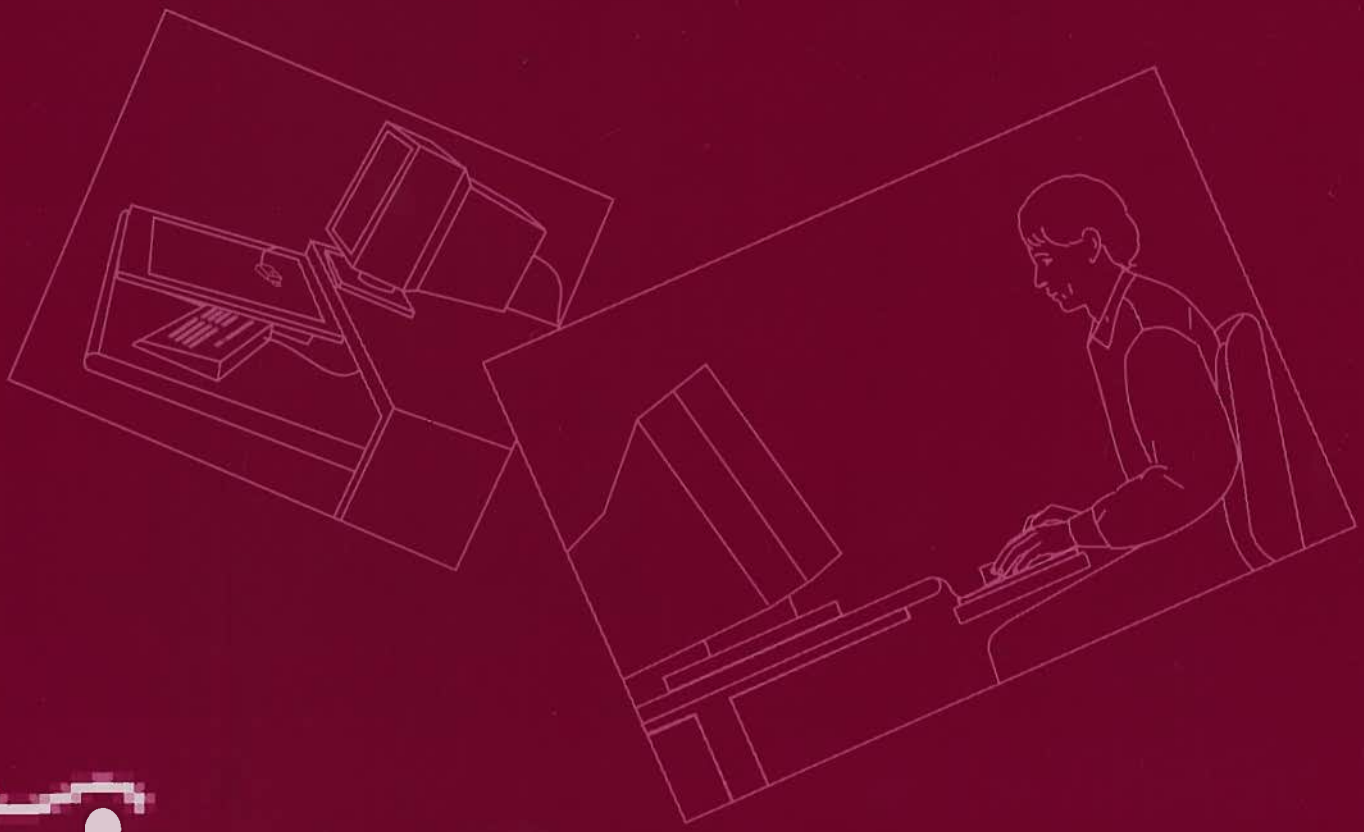
Prepress VDT Work

Preventing fatigue, tension and pain



Association paritaire de santé et de sécurité du travail
secteur imprimerie et activités connexes

Prepress VDT Work

Preventing fatigue, tension and pain

The Association paritaire de santé et de sécurité du travail, secteur imprimerie et activités connexes (joint occupational health and safety association, printing and related activities sector) has an important role to play in prevention. This is the reason we have prepared a guide on the prevention of fatigue, tension and pain for prepress VDT workers.

This guide presents the main body sites affected in prepress VDT workers, the risk factors, the determining factors, as well as the areas for preventive intervention. A summary table presents the basic information on VDT workstation layout. For a better overall understanding, refer to the different sections of the guide.

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Note

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This guide is based on work carried out in printing companies, particularly during interventions involving prepress VDT work. This work was supported by documentary research. The Association cannot guarantee the absolute accuracy or the exhaustive nature of this publication, particularly since ergonomics is a constantly developing field. This guide is based on current ergonomic knowledge and could be expanded upon in a future edition. We are not responsible for any errors or omissions in this guide or for any resulting application.

To make this guide easier to read, we have used the masculine gender. It is understood that this document is intended for both men and women.

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Acknowledgments
The Association sectorielle thanks the company representatives, employers and workers who gave us the opportunity to do an ergonomic assessment of prepress work, and who thus enabled us to increase our knowledge and prepare this guide for our industry. Special thanks go to Canada inc., Caractéra, Compo Em, Interchèques, La Tribune and Transmédia, where workers participated in our study to characterize prepress VDT tasks and identify the main body areas affected by fatigue, tension and pain. We also thank Thérèse Cadrin Petit of Gymnastique sur table TCP, who proposed exercises adapted to the needs of prepress workers based on their most frequently reported sites of pain or fatigue. Finally, we thank all the members of the Association's team for their support and invaluable advice.

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TABLE OF CONTENTS

INTRODUCTION

Musculoskeletal disorders are prevalent in the printing industry. In 1995, the printing and related activities sector ranked fifth among all economic activity sectors in Quebec in the proportion of musculoskeletal injuries compensated by the CSST in relation to all of the injuries compensated in the sector for the same period.

Although major trends do not emerge from the statistics supplied by the CSST for prepress workers, we were able to identify significant ergonomic problems which are most often expressed as fatigue, tension and pain, from a survey of 115 of these workers. To prevent more serious problems from developing, this guide specifically focuses on the prevention of musculoskeletal discomfort in prepress VDT workers.

This guide presents the main characteristics of prepress VDT work and its related risk factors. Some notions of anatomy help in understanding the discomfort felt. Finally, solutions are proposed, where personal action is important. Considering the characteristics of prepress VDT work, we believe that personal action is a major aspect in prevention.

This guide is primarily intended for people who know the importance of the fatigue, pain and tension involved in prepress VDT work and who want to take preventive action. These include workers, as well as company health and safety managers, committee members, and human resources and production managers. This guide contains information for those whose daily activities involve the use of a VDT, to help them improve their working conditions.

