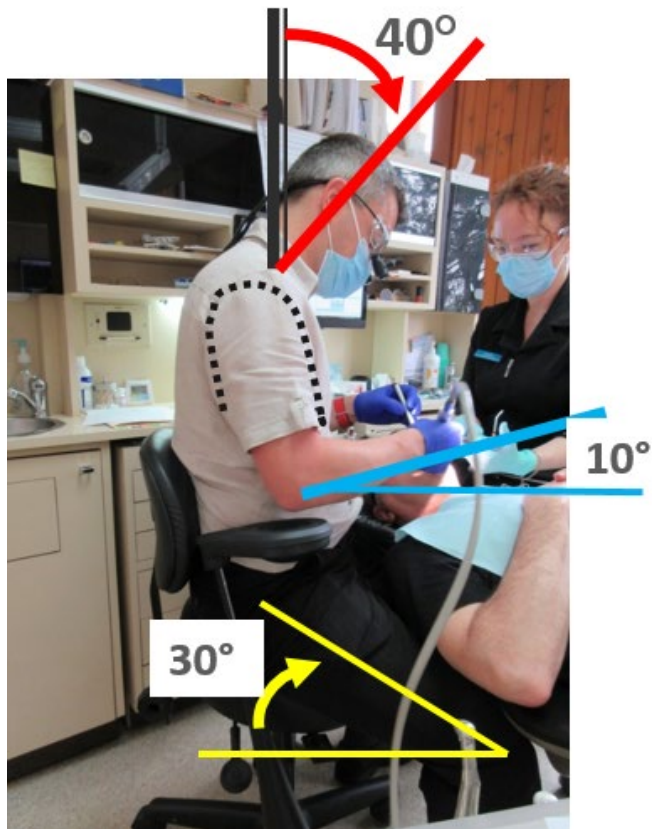


- Straight neck at 15 ° !!!
(without magnifying glasses)
- Straight back
- Lower back with good contact with lumbar support
- Forearms raised to 35 °
- Thighs raised at an angle of 35 °

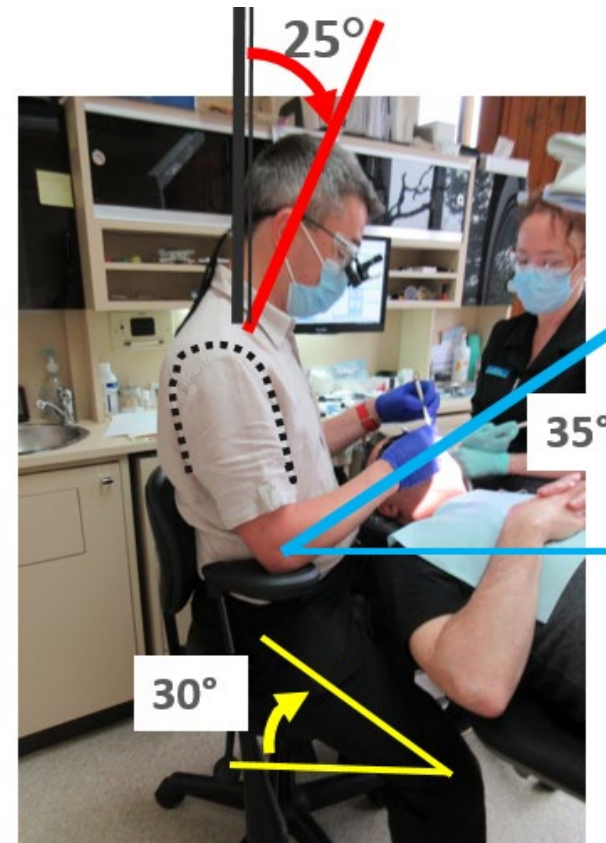
Variation of the flexion of the neck according to the height of the patient's mouth

Saddle stool, well placed lumbar support

Patient placed lower
Dentist's forearm at 10°

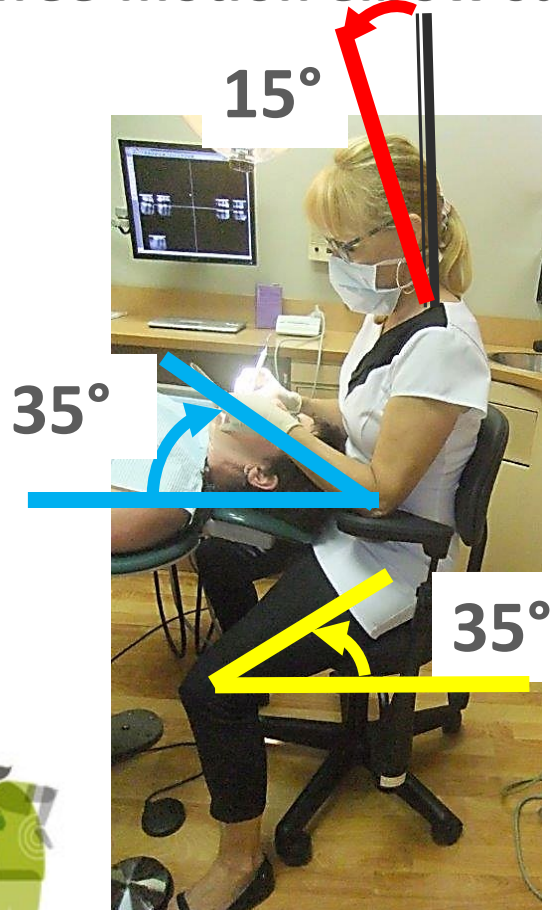


Patient placed a little higher
Dentist's forearm at 35°

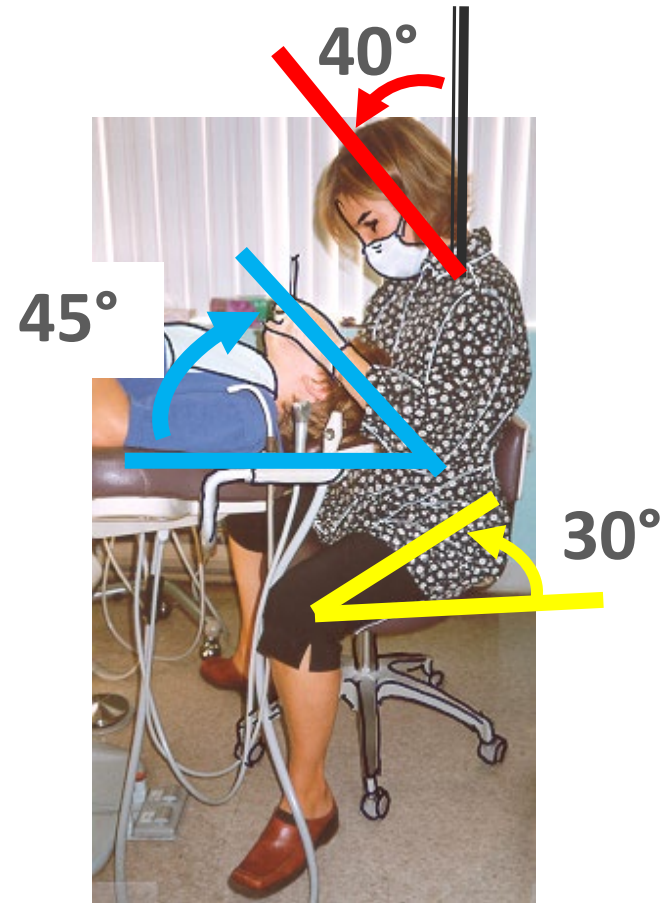


Most important factors for good postures: type of stool, working method, elbow-supports or all three?

Saddle stool and
free-motion elbow supports



Standard stool,
without elbow support



12. Solutions - Equipment for all areas at risk of MSDs

ASSISTANT'S STOOL WITH WIDE FIGURE 8 ELBOW AND TORSO SUPPORT PLUS LUMBAR SUPPORT (2006)



Posture to correct

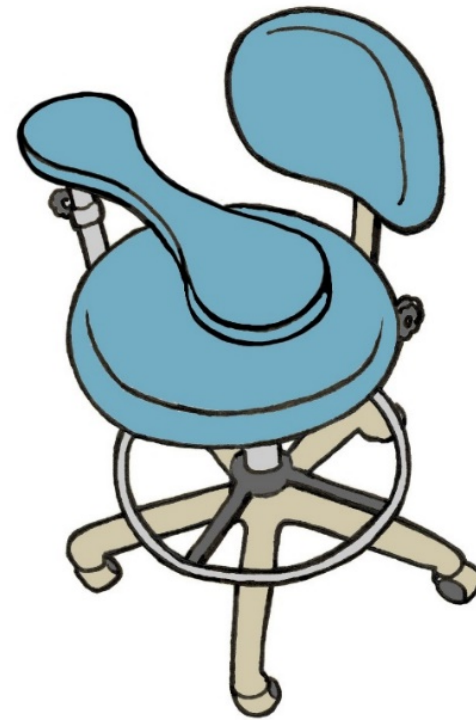


Torsion of the assistant's back when she can not insert her legs under the backrest of the patient's chair

Position of the assistant's arms often not supported by the narrow torso support

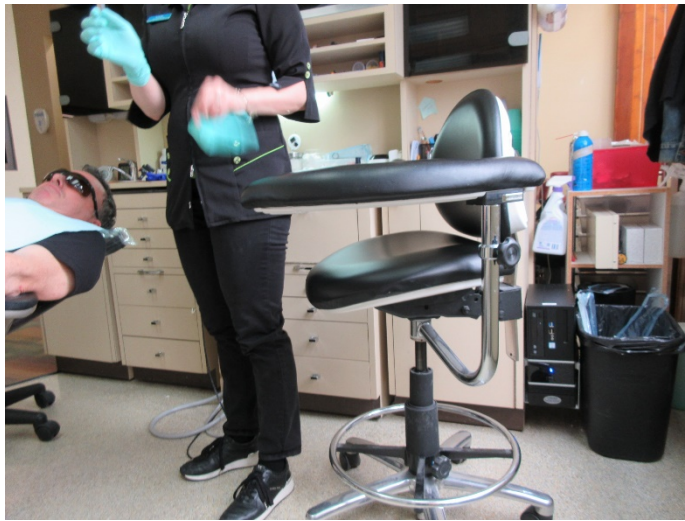


Assistant's stool with *wide figure 8 elbow* and torso support and lumbar support



Posiflex

Other assistant's stool with *wide elbow and torso support* and lumbar support



Model that offers more space for the assistant whose thighs are larger



Impact of the type of stool on the postures of the assistant



Standard assistant's stool with narrow torso support and no lumbar support

- Neck and back flexion
- Elbows without support
- Arms abduction

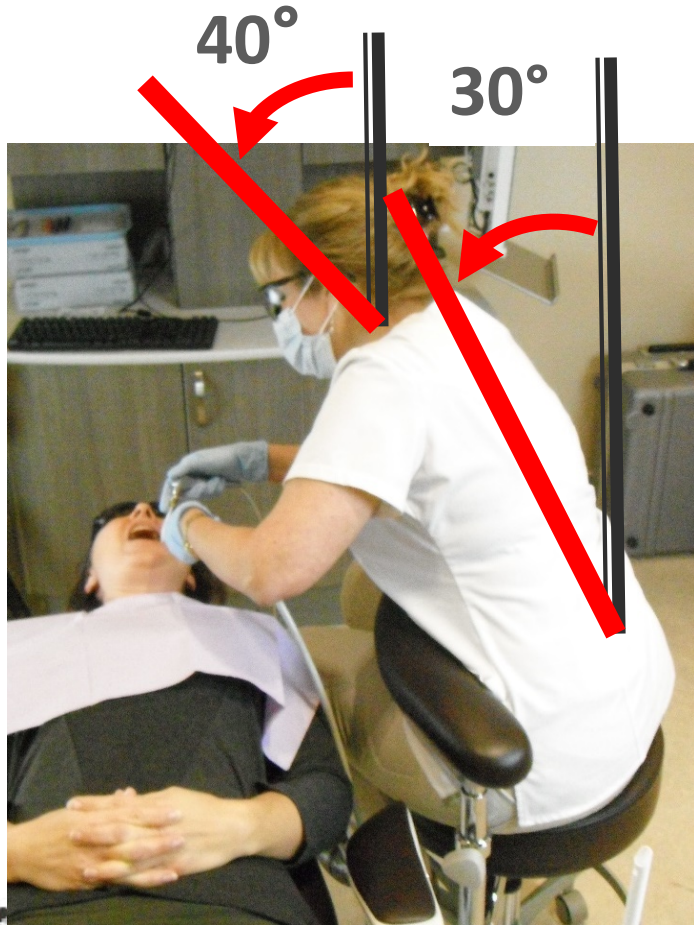
Impact of the type of stool on the postures of the assistant



Assistant's stool with *wide figure 8 elbow and torso support* and lumbar support

- Elbows resting on the enlarged torso support
- Straight neck (10°)
- Lower back straight and in contact with the lumbar support
- Winding the tubing of the fast suction around the arm reduces wrist strain

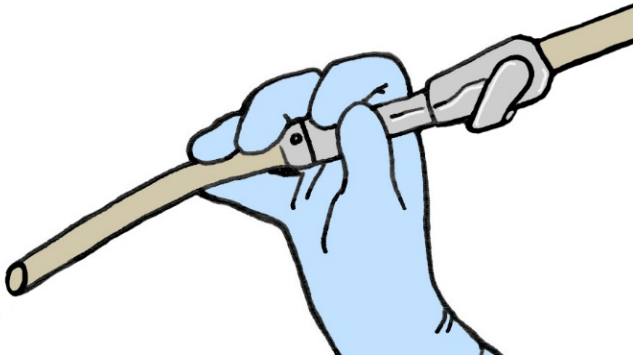
Comparison of postures depending on type of the assistant's stool



Neck
↘ 40° à 15°

Lower back
↘ 30° à 0°

Assistant's stool with *wide figure 8 elbow and torso support* allows for well aligned wrists