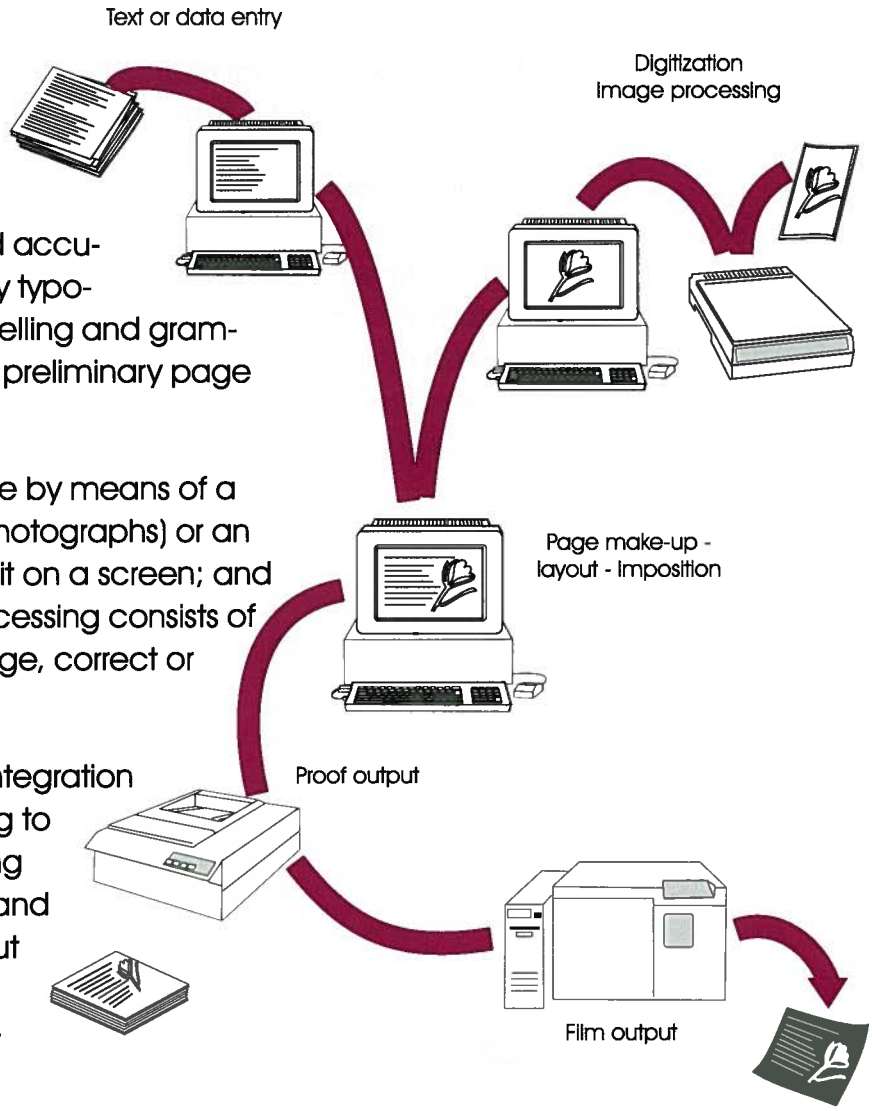
PREPRESS WORK

Printing has three main phases: prepress work, printing, and binding and finishing. Prepress work is an important link in the graphical chain; this is where the entire process begins.

New technologies have significantly changed prepress work; most workers now use computer tools and work in front of a screen, using a mouse and a keyboard.

Experts divide prepress work into five steps: data and text entry, image processing, layout and imposition, the production of proofs, and film output. In our guide, which begins with the tasks performed, we have divided it into four categories: text and data entry, image digitization and processing, page make-up–layout–imposition, and finally, proof or film output.

PREPRESS WORK



Text or data entry generally involves entering the information into a computer system. The main tasks are: entering the data rapidly and accurately, applying the necessary typographical rules, correcting spelling and grammar if need be, and doing a preliminary page make-up.

Digitization converts an image by means of a scanner, a camera (digital photographs) or an optical scanner; reproduces it on a screen; and then processes it. Image processing consists of analyzing this image to change, correct or retouch it (shape and colors).

Page make-up involves the integration of text and images according to the client's requirements, using specialized software. Layout and imposition consist of laying out the document to be printed according to printing and finishing requirements.

Proof or film output is the final step in prepress work. The proofs or films are given to the client or to the printer for the next step, printing.

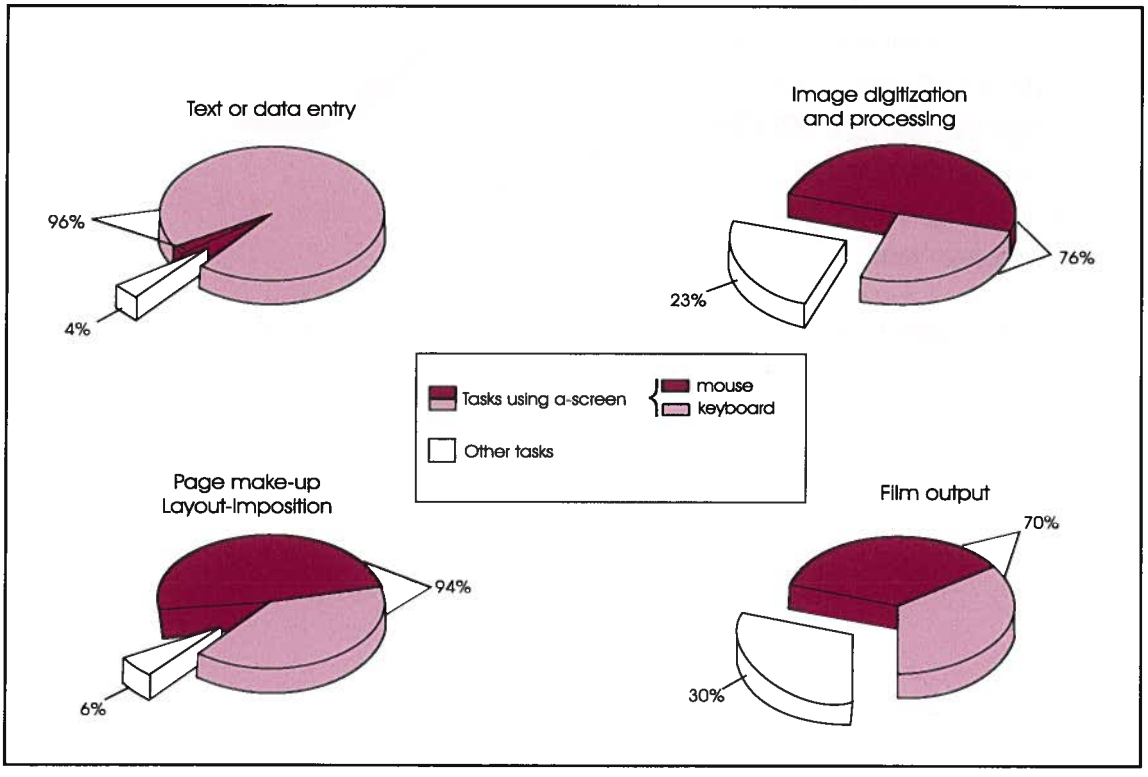
PREPRESS WORK
Job characteristics

Prepress work is characterized mainly by the many hours spent in front of a computer screen.

For text or data entry, a keyboard is generally used. This task involves rapid finger movements on the keyboard and the reading of documents containing the information to be entered. The various tasks from image processing to film output include staring at a screen for long periods of time and the frequent use of a mouse. In both these cases, considerable attention and concentration are required.

From a survey of 115 prepress workers in different companies, we evaluated the time spent in front of a screen and using a keyboard and mouse, and were thus able to identify the main characteristics of prepress VDT work in the printing industry.

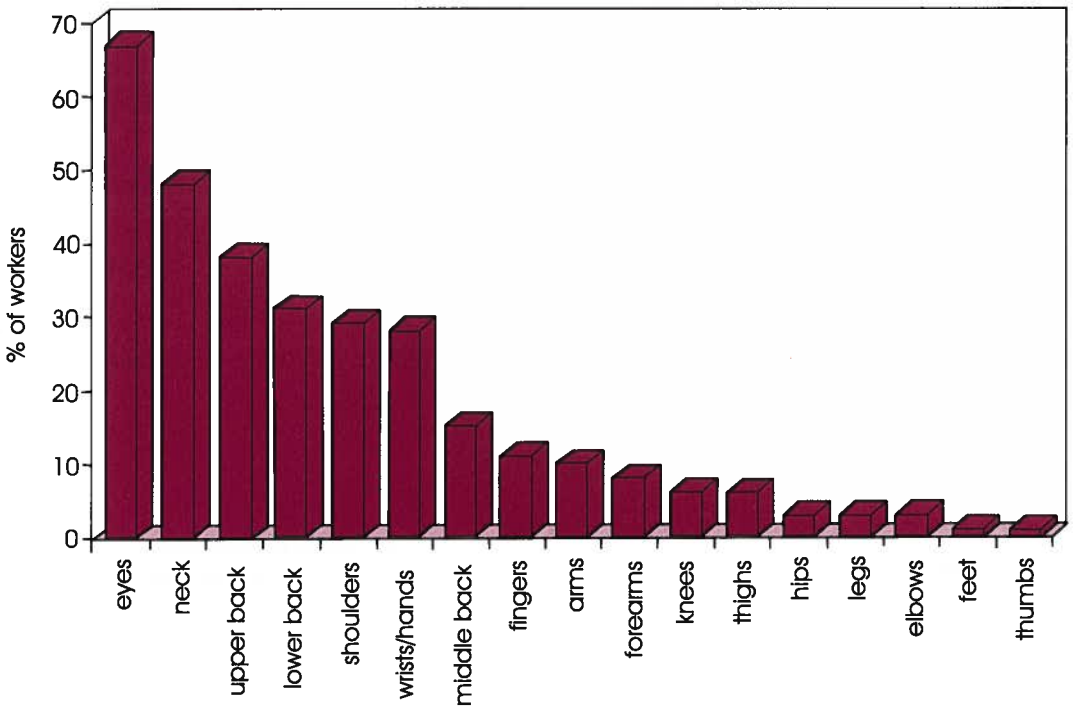
Use of screen, mouse and keyboard



PREPRESS WORK
Body areas affected

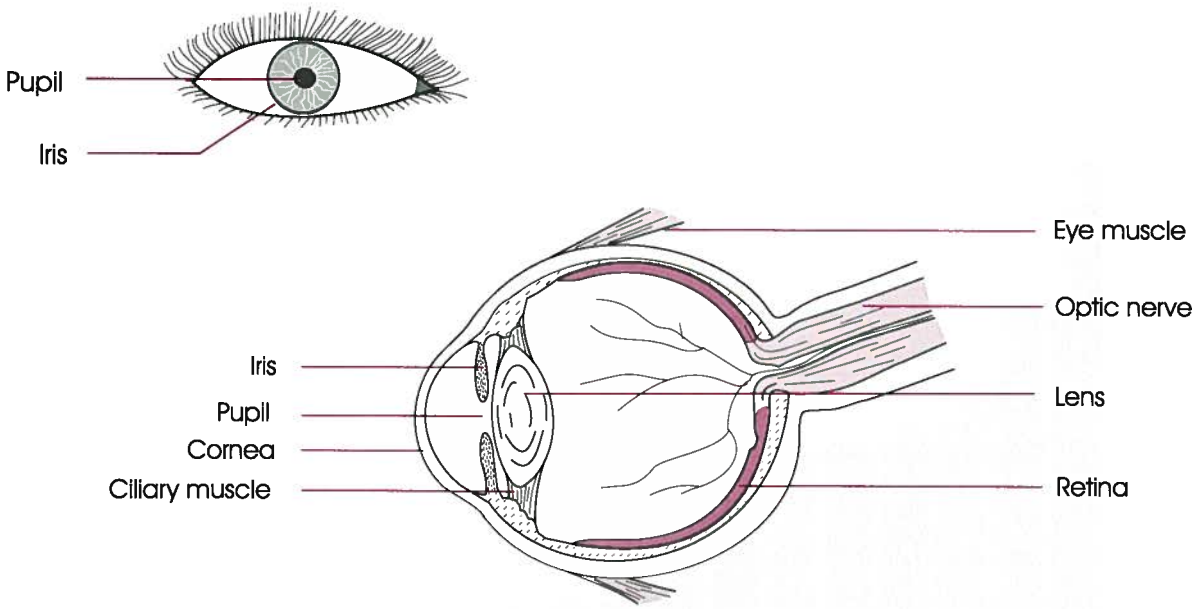
The survey identified the sites of discomfort, pain and fatigue reported by prepress workers. In order, the most affected areas are: the eyes, neck, upper and lower back, shoulders and wrists/hands.

Reported pain and fatigue
n= 115



VISUAL EFFORT
Anatomy of the eye

Prepress VDT tasks require significant visual effort involving some physiological mechanisms that allow objects looked at to be seen. A knowledge of these mechanisms provides us with an understanding of the visual discomfort and fatigue reported by workers. The eyes are in fact the first site of pain or fatigue reported.



Anatomy of the eye

Cornea Transparent tissue covering the eye and through which light enters the eye.

Lens Clear, oval structure that makes the light rays converge towards the retina.

Iris Coloured part of the eye that can be seen from the outside. The iris consists of small muscles that adjust the size of the pupil.

Eye muscles Muscles that make the eyes move.

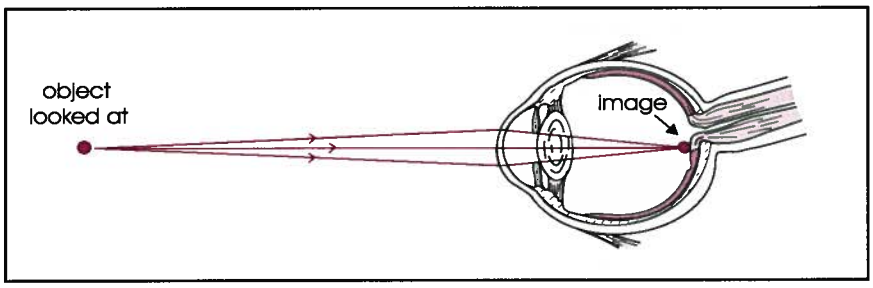
Ciliary muscles Muscles that change the curvature of the lens for focusing.

Pupil Black part of the eye located at the centre of the iris, through which light enters the eye.

Retina Membrane that lines the inside of the eye. Sensitive to light, the retina receives the image and transmits it to the nervous system via the optic nerve.

VISUAL EFFORT
Eye function

Our eye muscles turn our eyes in the direction of the object that we want to see. The light rays projected by the object enter our eyes first through the cornea, and then pass through the pupil to the lens. The lens directs the light rays towards the retina where an image of the object forms. Nerve cells located on the retina receive the light and send signals to the brain via the optic nerve. The brain analyzes these signals and tells us what our eyes are seeing.

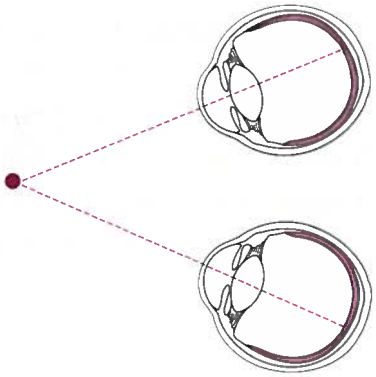


Eye movement and fixed gaze

Our eye muscles, located around our eyes, turn our eyes in all directions. However, these muscles do much more. They keep our eyes aligned towards the object looked at; this is called a fixed gaze.