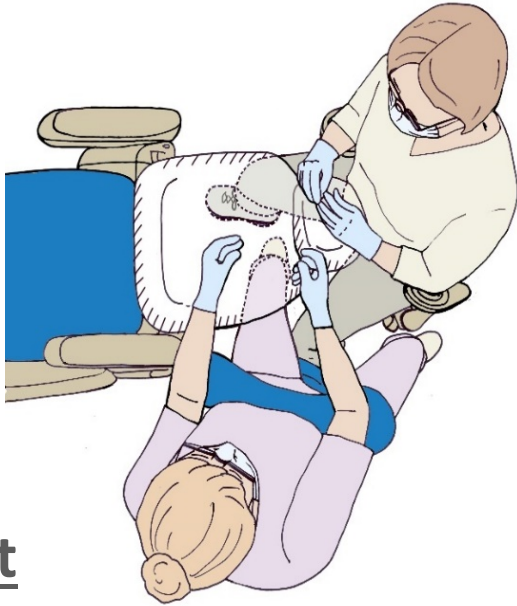


Without support :
the holding of the fast suction
with the right hand often causes
awkward wrist positions of
extension or deviation



With the elbows supported:
it is easier to use the left hand to
hold the suction with the left wrist
aligned with the left arm

Leg positions of the dentist and the assistant, when the patient's chair is placed in the high position, with the backrest flat



Dentist

- Legs slightly apart under the backrest



Assistant

- One leg under the backrest
- The other leg towards the counter

If necessary, the dentist and the assistant interpose a leg to:

- ✓ keep their backs and necks straight
- ✓ move closer to the patient's mouth

Assistant stool with *wide figure 8 elbow and torso support*, and lumbar support



Heights of seat and supports are adjustable



- The assistant keeps her elbows resting on the *wide elbow and torso support* when her instruments are in the client's mouth
- The dentist can turn her stool to be positioned at 12 o'clock without disturbing her assistant
- The assistant can then adjust her position by :
 - moving her legs a little
 - turning her stool a little

Assistant's survey

Impact of use of the assistant's stool with *wide figure 8 elbow and torso support plus lumbar support* (n = 24)

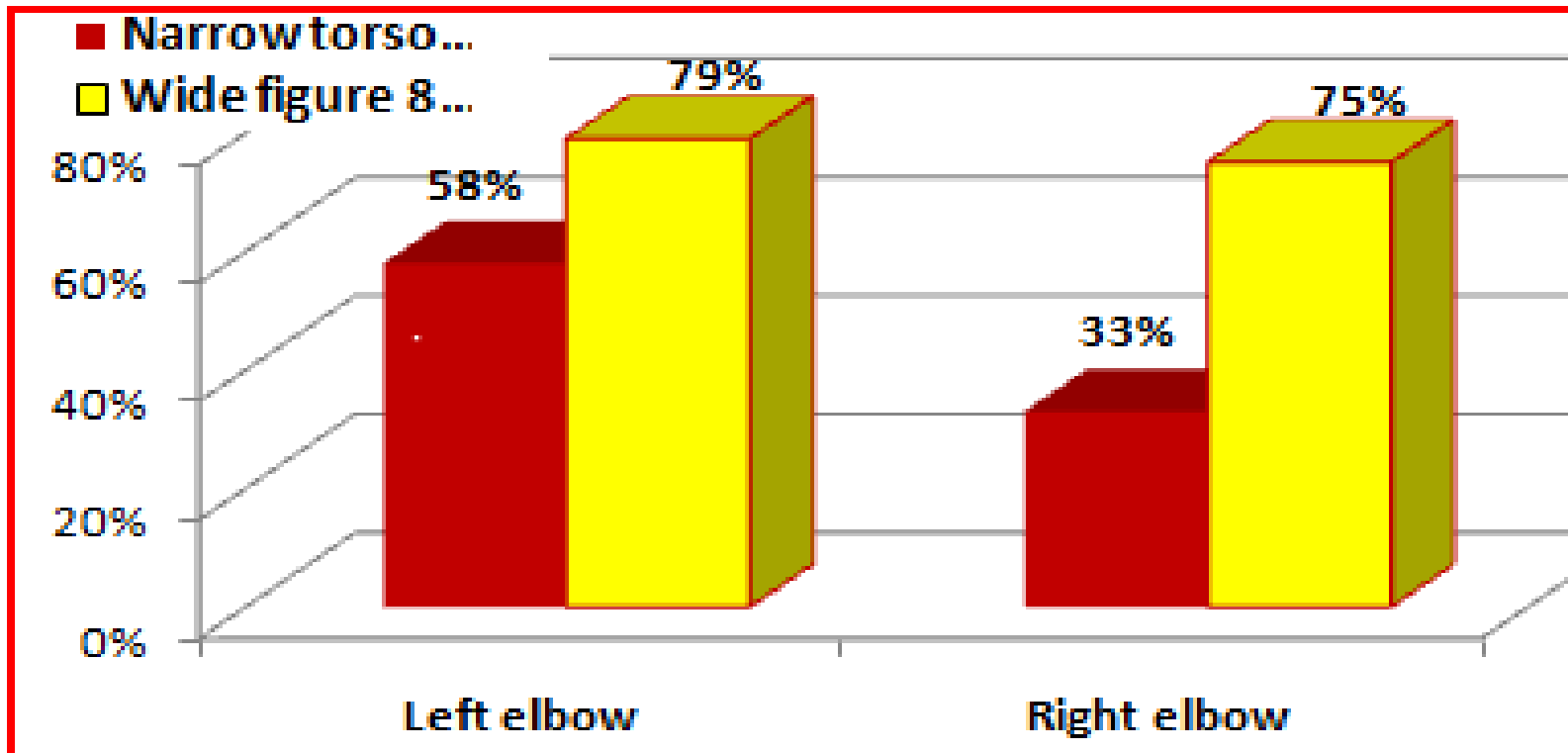
32 screening questionnaires were sent after a phone call, 24 returned them (*self-answered questionnaires*)

- Use of new assistant's stool for 1 month to 2 years
- Average time of use before they observed an improvement or deterioration in their symptoms: 5 weeks
- Average age: 40 years (*range 23 to 65 years*)
- Average experience: 16 years (*variation 1 to 37 years*)



Assistant's survey

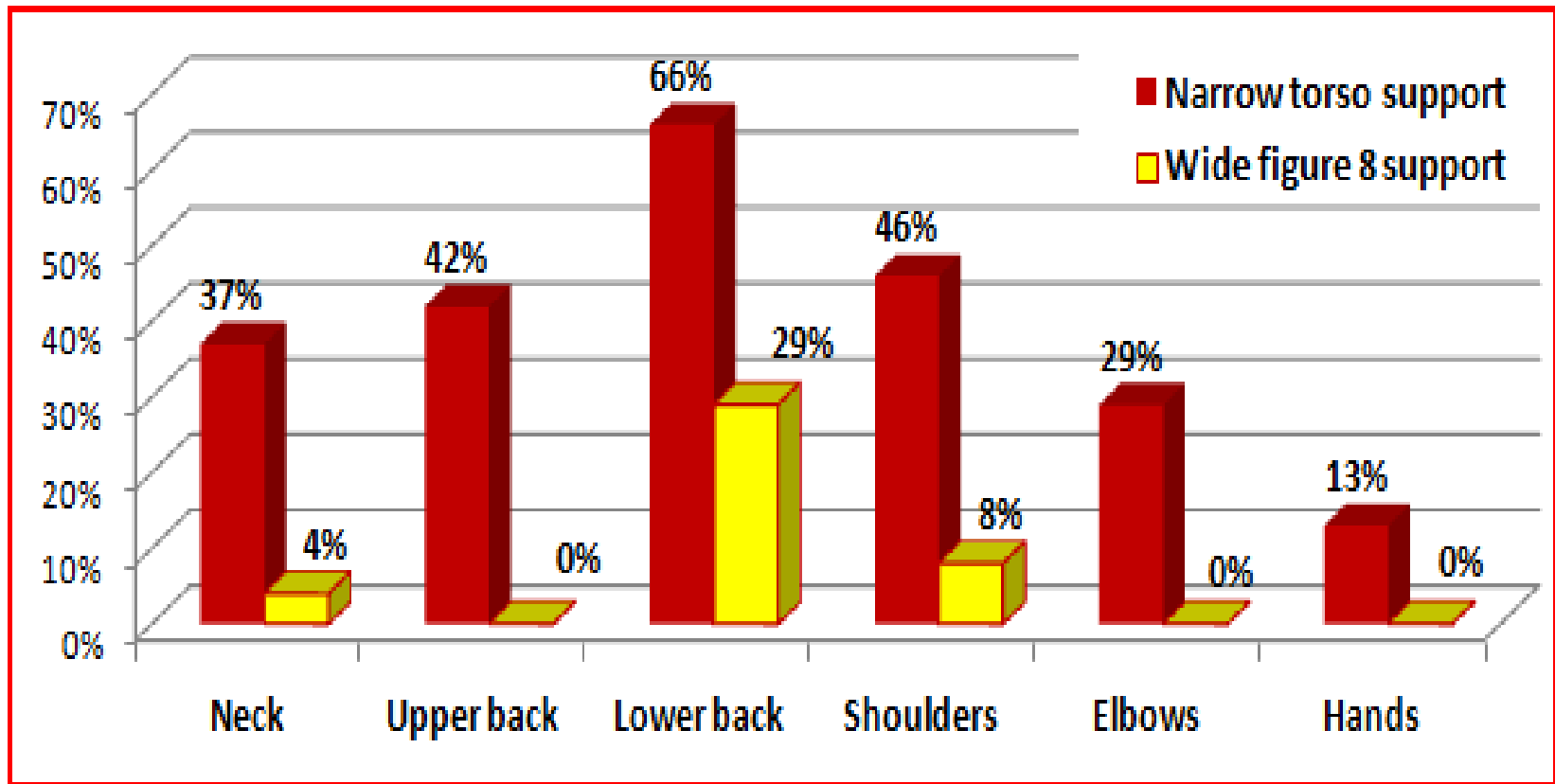
Time with right elbow supported doubled with *wide figure 8 elbow and torso support* (n = 24)



Assistant's survey

↘ frequencies of serious and disturbing pains

"quite often" or "all the time" in all body regions (n = 24)



PAIN ASSOCIATED WITH THE WORK OF DENTAL ASSISTANTS: CAUSES AND SOLUTIONS

Being able to work pain-free is a real challenge for dental assistants. Pain reduces job satisfaction, can lead to loss of work time, and even shorten career longevity. This article will attempt to explain some of the causes of this pain and also provide information about new support features for dental assistant stools, designed to reduce work-related pain. Users were recently surveyed to investigate the effectiveness of this new stool.

The Association paritaire pour la santé et la sécurité du travail du secteur des affaires sociales (ASSTAS) has been studying musculoskeletal disorders (MSDs) in dental clinics since 1977. Ergonomic studies were conducted, leading to the publication of "Guide de prévention des TMS en clinique dentaire" in 2002, revised in 2007, excerpts of which have been translated in "Prevention of Work-Related MSDs in Dental Clinics." These studies looked at the workstations of hygienists, assistants, and dentists. In 1999, ASSTAS asked Posiflex Design to develop free-motion elbow supports for hygienists and dentists. A study using electromyography was conducted (Proteau, 2001), demonstrating the benefits of using these free-motion elbow supports which were launched on the market in 2002. Since then, more than 3,000 pairs have been sold in the U.S. and Canada.

Dental assistants also tried out these free-motion elbow supports, but most found that the supports did not provide enough arm and torso stability when holding instruments. ASSTAS then asked the same manufacturer to develop a fixed, wider version of the elbow rests that would provide enough support for the assistant when working facing the patient (without having to twist her back). The Posiflex 8, a stool featuring a "wide figure 8-shaped elbow rests and torso support" was introduced in 2006. In August 2008, ASSTAS contacted many of the dental clinics that had purchased the new stool and asked the assistants to fill out a questionnaire about its use. The results of this study are presented in part two of this article.

Continued page 17

DOULEURS ASSOCIÉES AU TRAVAIL DES ASSISTANTES DENTAIRES : CAUSES ET SOLUTIONS

Travailler sans douleurs est un défi pour les assistantes dentaires. Les douleurs diminuent la satisfaction au travail, peuvent entraîner des absences et même menacer le maintien dans l'emploi. Cet article présente certaines causes de ces douleurs. Vous y trouverez aussi de l'information sur les nouveaux appuis pour les tabourets d'assistantes, conçus pour diminuer les douleurs causées par le travail. Une enquête a permis d'en vérifier l'efficacité auprès d'utilisatrices.

L'Association paritaire pour la santé et la sécurité du travail du secteur des affaires sociales (ASSTAS) étudie les troubles musculo-squelettiques (TMS) en clinique dentaire depuis 1977. Des études ergonomiques ont amené la rédaction du Guide de prévention des TMS en clinique dentaire en 2002, révisé en 2007. Les études ont couvert des postes d'hygiénistes, d'assistantes et de dentistes. En 1999, l'ASSTAS a demandé à Posiflex de développer des appuis-coudes mobiles pour les hygiénistes et les dentistes. Ils ont fait l'objet d'une étude avec électromyographie (Proteau, 2001) qui a démontré leurs effets bénéfiques et ils ont été mis en marché en 2002. Depuis, plus de 3 000 paires de ces appuis ont été vendus au Canada et aux États-Unis.

Des assistantes ont essayé les appuis-coudes mobiles. Pour la majorité d'entre elles, ils n'offraient pas suffisamment de stabilité aux bras et au tronc pour tenir les instruments. L'ASSTAS a donc demandé au même fabricant de développer des appuis plus larges pour permettre à l'assistante de s'y appuyer tout en travaillant face au client (sans torsion du dos). En 2006, le tabouret avec appui thoracique élargi en appui-coudes Posiflex 8 a été mis sur le marché. En août 2008, l'ASSTAS a contacté plusieurs cliniques dentaires qui avaient acquis ce tabouret et demandé aux assistantes de répondre à un questionnaire sur son utilisation. Les résultats de cette étude sont présentés en deuxième partie de cet article.

Continuer sur page 7



More information on assistant's work and this survey

- Results of research published
- Proteau, Rose-Ange, « Pain associated with the work of dental assistants : causes and solutions », *Journal of the Canadian Dental Assistants' Association*, November 2008, volume 49, issue 2, (p. 1, 17 to 20)
- (French version, p. 1, 7-10)

12. Solutions - Equipment for all body areas at risk of MSDs

HEAD OR LOUPES-MOUNTED LIGHTS AND MAGNIFYING GLASSES



Use of a magnifying system (loupes or binocular telescope)



« Surgical magnification »

- Posture Maker or
- Posture Breaker ? »

Rucker, 1998, p. 191

Poll 26

DENTISTS

Do you work with :

- magnifying system
(loupes or binocular telescope)

YES

NO

- head-mounted light or light
installed on correcting glasses

YES

NO

- magnifying system
with loupe-mounted light

YES

NO



Poll 26

HYGIENISTS

Do you work with :

- magnifying system
(loupes or binocular telescope)

YES

NO

- head-mounted light or light
installed on correcting glasses

YES

NO

- magnifying system
with loupe-mounted light

YES

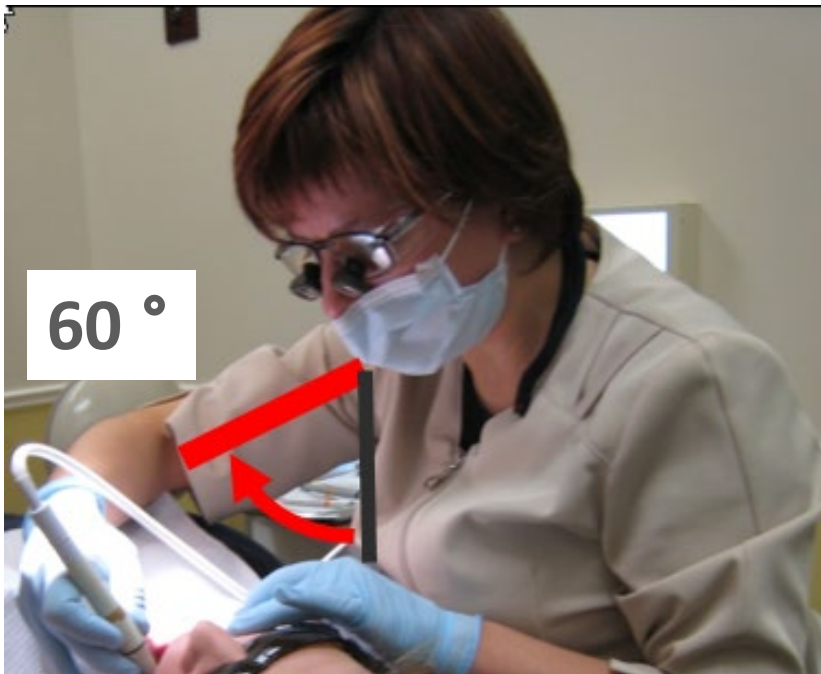
NO



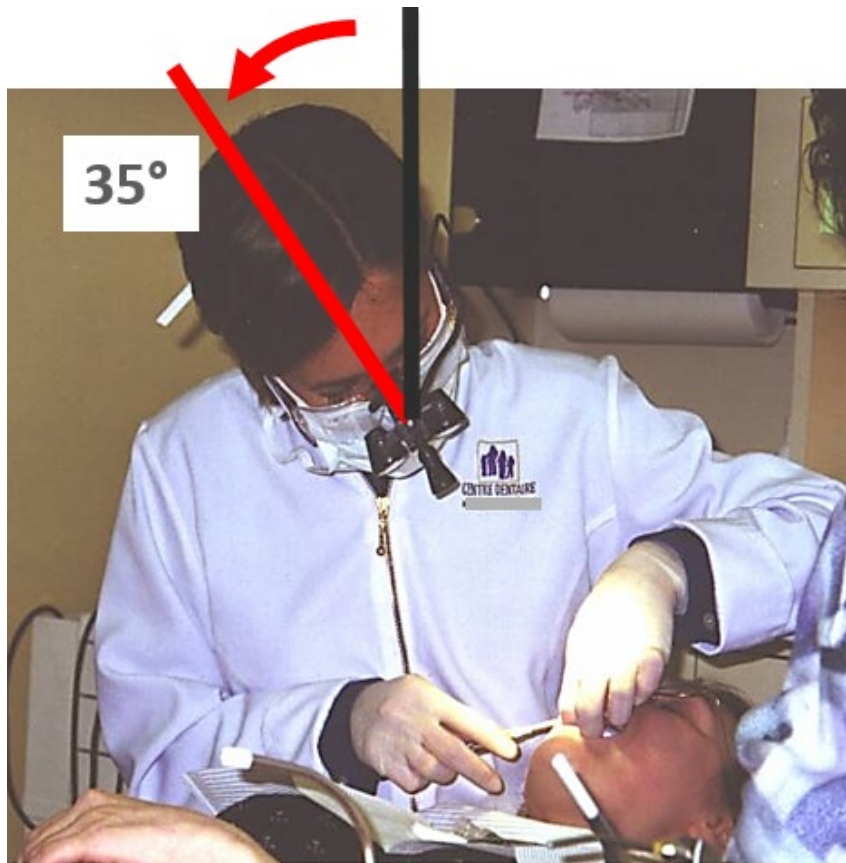
Do magnifying system (loupes or binocular telescope) always promote good postures?



- If the positions are good from the start
- The angulation of 20 ° the backrest of the patient's chair causes the right arm to be in abduction of about 60 °

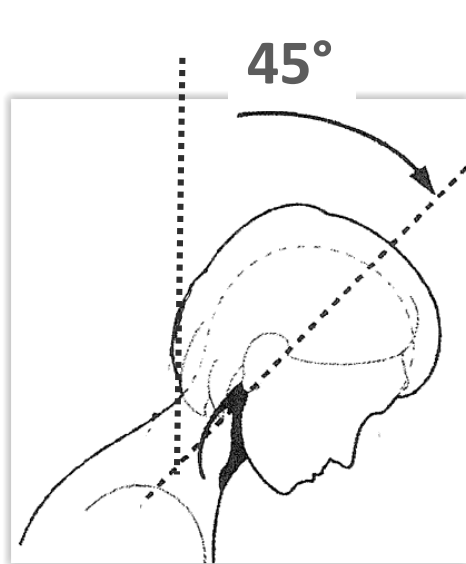


Magnifying system and loupe-mounted light or head-mounted light

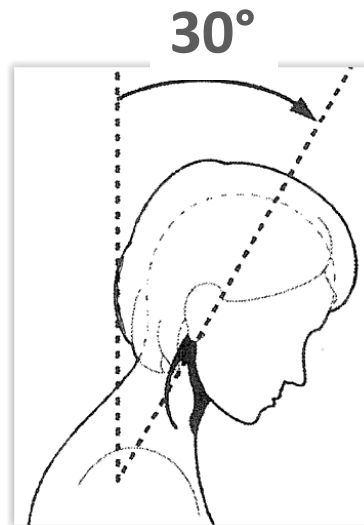


- Should allow to see mouth areas without turning or tilting the head
- Here, forward and lateral flexion of the head

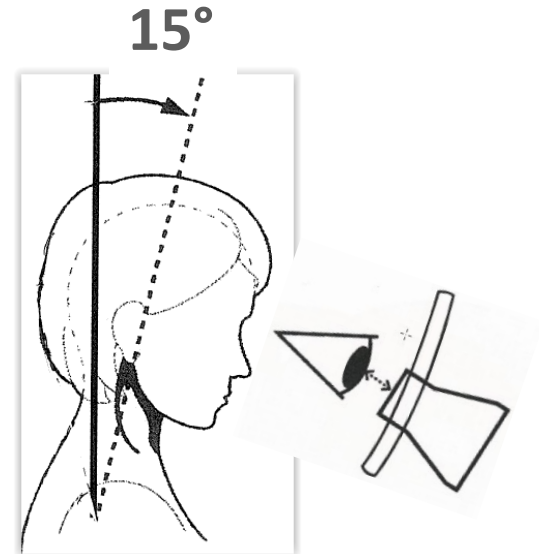
Neck flexion angles according to methods and equipment



- With the patient placed low



- With the patient placed higher



- With the patient placed higher + wearing magnifying system:
➡ flexion of the head

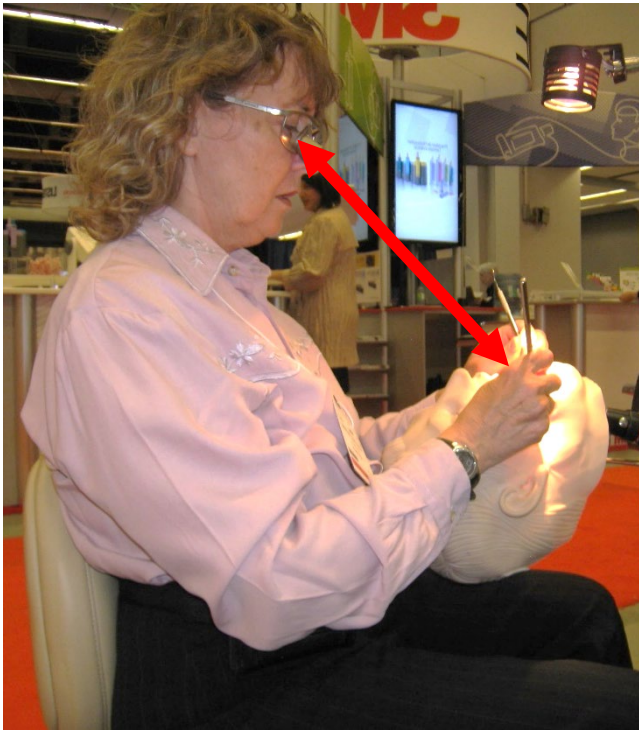
A frequent obstacle to good postures of your neck

90° elbows

- Are you ready to reconsider your position?
- Important to change your work postures before buying magnifying glasses to have optimal adjustment



Make sure to adopt good postures before determining the focal length



- For hygienists, magnification of 2X would be optimal
- Good vision ensured by magnifying glasses
- Increase the precision of gestures
- Adjusting the focal length with the patient flat and high (*see methods*)
- 4 focal lengths available

Glasses-mounted light attached to center of prescription glasses



- May delay the need for magnifying system
 - Very light weight
 - Produced a focused beam of concentrated light
 - Light always pointed in the right direction
-
- Cost: \$ 750 + universal adapters (\$ 60 to \$ 75)



Light attached to center of prescription glasses

External view



Internal view



No obstruction of vision



Loupe-mounted light on a magnifying system

- Produced a focused beam of concentrated light
- Can ↗ visual acuity and image resolution
- It makes work easier



Magnifying system, *free motion elbow-supports* and working methods



- Position of the patient's mouth higher
- ↘ bending of the head
- Lower back in contact with the lumbar support

Lighting with *installation of 10 lamps Del mounted on a circle* so that the lighting inside the mouth is not **↘** by the obstacles



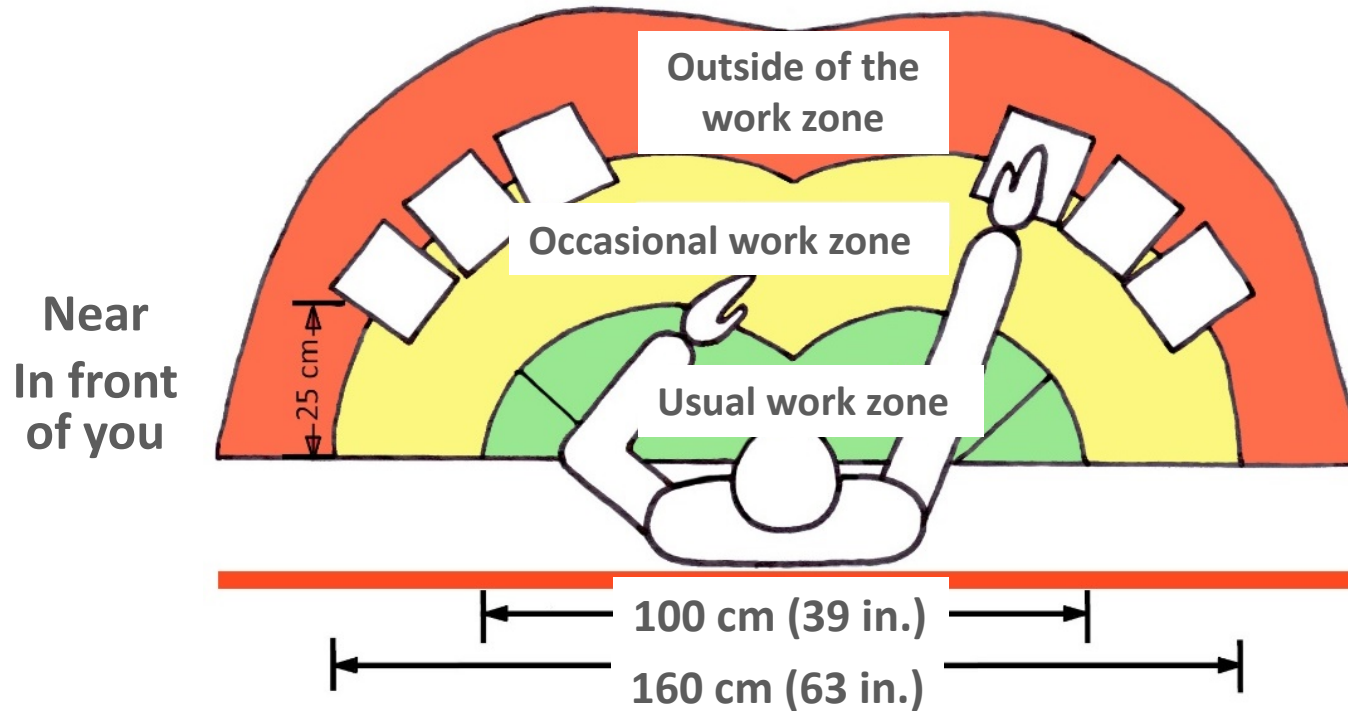
- The lighting inside the mouth is not **↘** by the obstacles (*arms, hand, head of dental workers*)