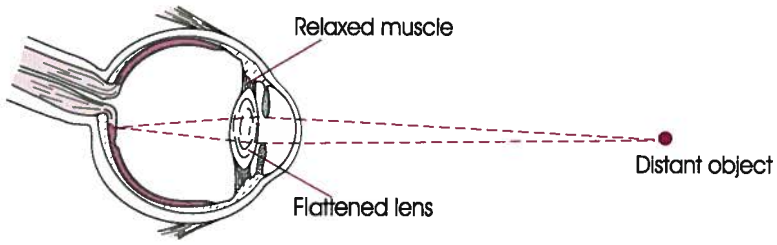
Convergence

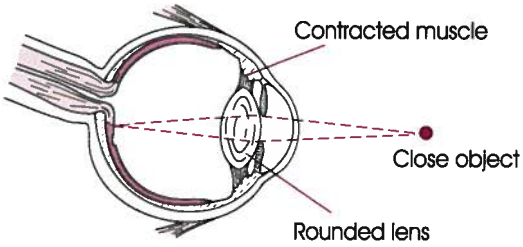
When we look at a close object such as a screen or document, our eyes are turned inwards. This is called convergence. The closer the object that we are looking at, the more our eyes must converge, and the harder our eye muscles must work.



Focusing or accommodation

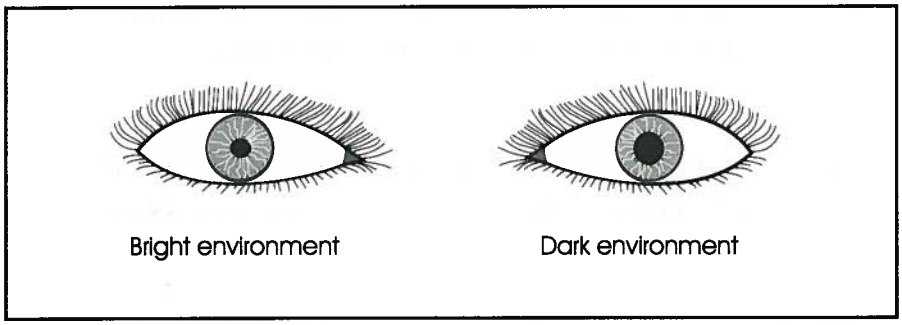
Eye convergence occurs at the same time as another important mechanism, accommodation. Our eyes must adjust to the distance of the object looked at. This phenomenon is similar to looking through binoculars: we focus by adjusting the lenses to make the image sharper. Focusing of the eyes is called the accommodation reflex. When we look at a close object, the lens becomes rounder; when we look at a distant object, the lens flattens. The shape of the lens is controlled by the ciliary muscles; the closer an object, the harder the ciliary muscles have to work.





Adapting to the light

Light enters our eyes through the pupil, the opening located at the centre of the iris. The amount of light that enters the eye is controlled by the iris, a coloured and opaque muscle that adjusts the size of the pupil. When the ambient lighting is bright, the iris closes the pupil to reduce the amount of light reaching the retina.



Eye blinking

Blinking is another important function of our eyes. This eyelid movement maintains a thin layer of liquid over our eyes. Any reduction in this liquid may result in dry and irritated eyes.

VISUAL EFFORT
Visual fatigue

Our eye muscles work hard when we work at a computer screen. They are responsible for eye movement, accommodation, convergence and pupil adjustment. Visual fatigue is the result of overuse of our eye muscles. Many people who work regularly at a computer screen often suffer from this type of fatigue. Fortunately, visual fatigue is a reversible physical condition.

When visual fatigue occurs, muscle capacity decreases; the ability to perform a visual task may also decrease. Visual fatigue should be considered as a signal that the eyes need to be rested.

Visual fatigue is felt as heaviness, burning, pain, irritation or drying of the eyes. Vision may be affected, visual acuity may diminish, and focusing on the screen may become difficult.

Visual fatigue can be due to the physical environment (i.e., improper lighting, reflection on the screen, poor screen resolution, eye–screen distance), the type of tasks performed (i.e., image processing), work organization (i.e., duration and intensity of visual work), and personal factors (i.e., age, habits, visual capacity).

BODY EFFORT
Upper limbs

The upper limbs, particularly the shoulders, wrists and hands are commonly reported sites of pain or fatigue of prepress VDT workers. A study of the tasks performed may provide an explanation.

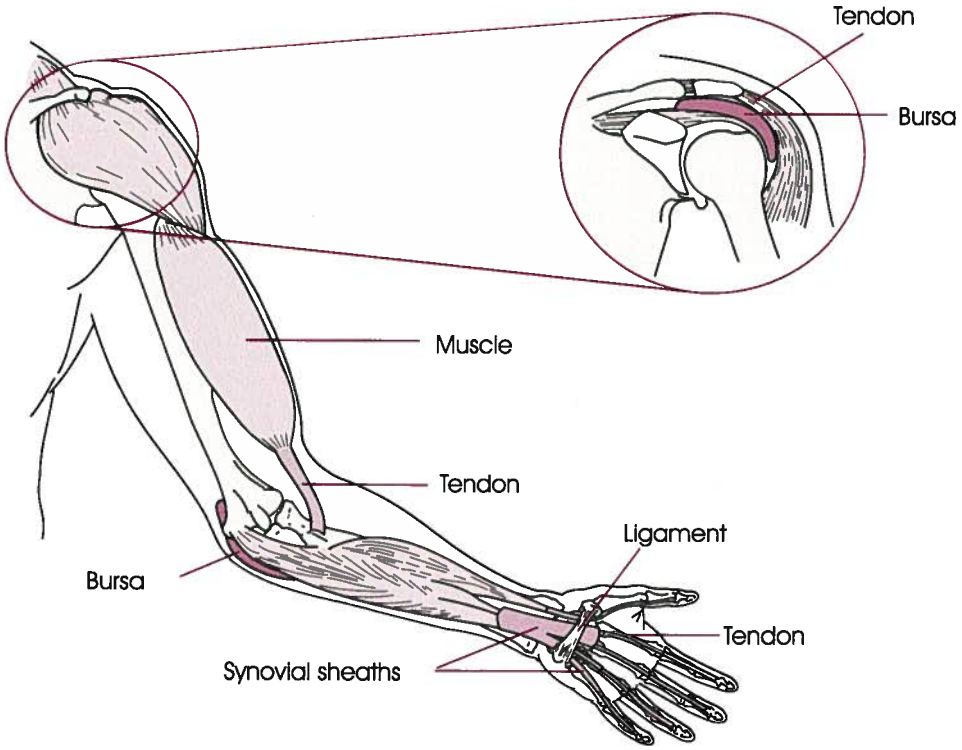
In prepress work, a mouse and keyboard are used and documents are handled. The muscles and joints of the upper limbs (hands, wrists, elbows, arms, shoulders) are used for this work, allowing precise movement and sustained postures. Arm muscles can be working even if the arms remain immobile. Also, shoulder muscles must remain contracted to support the arms as well as hands placed on a keyboard or mouse.

Muscles

Muscles consist of thousands of fibres which, by contracting and relaxing, produce body movements. Muscles are filled with blood vessels that supply them with the necessary oxygen and nutrients and that carry away waste products.

Muscles contract to produce movements or to maintain a position. When you hold your arm in a raised position, there is no movement, only a sustained position. When a position is maintained by a muscle contraction, this contraction is said to be static.

When muscles contract to produce movement, it is called dynamic work. When they contract to maintain a position, it is static work.



Tendons

Most muscles are not directly attached to the bones. Muscles end in dense fibrous cords or tendons that connect them to bones; tendons transmit muscle forces and movements to the bones.

Some tendons, such as those in the wrists and hands, have sheaths containing a lubricant called synovial fluid. These sheaths make it easier for the tendons to move and protect them from the bony structures that could damage them.

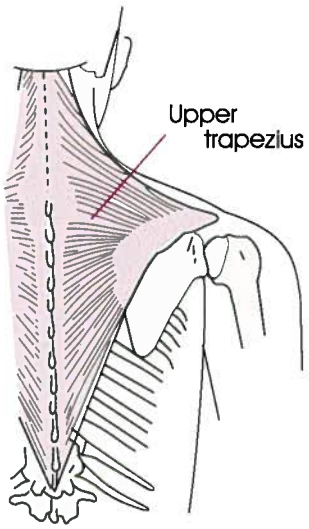
Ligaments

Ligaments are bands of fibrous tissue that connect bones together, forming the joints and preventing excessive movement. Ligaments cannot contract like muscles.

Bursae

Small fluid-filled sacs called synovial bursae are located in the body at points of pressure or friction between different tissues (tendons, bones or ligaments). Their main role is to allow the tissues to move freely over each other.

BODY EFFORT
Neck and upper back



The neck, upper back and shoulders share a large muscular mass called the trapezius muscle. This muscle works when the shoulders are raised and helps support the head when it is bent forward.

Tension and fatigue in the shoulders, neck and upper back can be associated with static or constrained postures of the shoulders, arms or head. These put stress mainly on the upper trapezius.

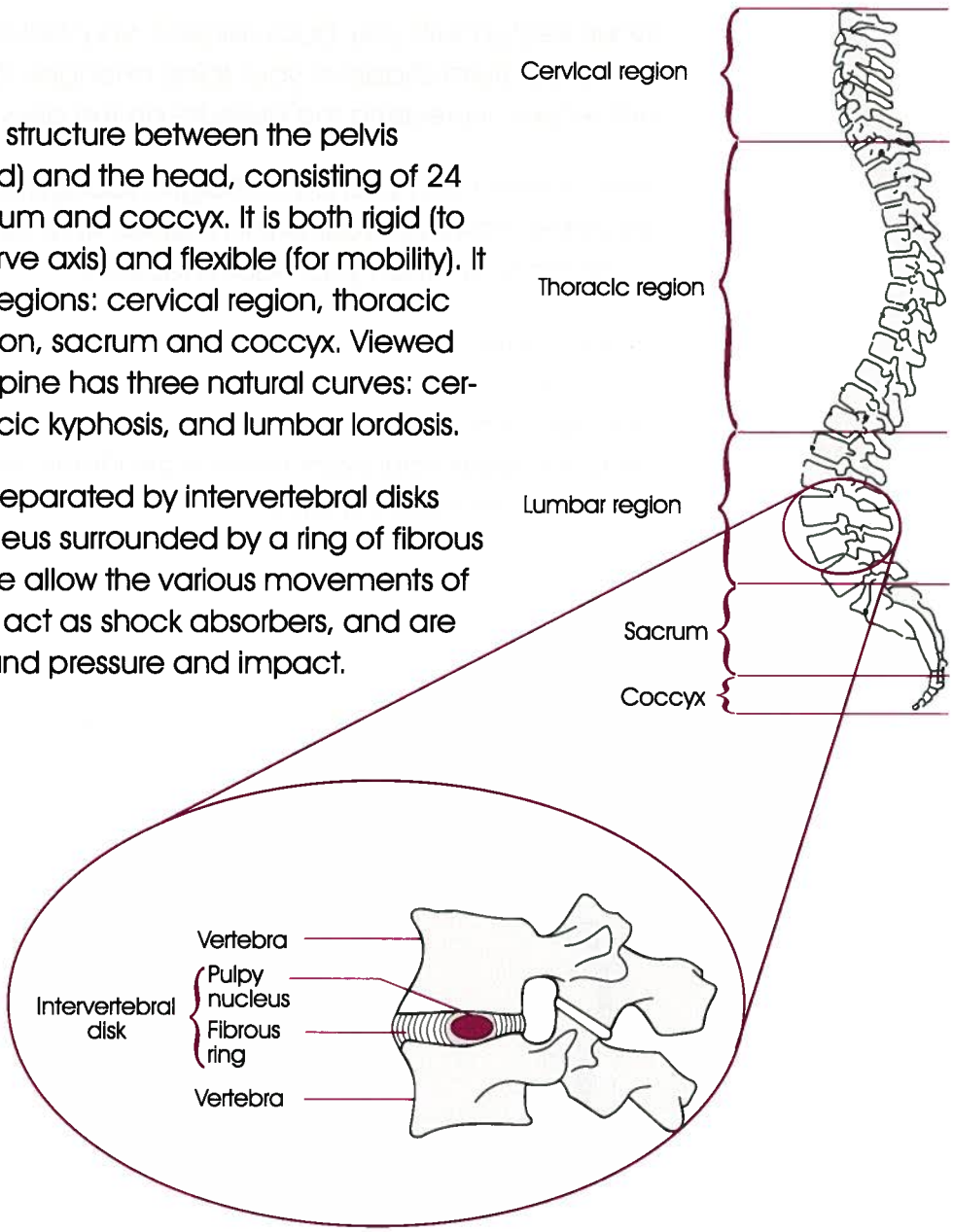
The neck and upper back are ranked second and third as sites of fatigue and pain felt by prepress VDT workers.

The back consists mainly of the spine, muscles and ligaments.

Spine

The spine is a bony structure between the pelvis (where it is attached) and the head, consisting of 24 vertebrae, the sacrum and coccyx. It is both rigid (to protect the vital nerve axis) and flexible (for mobility). It is divided into five regions: cervical region, thoracic region, lumbar region, sacrum and coccyx. Viewed from the side, the spine has three natural curves: cervical lordosis, thoracic kyphosis, and lumbar lordosis.

The vertebrae are separated by intervertebral disks consisting of a nucleus surrounded by a ring of fibrous tissue. The vertebrae allow the various movements of the spine. The disks act as shock absorbers, and are designed to withstand pressure and impact.



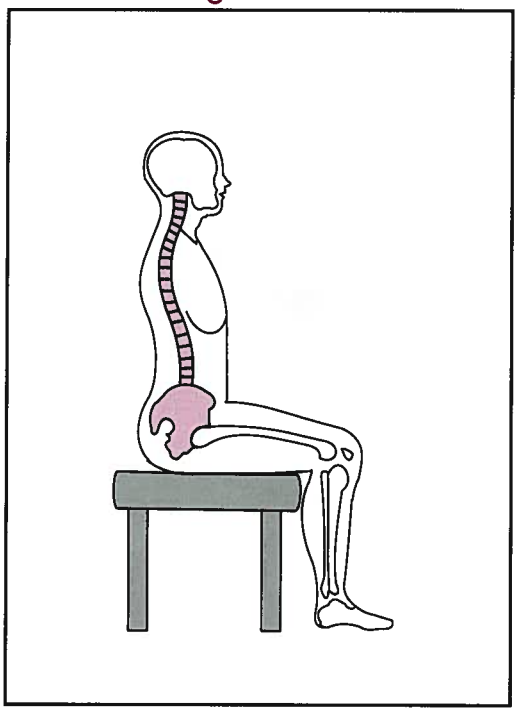
Back posture when seated

When seated with your back relaxed, your pelvis tilts backward and the natural shape of your spine changes. The lumbar curve decreases, increasing the pressure on the disks in this region.