13. SOLUTIONS - ENVIRONMENT

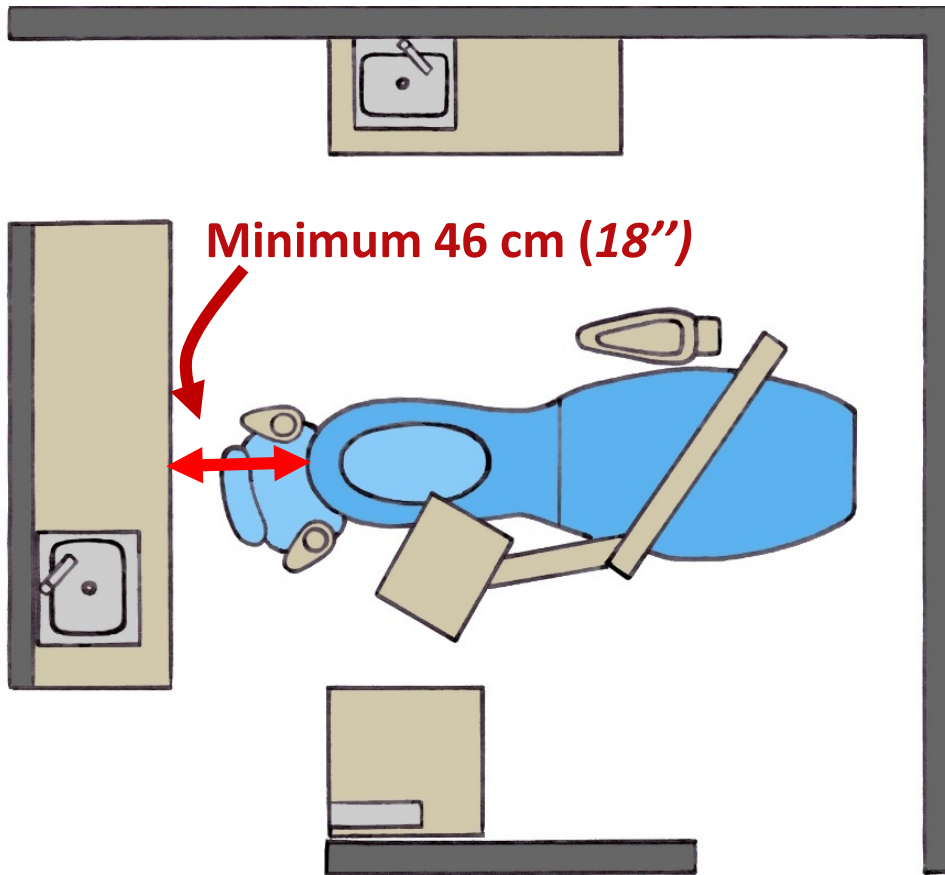


General objective: to be able to place your instruments in front of you



**Do not cross the middle of the body
to get an instrument or a product**

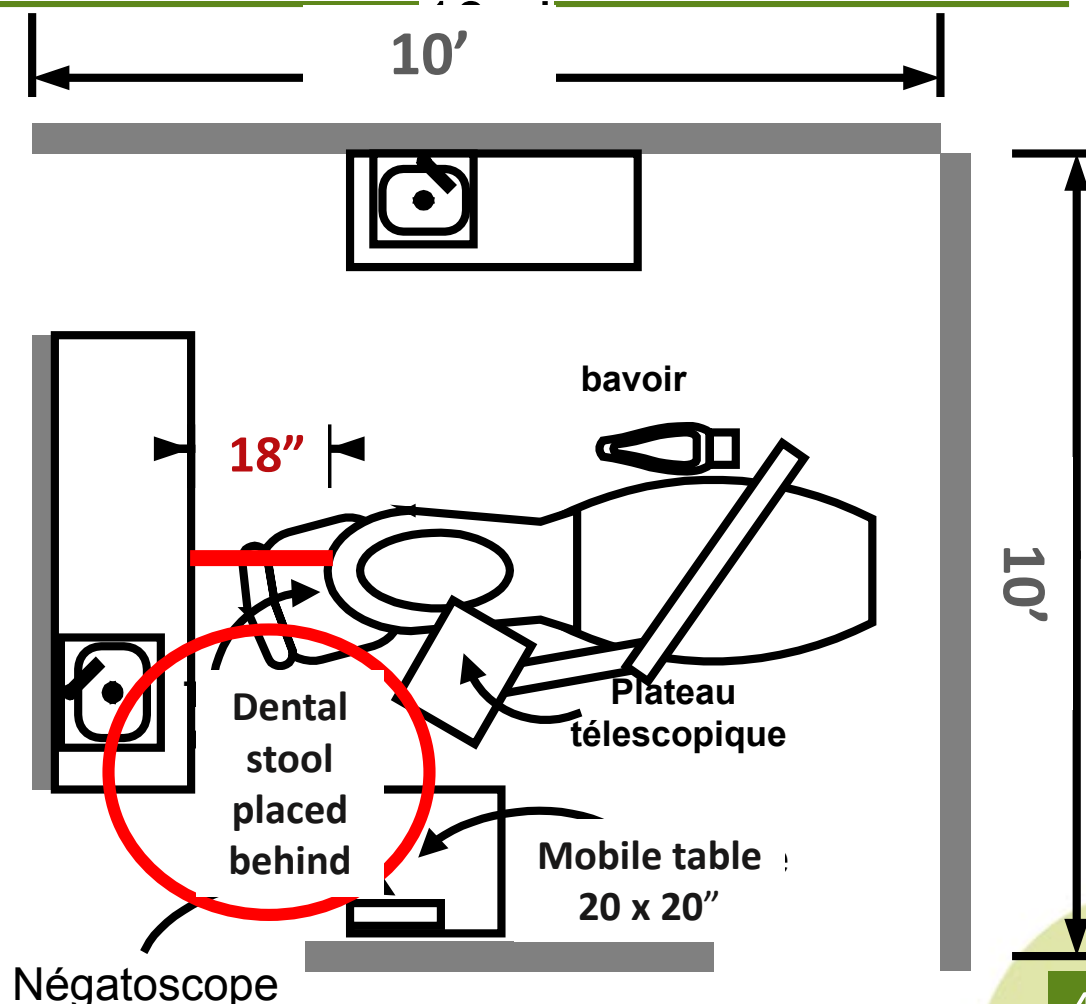
Arrange space to be able to work at 11:00 and 12:00



- Place the instruments at the front
- Have enough free space between the counter and the patient's lowered backrest (minimum 46 cm (18")) for easy movements of the stool around the patient's head

Arrange the space to be able to work at 11:00 and 12:00

At least 46 cm (18") free space between the counter and the patient's lowered backrest



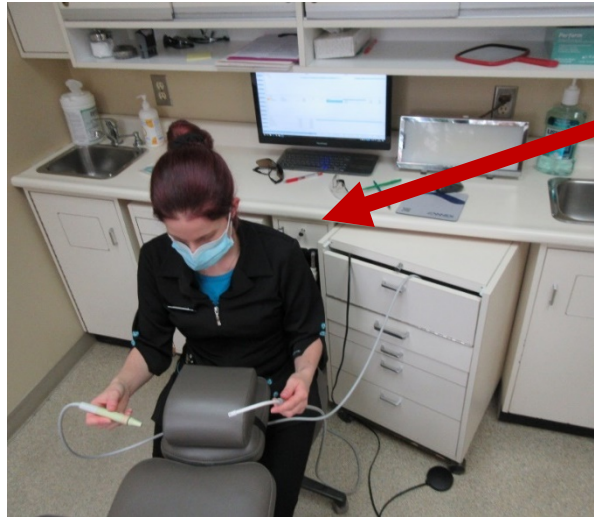
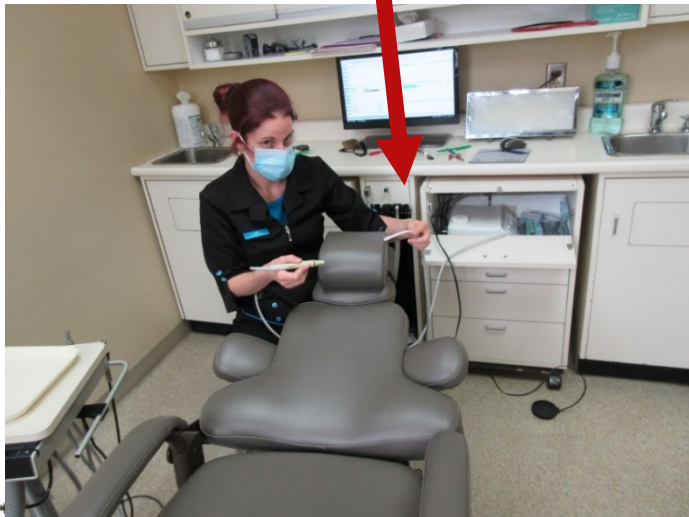
Move patient's chair 15 cm (6") from the counter to be able to work at 12:00

BEFORE

Lack of space to be able to be positioned at 12:00 when using ultrasound



Move the patient's chair farther from the counter



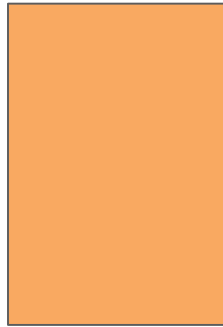
AFTER

Enough space to be able to position herself at 12:00

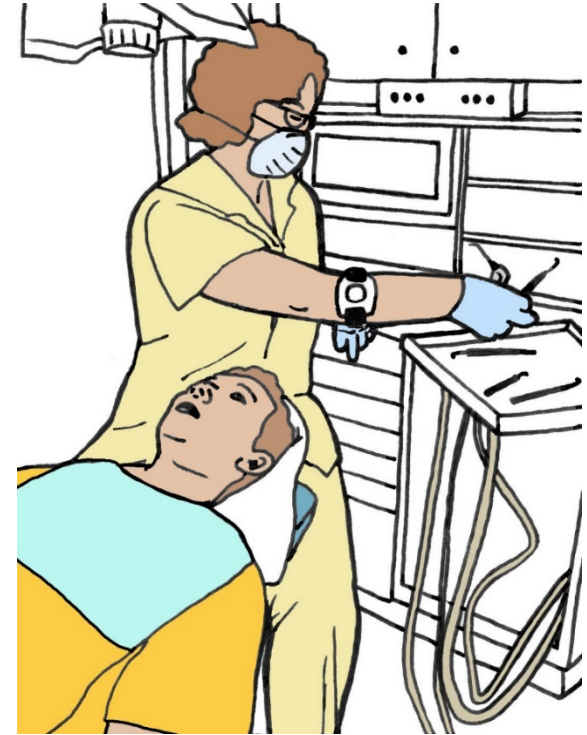
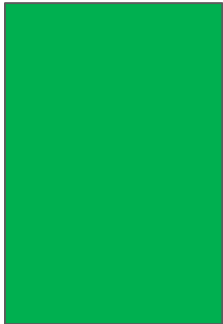
Poll 27

In your clinic, are there hygienists using a workstation with a rear delivery?

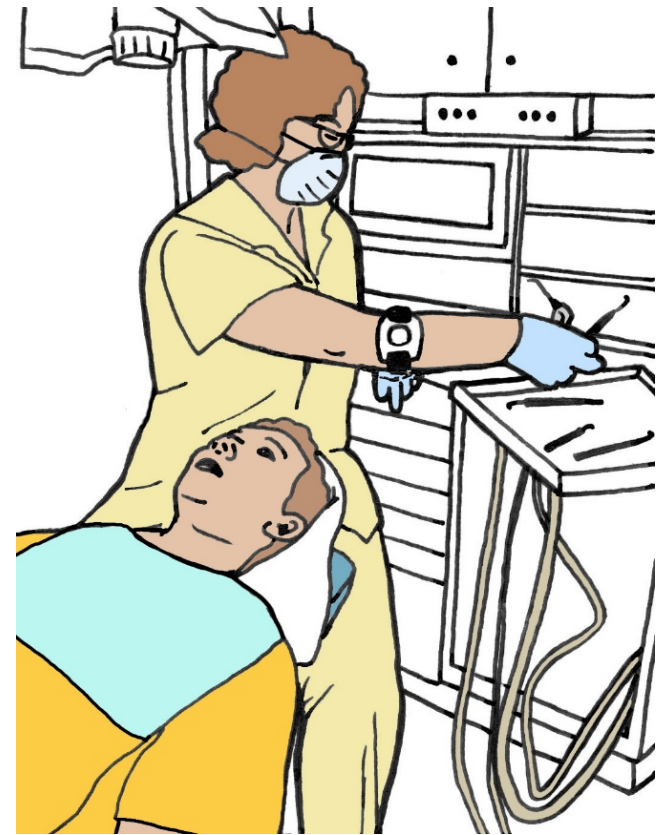
YES



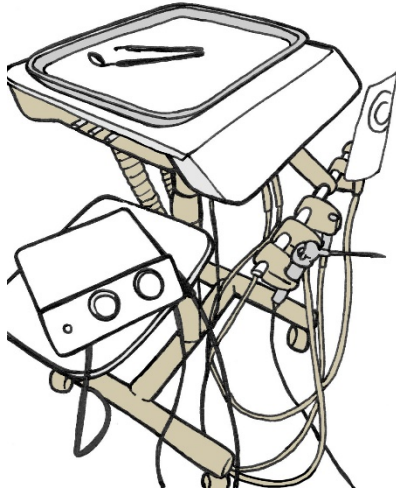
NO



The use of a workstation with rear delivery, when working alone, results in postural torsion of the neck and back



Correction of a workstation with rear delivery: add a mobile cart, in the front, on the dominant side



Cost: about \$ 5,000



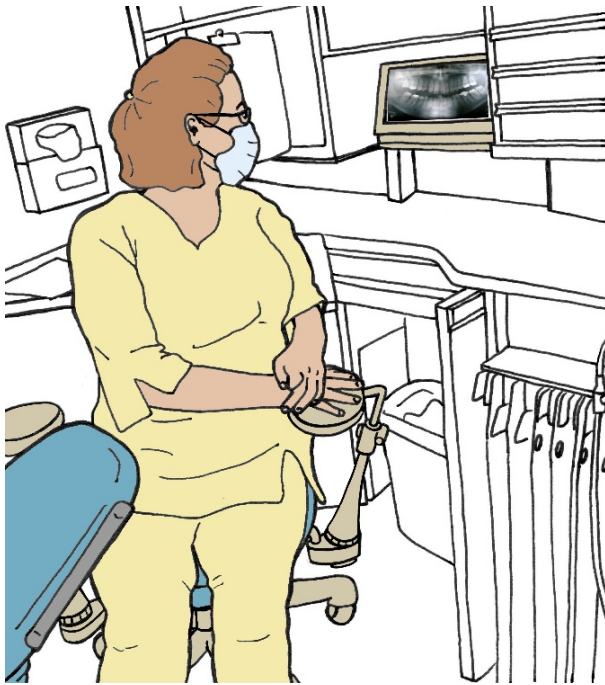
Correction of a workstation with rear delivery: add a custom furniture, in the front, on the dominant side

- Long supply tube (water, air, suction)
- Instruments holders on the side
- Pull shelf for ultrasound device
- 2 storage drawers

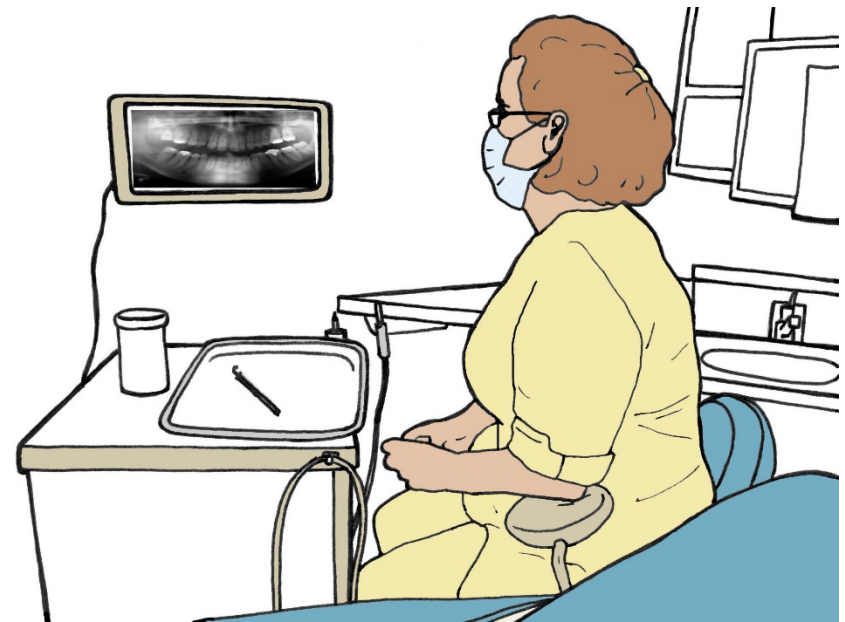


Move the light box (*negatoscope*) and/or screen in the front

Before



After



- Light box (*negatoscope*) and/or screen, when placed at the back, causes twisting of the neck and back

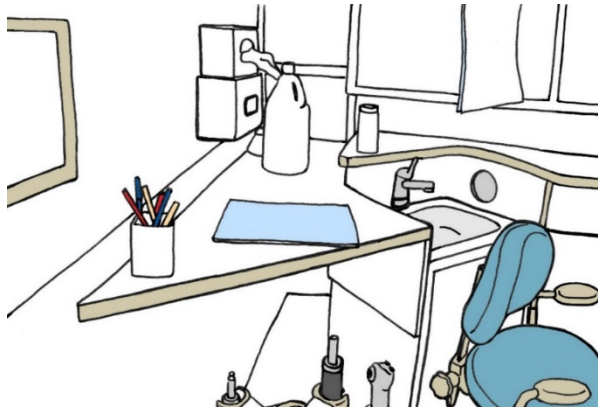
Add a corner shelf, on your dominant side, to write and put the keyboard and mouse on



- Install at the end of rear countertop
- Creates legroom
- Allows your back and neck to remain straight when writing or using the computer



Position the center of the light box (*negatoscope*) and the screen at eye level



- The screen should also be visible to the patient who turns his head



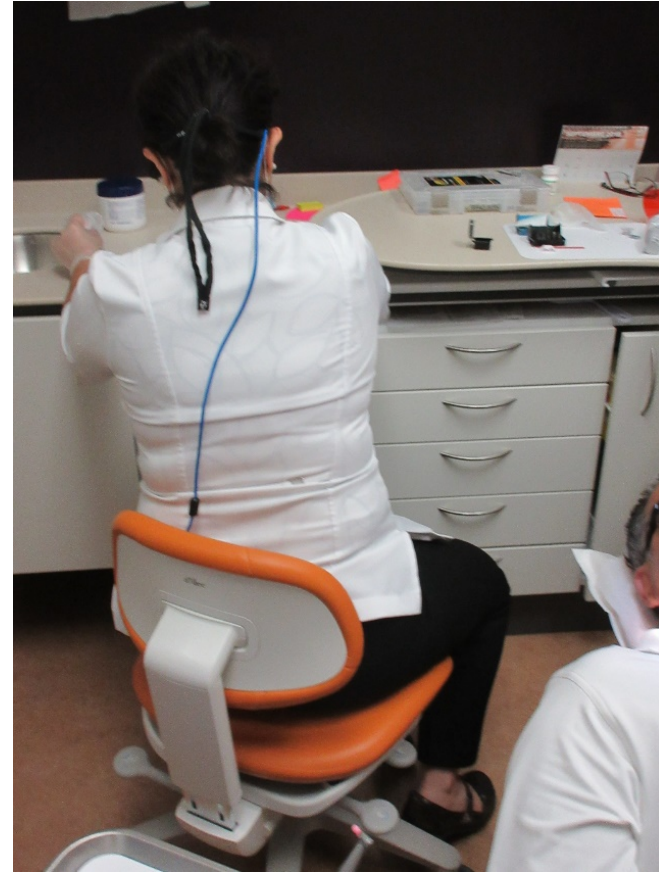
Twisting of the lower back when writing on a high counter, with no clear legroom



- In most treatment rooms, there is no place to write comfortably
- The back counter is too high to write on
- There must be legroom in order to be able to keep the back straight when writing



Twisting of the lower back when writing on a high counter, with no clear legroom



Small table to reduce twisting of the back and the neck while writing



13. Solutions – Environment

**PLAN THE INSTALLATIONS FOR THE SCREEN,
KEYBOARD AND MOUSE,
WHILE SITTING OR STANDING**



A single screen for the computer, the intra-oral camera and radiographs on a wall, on the dominant side



Keyboard and mouse placed on a narrow and closed storage cabinet

Positioning of the screen, in the back while standing, causes twisting of the back and neck when using the intra-oral camera



Awkward postures when the screen of intra-oral camera is placed on the wall, at the foot of the patient, and the mouse is on the back counter

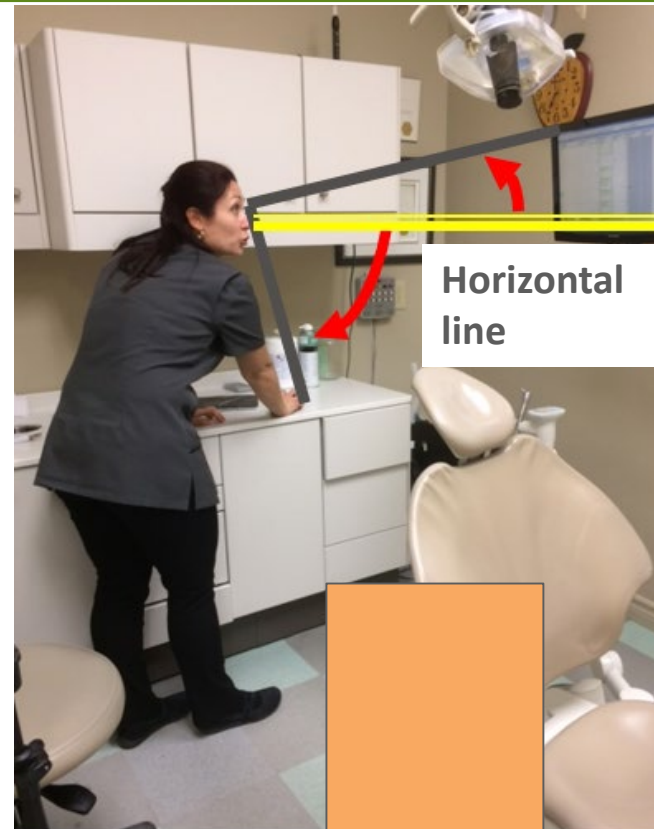
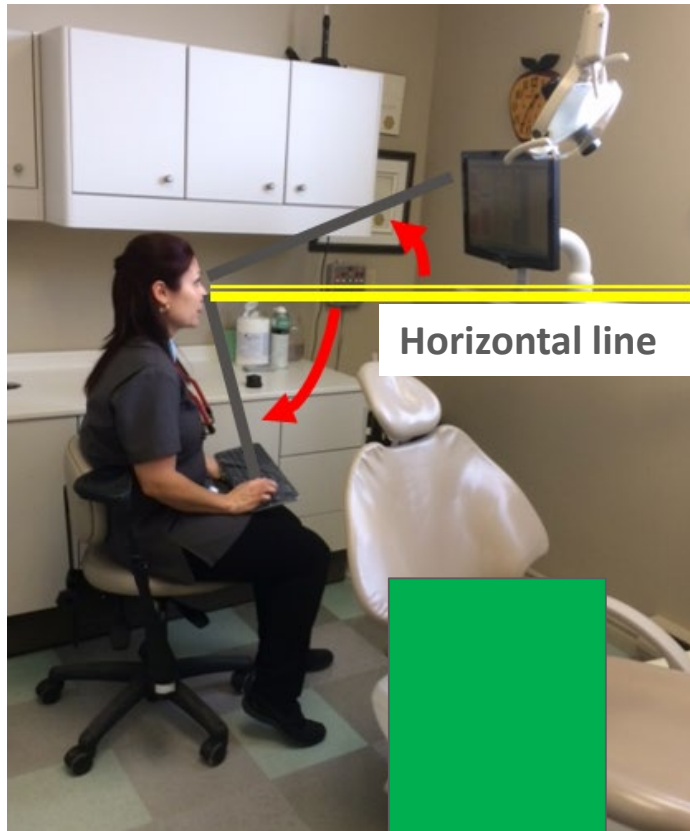


- Arm gap
- Neck and back twisting from side to side



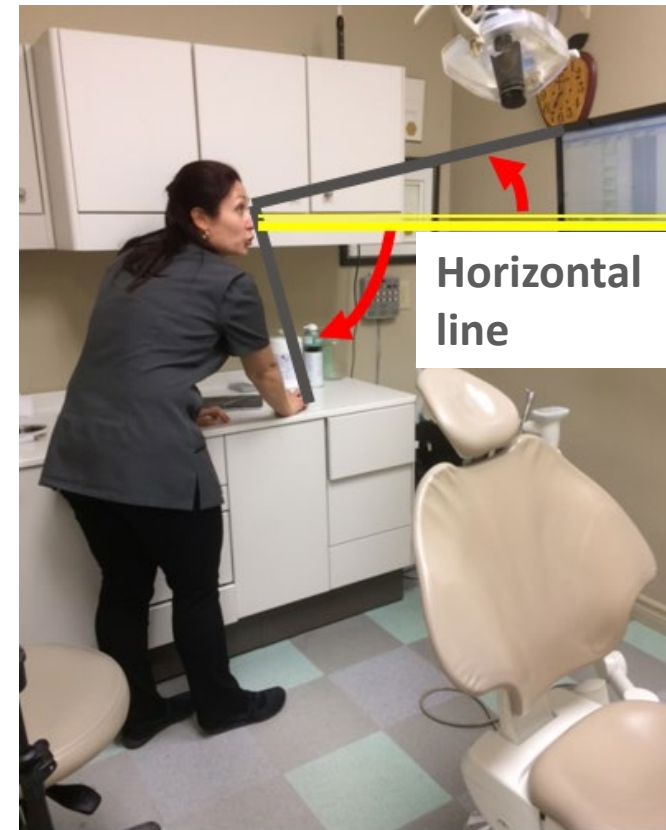
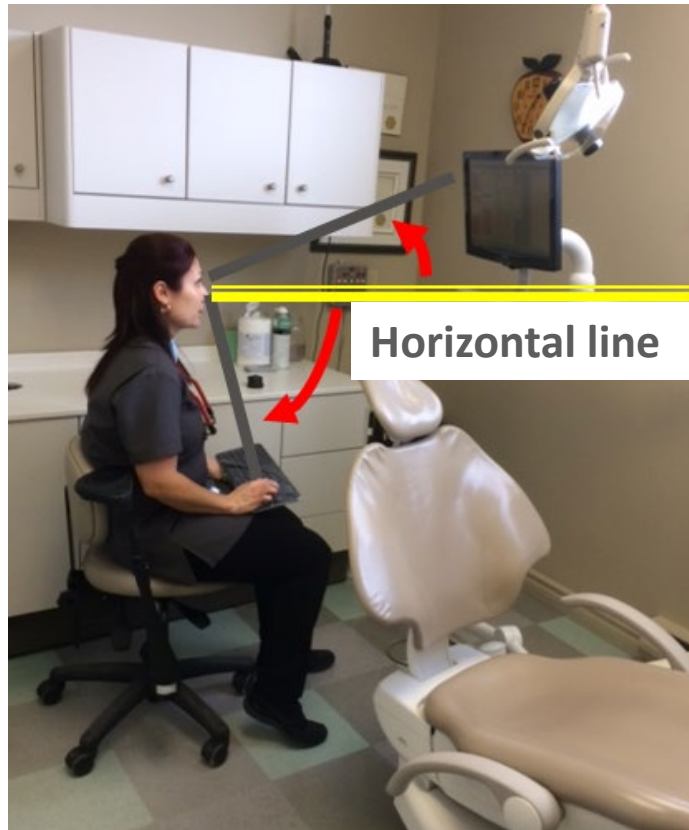
Poll 28

Which is the best position for the hygienist to see a screen placed at this height, sitting or standing?