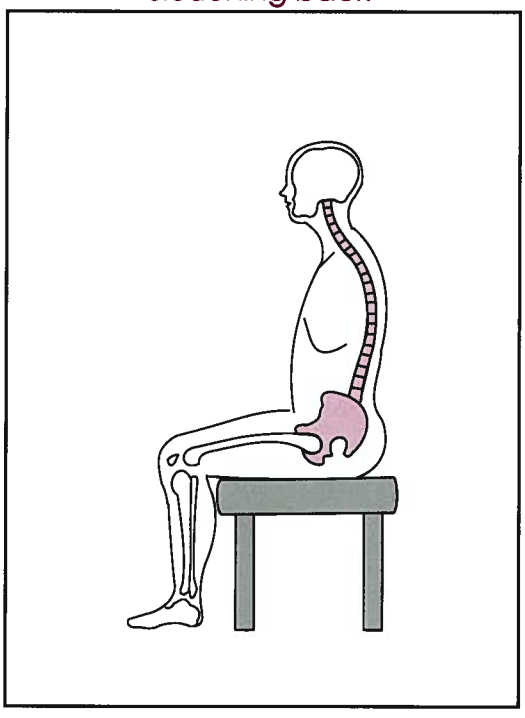
When seated with your back straight, your spine maintains its natural shape. However, your back muscles work statically. They have to do less work when your back is relaxed.

Straight or relaxed, no back position is perfect. The first requires more muscular effort, while the second is hard on the intervertebral disks. When you have to spend many hours seated, you should change your back position frequently and use a back rest to support your back muscles.

Straight back



Slouching back



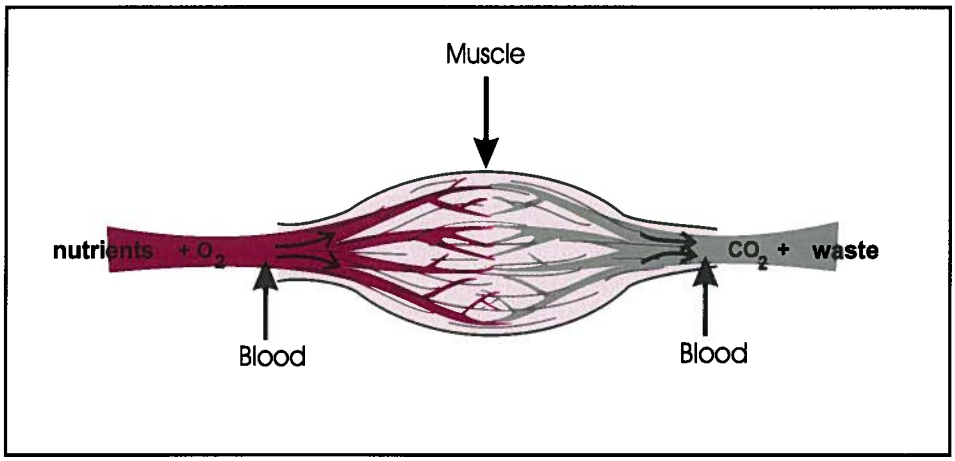
There are three main types of fatigue: localized (muscular) fatigue, general (physical or mental) fatigue, and psychological fatigue. This guide focuses mainly on muscle fatigue.

Muscle fatigue

Muscle fatigue is characterized by a condition or sensation in the muscles, often in a specific area such as the back, neck, shoulders or hands. With fatigue, muscle performance decreases and movements are slower.

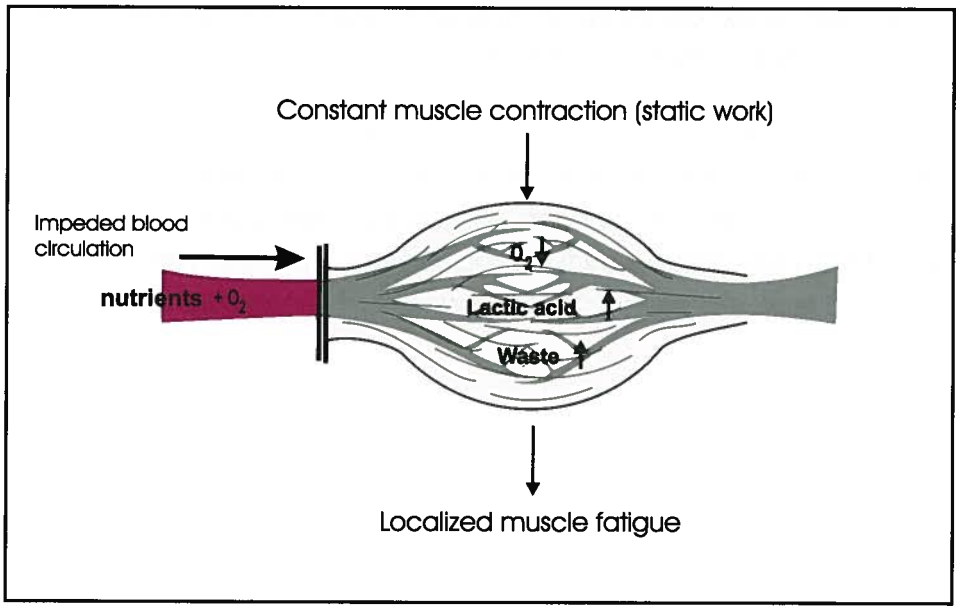
Fatigue should be considered as a warning sign that the body cannot go beyond its capabilities, and that it needs to recover. When there is excessive accumulated fatigue and a limited possibility of recovery, there is a risk of pain or injury.

In moving to adopt a position, the muscles contract and work. They therefore need the energy required for their work. This energy comes from nutrients (glucose, fats and proteins) and from oxygen, which are carried by the blood to the muscles. The blood also carries waste products of the work to the organs that eliminate them.



When muscles are relaxed, oxygen is carried more easily because the blood vessels are dilated. When muscles are contracted, the diameter of the blood vessels decreases, making blood circulation difficult.

During static work, which imposes constant muscle contraction, the oxygen supply is therefore low. The lactic acid and waste accumulated in the muscles increases considerably, and the muscles then have more difficulty moving and fatigue occurs. When movements are too rapid and the recovery time insufficient, dynamic contractions like those required for keyboard finger movements can also produce muscle fatigue.



BODY EFFORT
Fatigue

Muscle fatigue is reversible if the recovery periods are long enough. The recovery time depends on the muscular work and the individual involved. Blood circulation has to return to normal.

A person will be less easily tired if the static or dynamic effort occurs under the best conditions. Sufficient recovery periods and a workstation layout promoting comfortable postures are examples of desirable conditions.