Answer to poll 28

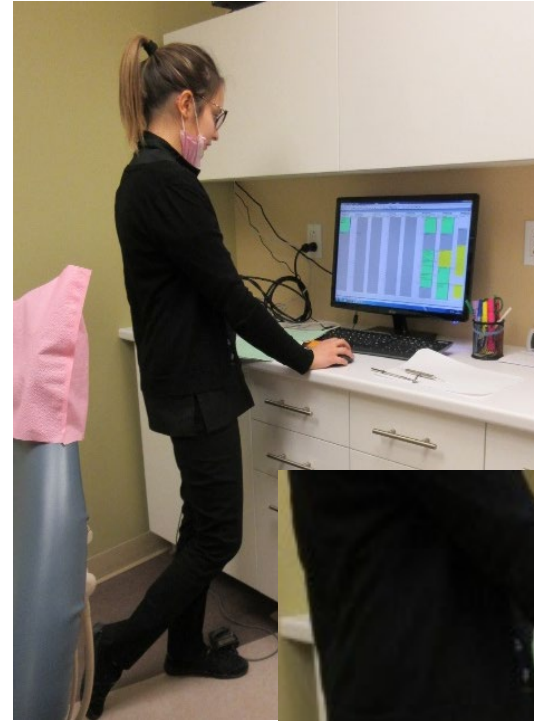
The standing position is better position to see the screen, but her lower back is flexed when she uses the keyboard and mouse on the counter



Screen placed too high and lack of specific space for keyboard and mouse



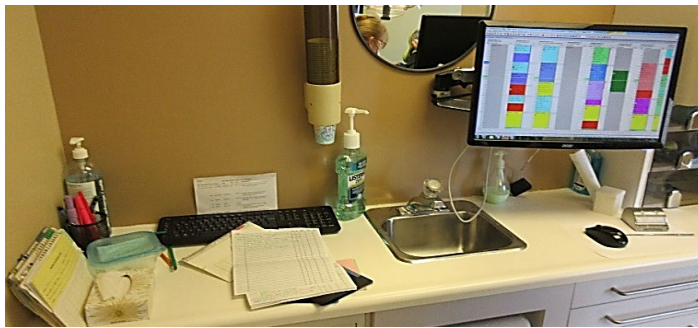
Computer screen at the back of the counter, without specific space to use the keyboard or mouse



Wrist in extension



Take out about half of a mobile unit from the counter to create a more accessible surface for placing the keyboard and mouse



Move the screen towards the mobile unit (ideally in front)



Arrange a space for on-screen work in one of the counter modules

Steps to arrange:

- Remove the doors
- Clear floor space
- Install a solid sliding shelf to put the keyboard and mouse on
- Install the screen in front of this layout



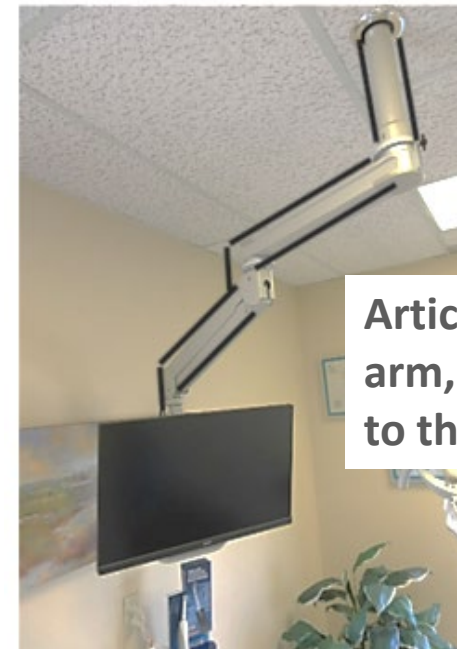
Safer room layout: the 2 screens are placed on the non dominant side

Observation of a better design to see both screens :

- **little twisting of the neck**
- **no twisting of the back**



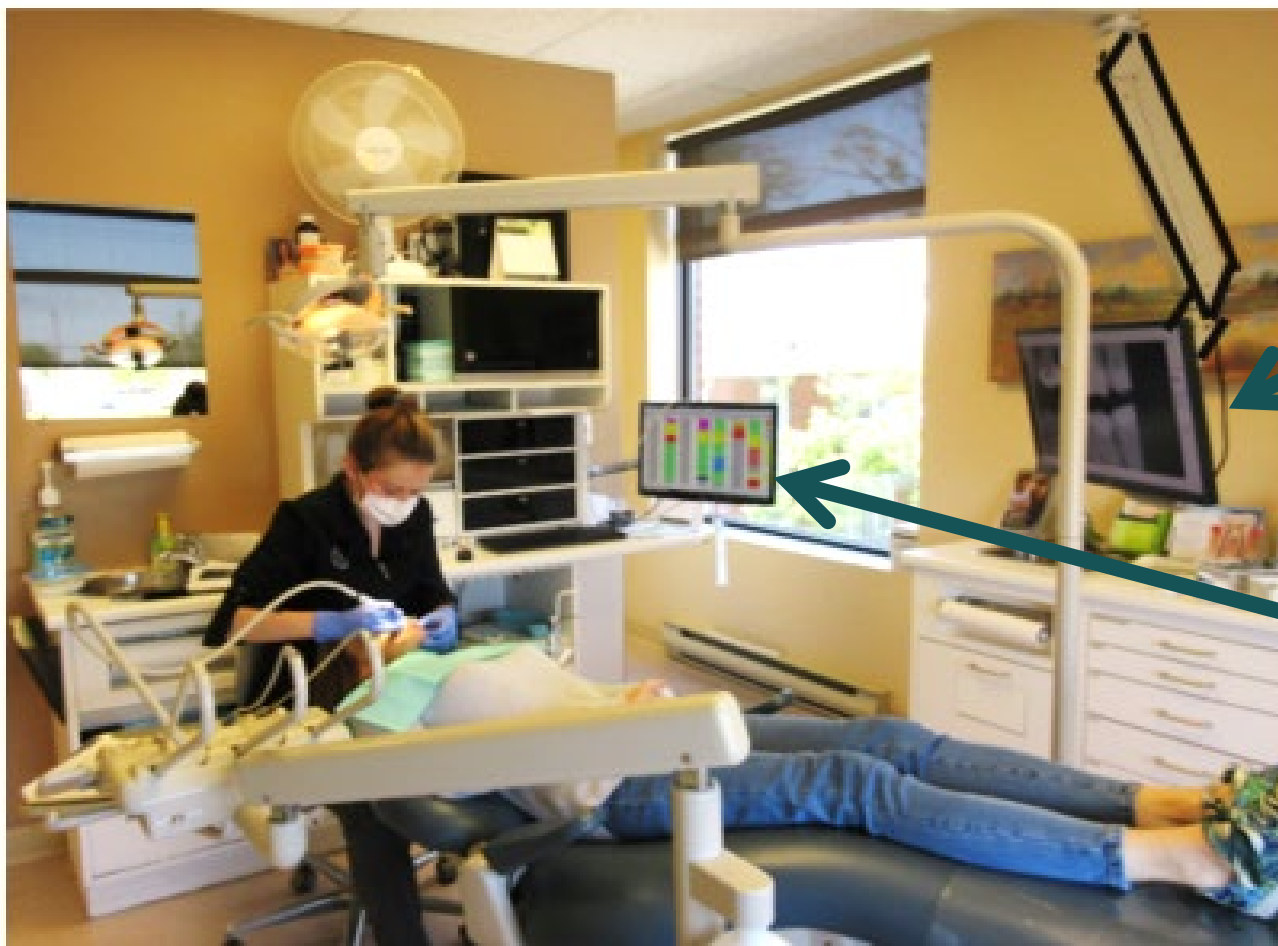
The screen, for the intra-oral camera and radiographs, is supported by articulating arm, attached to the ceiling, on the non-dominant side



- Screen can be moved and steered as needed
- Little twisting of the neck and no torsion of the back
- The arms stay close to the body



Room where the screen for the intra-oral camera and radiographs and the screen of the computer are installed on the same side (*non-dominant*)



Screen for
intra-oral
camera and
radiographs

Computer
screen

Add a shelf at the end of the counter, under the screen installed on a telescopic arm



Add a shelf (*fixed, sliding or pivoting*), at the end of the counter

- The computer screen is supported by a telescopic arm at the end of the upper cabinets
- At the end of the counter, add a shelf in order to :
 - ✓ place keyboard and mouse
 - ✓ increase legroom
 - ✓ work at the computer with a straight back

Other solutions: install screen and keyboard racks, fixed or mobile, compatibles for work while standing



Install a fixed wall station :

- A support for the screen at about eyes height
- Keyboard and mouse stand at about waist height



Mobile work stations:

- Height adjustable

Other solution: install a fixed wall mount with retractable support for the keyboard and mouse, compatible for work while standing

Install a fixed wall station

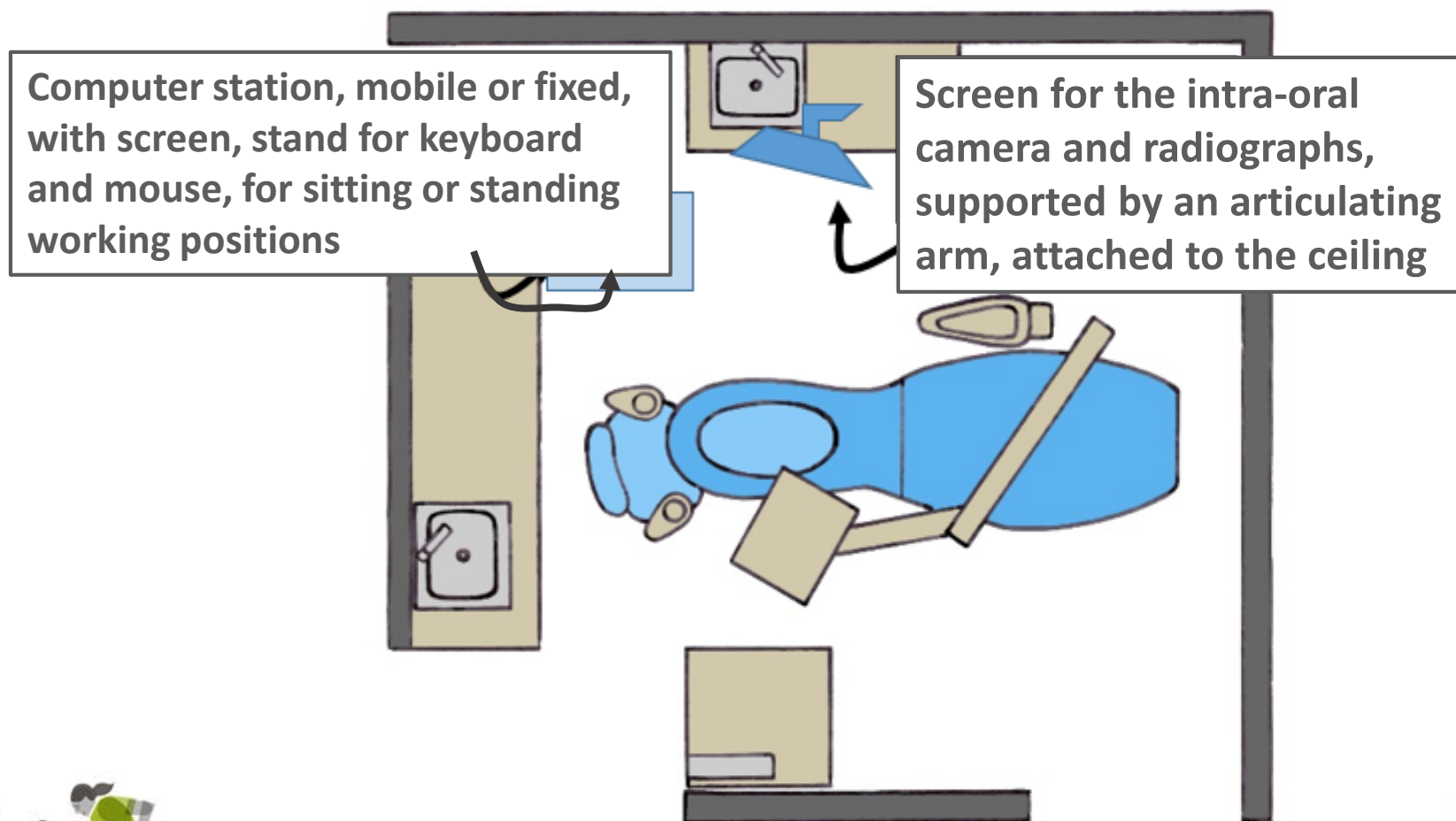
- A support for the screen vis-à-vis the eyes
- A folding keyboard stand
- A wall mount for the mouse
- Keyboard support automatically retracts to storage position when not in use



Other solution: patient's chair with articulating arm to hold the screen and a support for the keyboard and mouse

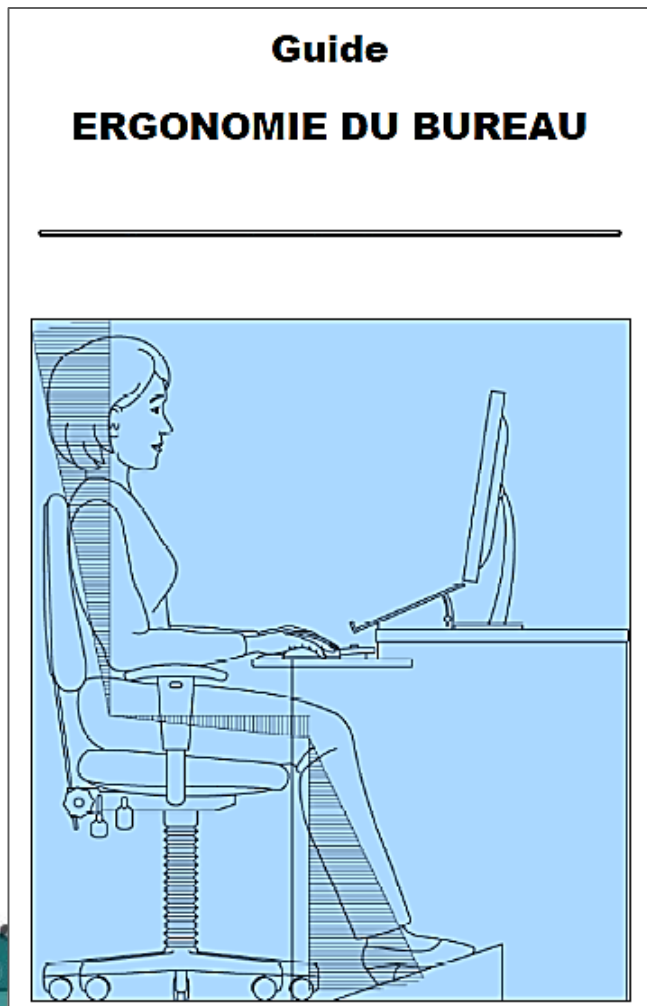


Floor plan : the screen seen by dental staff and the patient (*intra-oral camera and radiographs*) and the screen of the computer workstation are close together and located on the same side (*non-dominant of dentist or hygienist*)



Safe work at the computer

Guide ergonomie du bureau (124 pages)

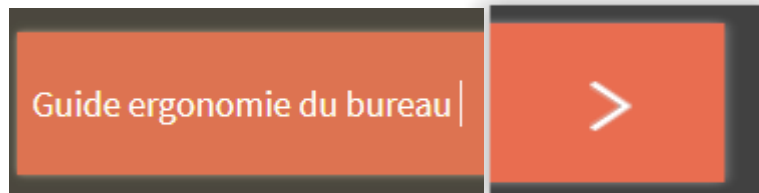


- Free download on the website of ASSTSAS:
www.asstsas.qc.ca/GP67

- In French

www.asstsas.qc.ca

On the homepage: enter the “*Guide Ergonomie du bureau*” in the search box:



Guide de prévention- Aménagement d'un poste d'accueil (52 pages) (*Design and lay-out(s) for reception area*)



- Free download on the website of ASSTSAS: www.asstsas.qc.ca/GP72
- French only
- On the home page :
write « *poste d'accueil* »
in research box (*boîte de recherche*) :

Guide postes d'accueil

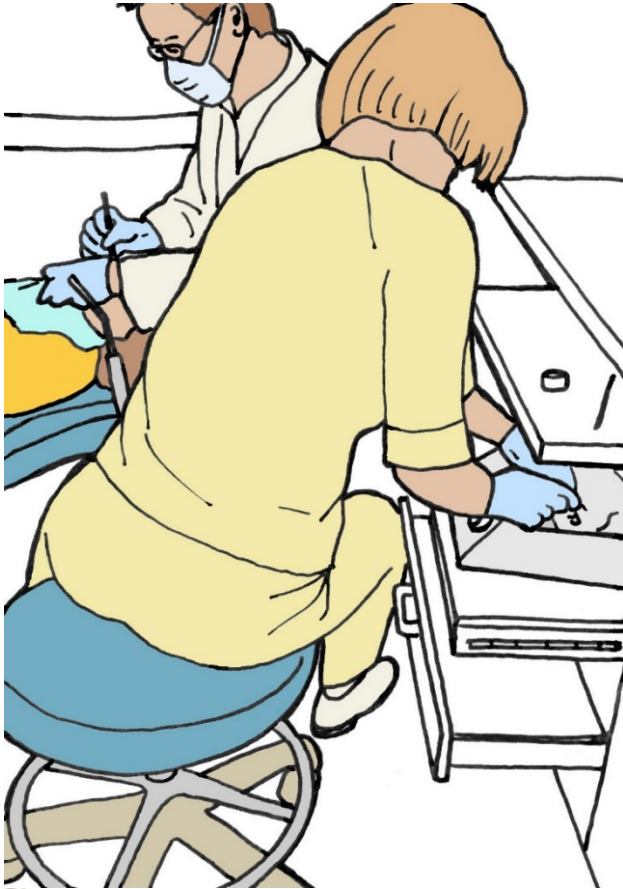


13. Solutions – Environment

COUNTERS AND MOBILE UNITS FOR ASSISTANTS



Twisting of the back and neck of the assistant when taking products and instruments from a fixed counter



Mobile unit equipped with a sliding shelf to deposit products and instruments



Round swivel tray for the assistant to prepare products. Equipped with dynamic instruments supports



- Supported by an articulating arm, fixed to the back counter
- Provides legroom to the assistant
- Facilitates the adoption of positions with straight back and neck

The position of the swivel tray that does not interfere with the dentist at 12 : 00



- Other models with similar characteristics



14. ORGANISATIONAL AND PSYCHOSOCIAL FACTORS INSUFFICIENT REST



Organizational and psychosocial factors-1

- Schedules of more than 8 hours /day: significantly ↗ the effects of all the constraints of the work
- Working **4 days a week** can have a **high musculoskeletal cost** if it requires long hours of work / day
- This **high cost** ↗ with the number of hours worked each day (9 to 12 hours)
- Pressure of the patient schedule



Organizational and psychosocial factors-2

- Treatments longer than expected
- Time not planned for related tasks (eg. sharpening and preparation)
- Higher MSDs risks if working days are “quite” or or “extremely” stressful (compared to a low degree of stress) *

*DAVIS, K.G. *et al.*, 2000, p. 59-62

Insufficient rest

- If the muscles do not have time to recover:
 - the effect of efforts, movements, postures
- Importance of breaks
- Importance of taking micropauses often
 - Release muscles for a few seconds during the work activity
 - Make it a routine when changing tools



15. MUSCLE RECOVERY TECHNIQUES



Cushions magic bags to relax the neck and upper back



- In length 45 cm (18") around the neck
- U-shaped above the shoulders and upper back
- Use both types of magic bags at the same time



Warning

■ For stretching

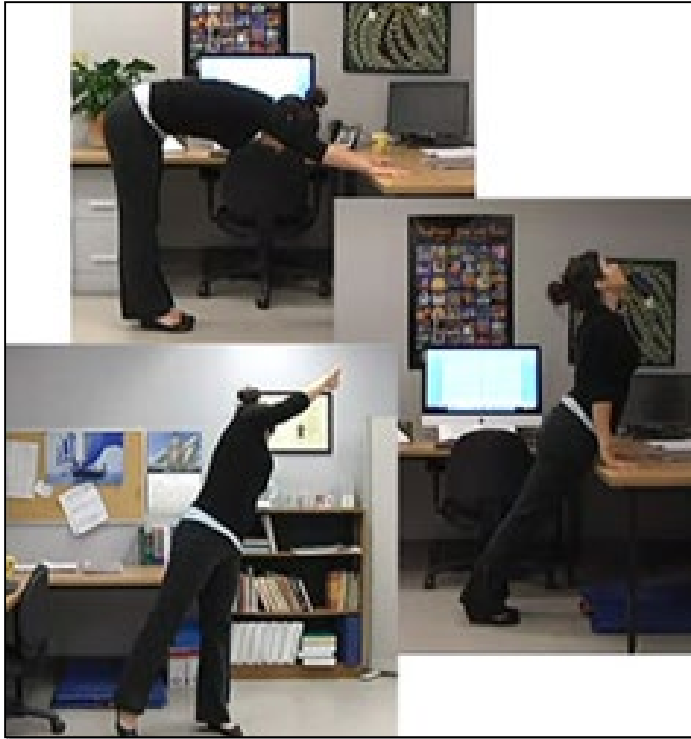
- Do not stretch cold muscles
- Do not stretch more than 6 seconds
- Feel the stretch but no pain

■ Do not force the head against 1 or 2 hands

- The arms are much stronger than the neck and this can create significant forces of the neck
- This movement of resistance could aggravate vertebral lesions (eg. DIM or herniated discs)



2010 - Development of exercise routines (*office, sitting and static work*)



- At the request of ASSTSAS and APSAM (ASP municipal affairs)
- By Denis Marchand, professor in the department of kinanthropology at UQAM and Vincent Mandeville-Gauthier, master's student
- Reduce the associated discomforts
 - Of office work
 - At work when usually sitting in a sitting and static position

Video Exercise Routines

- 2 videos available on the website of ASSTSAS
 - Short Routine:
3 minutes - 4 exercises
 - Long Routine:
8 minutes - 14 exercises



www.asstsas.qc.ca/routines_bureau



16. SYNTHESIS OF SOLUTIONS

DENTISTS AND DENTAL HYGIENISTS

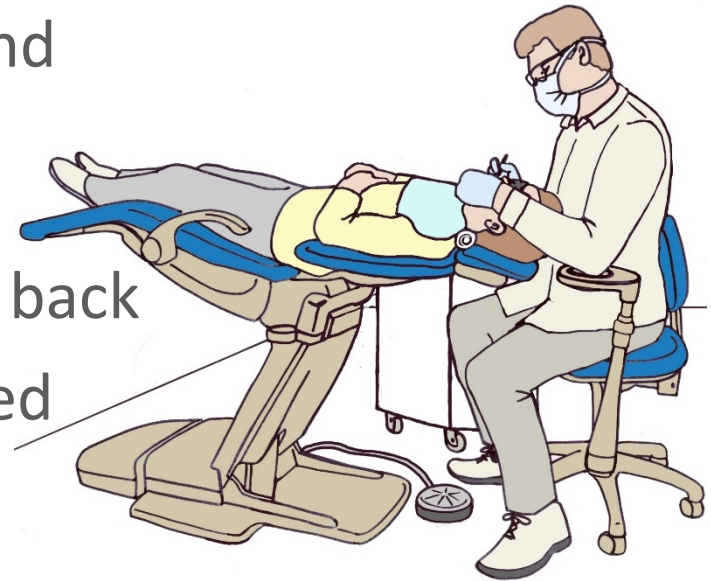
DENTAL ASSISTANTS

FOR ALL



For an "ideal" positioning of dentist and hygienist (1)

1. Raise the height of the patient's chair as much as possible and lower the patient's backrest horizontally
2. Ask the patient to slide to the end of the headrest
3. Adjust the lumbar support of your chair to the hollow of your back
4. Work most of the time positioned at the end of the headrest
11:00 – 12:00 (right-handed)
or 12:00 – 13:00 (left-handed)




For an "ideal" positioning of dentist and hygienist (2)

5. Equip your chair with cushioned elbow supports and adjust them in height and tension
6. Place the tips of your elbows in the center of the supports
7. Raise forearms from 30° to 60°
8. Keep wrists in a neutral position, hands aligned with forearms
9. Opt for big-sleeve instruments and sharp curettes



More information for dentists and dental hygienists

ASSTSAS  Ensemble en prévention 21

DENTAL CARE **Dentists and dental hygienists**
Work pain-free!


Providing quality care may pose risks to your health and safety. You could develop musculoskeletal disorders. Starting today, avoid suffering by opting for safe postures and safe work practices.

TO PROTECT YOUR MUSCLES AND YOUR JOINTS, YOUR BODY MUST REMAIN IN SYMMETRICAL AND NATURAL POSITIONS.

Your neck and your back
The challenge is to stay as upright as possible, facing your work area, without torsion or lateral flexion, the lower back well supported. Avoid bending the neck forward and to the sides.

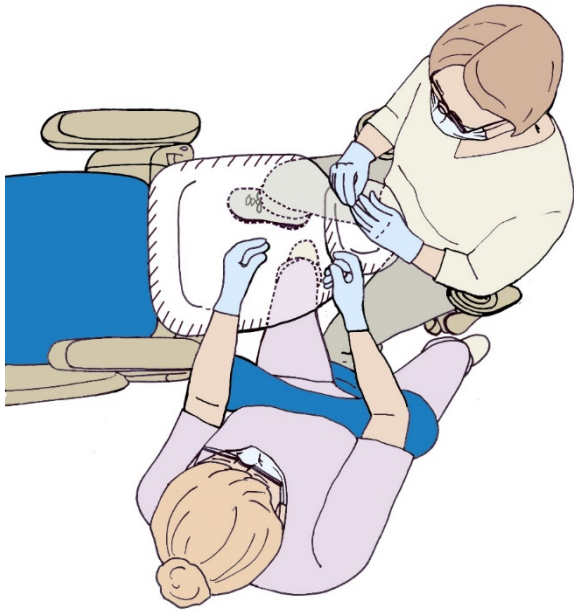
Your shoulders
Shoulder problems are common. To prevent them, it is necessary to reduce the efforts required to keep the arms elevated and limit the use of postures where the arms are kept apart from the body.

Your elbows and your wrists
Extensions, flexions and deviations of the wrists (to the thumb or little finger), frequent or prolonged, can damage them and cause injuries to the elbows. Hand efforts to use the cleaning tools can damage the tendons.



- Free download on the ASSTSAS website:
www.asstsas.qc.ca/FT21A
- Also available in French :
Soins dentaires- Dentistes et hygiénistes
www.asstsas.qc.ca/FT21

For an "ideal" positioning of dental assistant



1. Insert your legs under the patient's chair and, if necessary, interpose your knees with dentist's
2. During treatments, keep your elbows on the *wide figure 8 elbow and torso support*
3. Keep your wrists in a neutral position, your hands aligned with your forearms

More information for Dental assistant

ASSTSAS  Ensemble en prévention 20

DENTAL CARE **Dental Assistants**

Pay attention to your work posture!

You work well as a team and you have a great sense of organization. However, your work postures can make you suffer. Opt for safe postures!

Your back and your neck
The challenge is to stay as upright as possible in front of your work area to eliminate twisting and side bending of the back. Also avoid bending the head forward and to the sides.

Your shoulders
Shoulder problems are common. To prevent them, it is necessary to reduce the efforts required to keep the arms elevated and limit the use of postures where the arms are kept apart from the body.

Your elbows and your wrists
Extensions, flexions and deviations of the wrists (to the thumb or little finger), frequent or prolonged, will damage them and cause injuries to the elbows. Efforts to hold the tip of suction can also cause problems in the wrists and hands.

TO PROTECT YOUR MUSCLES AND YOUR JOINTS, YOUR BODY MUST REMAIN IN SYMMETRICAL AND NATURAL POSITIONS.