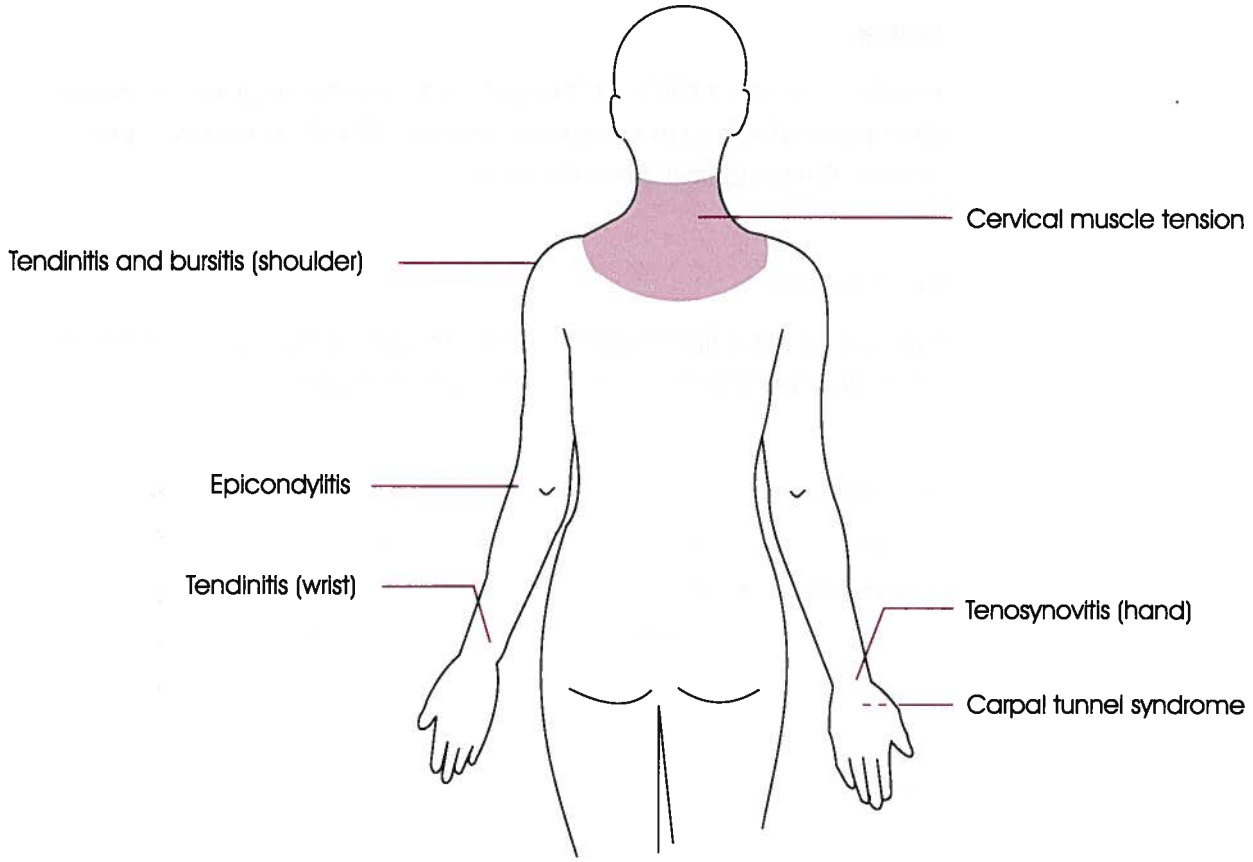
General fatigue is characterized by a non-localized sensation, meaning that it is not in a specific location. The worker feels weak and tired. This fatigue can be physical or mental. Physical fatigue is the result of a generally overworked body. Mental fatigue is the result of excessive mental or intellectual work. Psychological fatigue is related to various factors such as a lack of motivation, pressures at work, or monotony.

BODY EFFORT
Musculoskeletal injuries

Some muscles or joints work constantly in hitting keyboard keys or mouse buttons, moving the mouse, or supporting the arms and back. With overuse, the tendons and structures around the joints no longer have the capacity to regenerate, and are progressively worn, producing musculoskeletal injuries. Some may be irreversible.

Musculoskeletal injuries mainly affect the tendons, ligaments, joints and bones. These injuries can be due to repetitive movements of the fingers on the keyboard, by constrained postures, or by sustained static postures which, in time, produce wear on the musculoskeletal system. Musculoskeletal structures become irritated and swollen, causing tendinitis, bursitis or epicondylitis.

Few musculoskeletal injuries are documented in prepress work; this does not mean that these injuries do not occur. Because of the risk factors to which prepress VDT workers are exposed, these are the ones most likely to occur.



Cervical muscle tension

Cervical muscle tension is a painful condition of the neck and shoulder muscles. The muscles become sensitive to the touch. The adoption of constrained head and arm postures (i.e., head tilted, outstretched arms, raised shoulders) increases the likelihood of this problem.

Tendinitis

Tendinitis is tendon inflammation caused by tension or exaggerated use. Muscles then become less able to perform their functions.

Bursitis

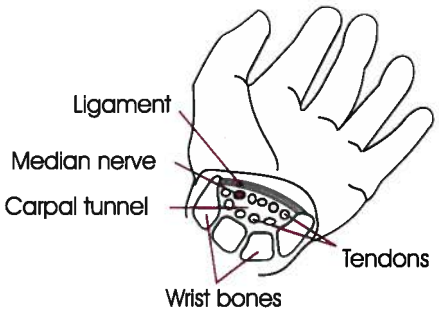
Bursitis is inflammation of the synovial bursae, leading to swelling and pain which can become chronic. Bursitis is mainly due to major friction at the synovial bursae.

Epicondylitis

Epicondylitis is inflammation of the tendon at the elbow, where the muscles responsible for finger and wrist movement are attached.

Tenosynovitis

Tenosynovitis is inflammation of the hand and wrist tendons and the sheaths around them. As in tendinitis, the risk of tenosynovitis increases with excessive use of the finger muscles and extreme wrist postures.



Carpal tunnel syndrome

The carpal tunnel, through which the tendons controlling the fingers and the median nerve pass, is formed by the bones of the wrist and the annular ligament. Carpal tunnel syndrome is a compression of the median nerve at the wrist, producing numbness and pain in the hand. Extreme wrist positions make the carpal tunnel smaller, thereby increasing the risk of friction of the tendons that pass through it and compression of the median nerve.

RISK FACTORS

Risk factors are the factors related to VDT work that can produce discomfort, fatigue or injuries, or are likely to create conditions that promote their occurrence.

An analysis of prepress tasks has identified the main risk factors:

- Excessive visual effort
- Static postures and loads
- Constrained postures
- Repetitive movements
- Local pressure on body tissues

Risk factors are not mutually exclusive. More than one risk factor is often found in a given work situation. Three aspects must be considered in evaluating the importance of a risk factor: duration, intensity and frequency.

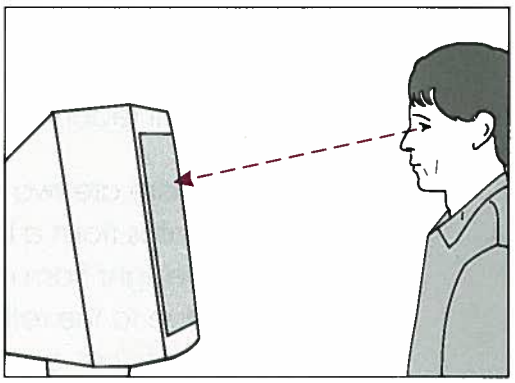
RISK FACTORS
Excessive visual effort

Prepress VDT work imposes a significant visual load on the eyes. Many hours are spent in front of a screen. Image processing, lay-out and graphical page make-up are tasks that require staring at a screen for long periods of time. In data entry, the eyes move frequently between the document, screen and keyboard. These visual activities involve many different eye movements and adjustments that require that the eye muscles work continuously.

Visual fatigue and discomfort occur mainly when the eyes are overworked and visual conditions are inadequate (i.e., reflection, lighting, screen display). Inadequate visual conditions not only increase the visual load but may also explain certain uncomfortable postures adopted by the workers so that they can see better. For example, in getting closer to the screen to see better, the worker adopts an uncomfortable posture with his body bent forward, without any support for his back.

RISK FACTORS
Excessive visual effort

Fixed gaze



Workers who do image processing, page make-up or graphical layout must constantly stare at a screen. This work requires considerable precision and attention, and consequently their eyes are fixed on the screen for long periods. In close visual work in a sustained position, the mechanisms of convergence and accommodation are sustained. The muscles involved are therefore working intensely, resulting in visual problems and fatigue.