Free download on the ASSTSAS website:

www.asstsas.qc.ca/FT20A

- Also available in French : Soins dentaires- Assistantes dentaires:

www.asstsas.qc.ca/FT20

For an "ideal" positioning for ALL

Shoulders, neck, upper and lower back	Elbows, wrists and hands
Working methods	Working methods
Equipment	Equipment
Environment	Environment
Adjustment of the patient's chair	Adjustment of the patient's chair
Work organisation	Work organisation
Muscle recovery techniques	Muscle recovery techniques

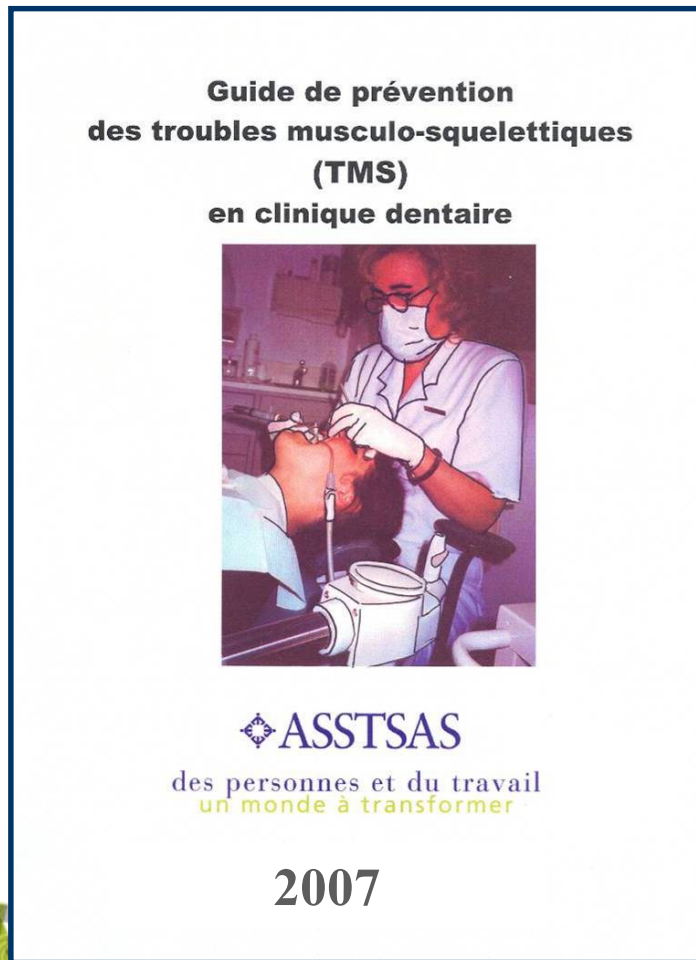
Valid for dentists, hygienists and assistants

See ASSTSAS. *Guide de prévention des TMS en clinique dentaire*, 2007, p.235 à 238

www.asstsas.qc.ca/GP50



More information in French (*256 pages*)



- Diagnosis of MSDs
- MSDs of shoulders, neck, upper and lower back
- MSDs to elbows, wrists and hands
- Effects of static work
- Solutions

Free download on the website of ASSTSAS :

www.asstsas.qc.ca/GP50
(Revision in progress)

More information in English

Extracts from the French publication (*104 pages*)

Prevention of Work-Related Musculoskeletal Disorders (MSDs) in Dental Clinics



Rose-Ange Proteau



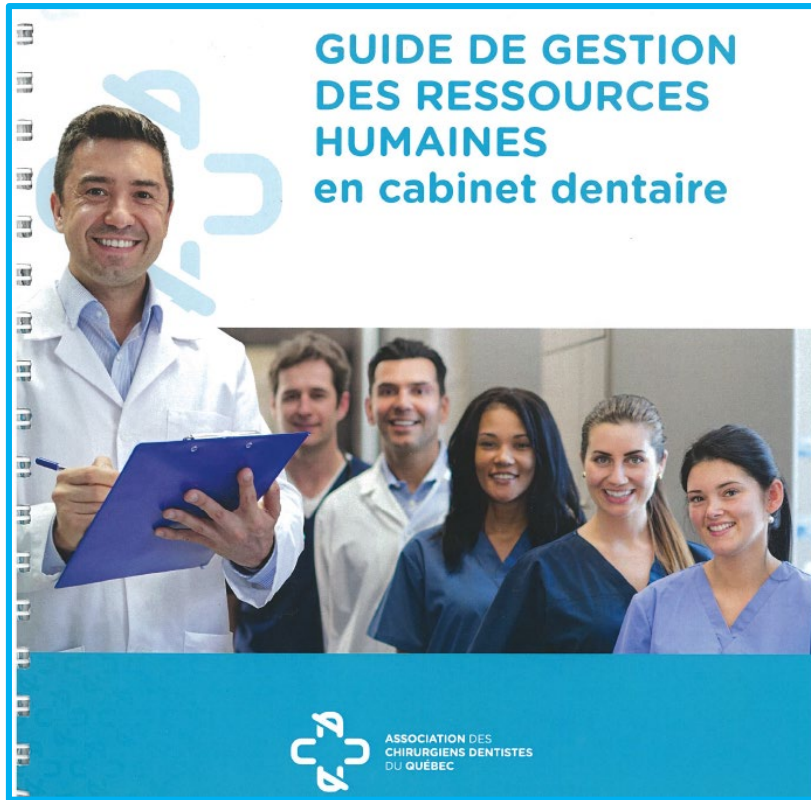
ASSOCIATION PARITAIRE POUR LA SANTÉ ET LA SÉCURITÉ DU TRAVAIL
DU SECTEUR AFFAIRES SOCIALES

2009

- Diagnosis of MSDs
 - MSDs of shoulders, neck, upper and lower back
 - Effects of static work
 - Solutions
-
- Free download on the website of ASSTSAS:
www.asstsas.qc.ca/GP51

More information

(Available in English ? If so, please translate)



- Fiches SST (2017), section 8 : santé et sécurité du travail - Optimiser l'environnement de travail
 - 8.4 - TMS régions cervicales et lombaires (p. 111 à 112) + Outil 24 (p. 188 à 195) + Outil 24 pour les assistantes dentaires (p. 196-198)
 - 8.5 - TMS des épaules (p. 113) + Outil 25 (p. 200-201)
 - 8.6 - TMS des coudes et des poignets (p. 114-115) + Outil 26 (p. 202 à 207)
- Available on ACDQ website www.acdq.qc.ca

CONCLUSION

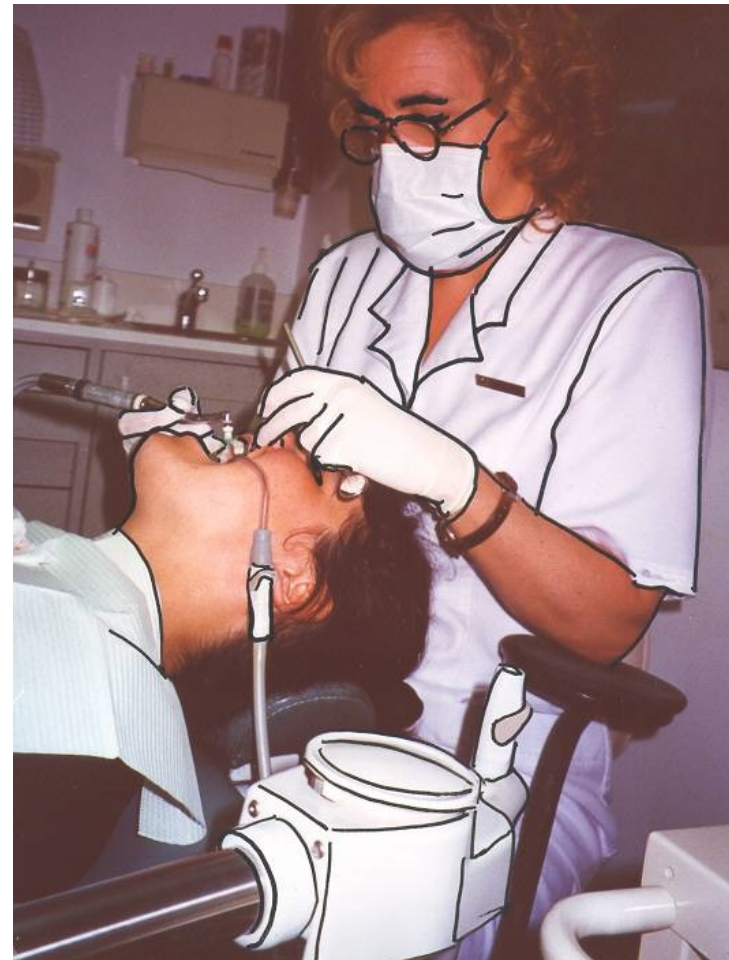


Prevent pathological conditions

- Listen to your **PAINS = WARNINGS**
the longer you endure the pain
↓
the longer it can take a to heal
- Recognize the links between work, discomfort and pain
- Seek solutions
- Consider stop working when the pain is severe and could lead to incapacities



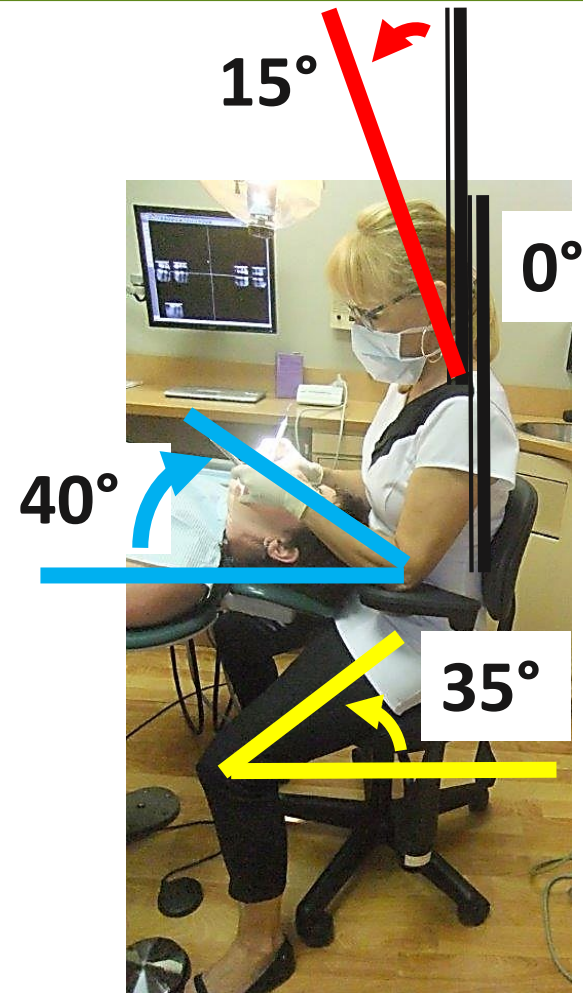
Dental work can cause less musculoskeletal strain



TIME TRAVEL (1997 - 2019)

Bending angles of the neck can be ↘ from 45° to 15°

Bending angles of the back can be ↘ from 15° to 0°



For dentists and hygienists

For the muscles of the neck, upper and lower back and shoulders

- Working with the patient placed higher decreases the flexion of the neck
- The use of *free motion elbow-supports* is a preventive and curative measure
 - Since 2003 (16 years), they have helped many dental hygienists and dentists:
 - ✓ continue to practice or
 - ✓ return to work

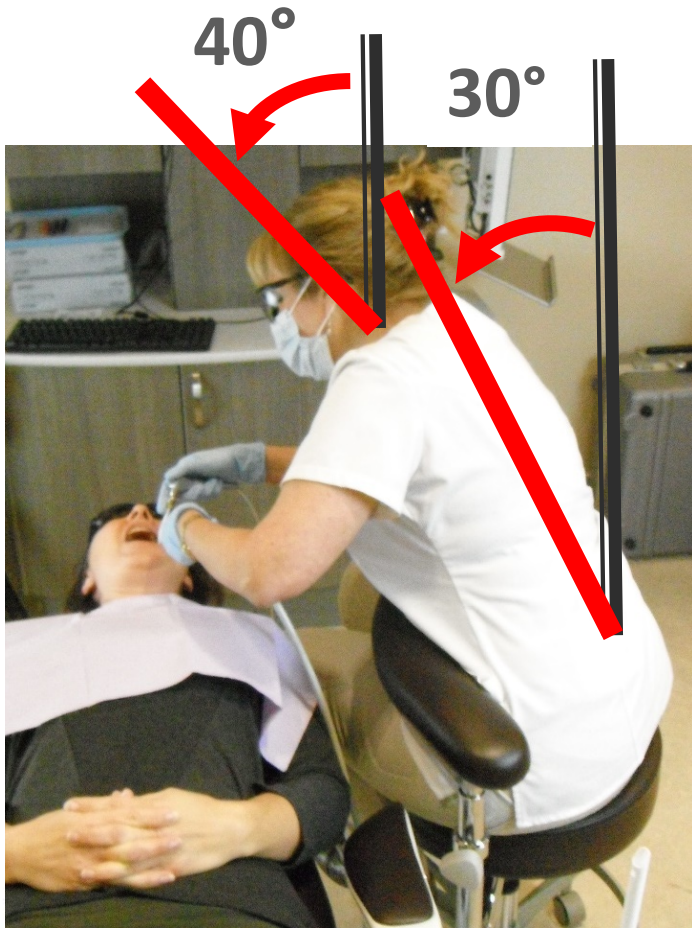


TIME TRAVEL -

Dental assistants (1997 - 2019) :

Bending angles of the neck can be ↘ from 40° to 15°

Bending angles of the lower back can be ↘ from 30° to 0°



For dental assistants

For the muscles of the neck, upper and lower back and shoulders:

- You may not always need to see everything in the patient's mouth...
- Ask your dentist to make room for your legs (it's also to his advantage)
- The use of *wide figure 8 elbow and torso support* is a preventive and curative measure
 - Since 2006 (13 years), it has helped many dental assistants:
 - ✓ continue to practice or
 - ✓ return to work



FOR ALL

All small gains to ↓ muscle and joint loads are important

- Dental work has several requirements that, taken in isolation, may seem trivial
- Joints that always repeat the same movements become at risk of MSDs



PERSEVERE !

IT'S NOT EASY TO CHANGE WORKING HABITS

A period of acclimatization,
during which one feels less skilled,
is necessary before

THE CHANGES BECOME NATURAL



QUESTIONS ?

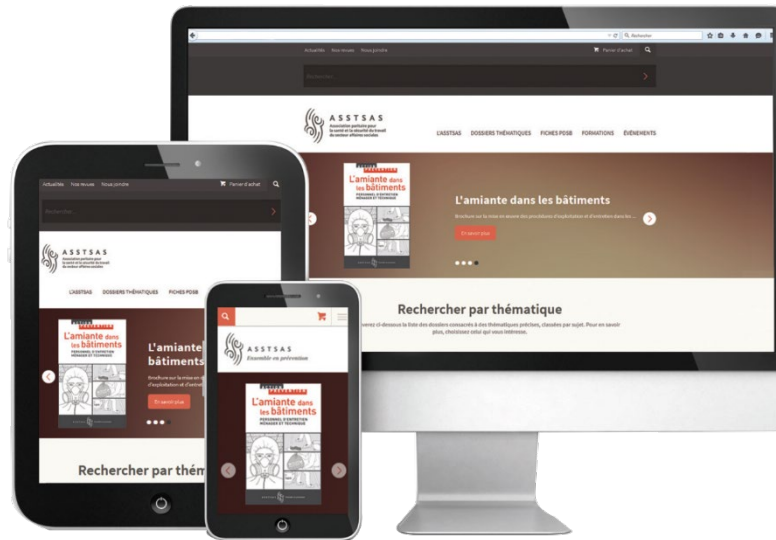


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- Please do it before the end of the day.
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 - Click on the Hyperlink



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