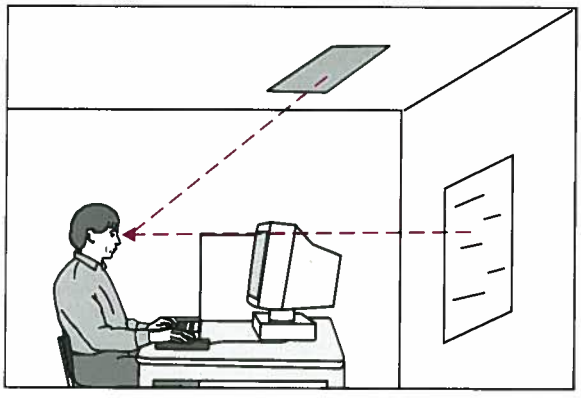
Eye blinking is also less frequent in visual tasks that require concentration and attention. Some people who concentrate too much on their work forget to blink, thus increasing their risk of dry and irritated eyes.

Glare

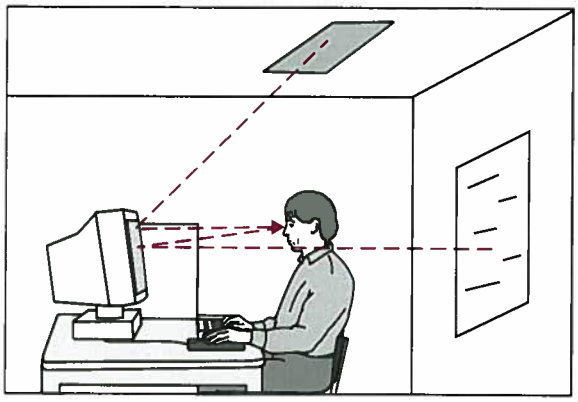
Glare due to screen reflection is a frequent complaint of VDT workers. Glare interferes with vision and is caused by too much light reaching the retina despite the pupil's adjustments.

There are two types of glare: direct and indirect. Direct glare originates from a light source located in a person's visual field. It can be light from a window, a lamp or a light fixture. Indirect glare is due to the reflection of the light from a light source on a shiny surface (i.e., screen, film covering documents or digitizer tablet).

Direct glare



Indirect glare



In both cases, too much light coincides with the line of vision, impedes vision, reduces visibility and can be a major cause of eye discomfort and visual fatigue. Too much light may make the pupil constrict; its diameter no longer responds to the screen task's visibility requirements. This happens when we work facing a window.

Glare generally depends on workstation and screen layout in relation to the light sources.

Intensity of the lighting

The intensity of the lighting, or the amount of light in an environment, has a considerable impact on visibility in the task to be performed. In several companies, it was noted that the lighting was not always appropriate for the screen task performed.

Many prepress VDT workers complain about the intensity of the lighting. In image processing and layout, most people generally consider the light too bright; in data entry, it is often considered to be too dim. Also, rooms frequently contain people performing VDT tasks that have different visual requirements.

Improper lighting reduces visibility, increases visual effort and contributes to eye problems and fatigue.

Screen and document characteristics

Document or screen characters that lack sharpness or are small in size may cause visual problems.

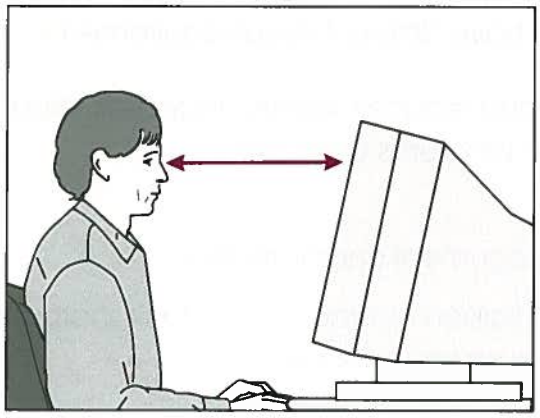
Factors such as general lighting, brightness and screen resolution, character–background contrast (on the screen or on the document), and dust on the screen have a significant impact on visual quality. Objects displayed on the screen can be seen because of the light emitted by the screen. Too bright lighting can reduce the contrast between the screen display and the background.

A lack of sharpness makes the eyes work harder, and attempting to compensate for it increases the risk of eye fatigue and discomfort.

Eye–screen distance

Eye–screen distance is an important consideration in visual tasks. It determines the convergence and accommodation work that the eyes must do. The shorter the distance, the more the eyes have to work. This has a direct impact on eye fatigue.

When the table supporting the screen is not deep enough, the user is forced to work too close to the screen.



RISK FACTORS
Static postures and loads

Dynamic work involves muscle contraction and relaxation, while static work involves sustained muscle contraction. Sustained postures against gravitational forces produce static loads, which can result in fatigue and injury.

Prepress VDT work involves static muscular work. The different parts of the body are practically immobile and there is very little articular movement. The improper layout of some equipment may involve an upper limb position that requires additional muscular effort.

The duration of VDT work makes static loads an important risk factor.

Areas affected by static loads

A sustained sitting posture

Most prepress work requires a sustained sitting posture. Over time, this can be tiring and painful for the back and neck. The sitting posture adopted and the back support provided by the chair's backrest are determining factors in evaluating this risk factor.

Many workers do not rest their backs against their chair's backrest when they do VDT work. This happens mainly when they bend forward to see better or when the backrest is poorly adjusted or the seat pan too deep. Without support, the back and neck muscles remain contracted to stabilize and support the body and head. This static muscular work may cause fatigue, tension and stiffness in the back and neck.

Sitting also increases the pressure exerted unequally on the lumbar disks. This pressure may cause problems, particularly when it is sustained, and explains the discomfort and pain felt by some prepress workers.

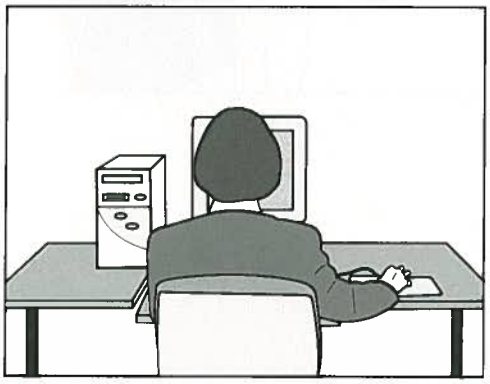
Shoulders held in a raised position

Working continuously with the shoulders raised is a frequent cause of discomfort in prepress workers. This sustained position requires static muscular effort, which over time, produces muscle tension in the trapezius muscle. The result is fatigue in the shoulders, neck and sometimes even the upper back.

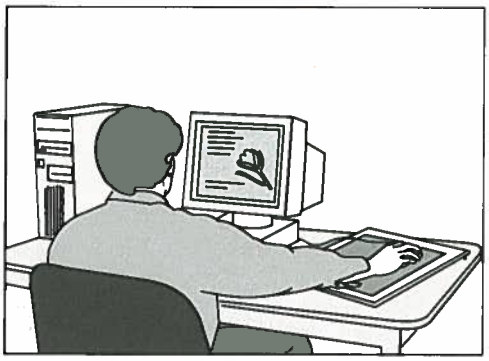
The height of the keyboard or mouse is the most common reason for this posture. A keyboard or a mouse placed too high forces us to raise our hands, and consequently our shoulders. This posture alone creates tension and muscle fatigue.

Arms held outstretched

Holding an arm outstretched is another position frequently observed in prepress workers. It is mainly seen in image processing, page make-up and layout. In most cases, workers use a mouse placed on their work table, beside the keyboard, or beside the screen if the keyboard is on a retractable keyboard tray. The effect is an outstretched arm to the front or side.



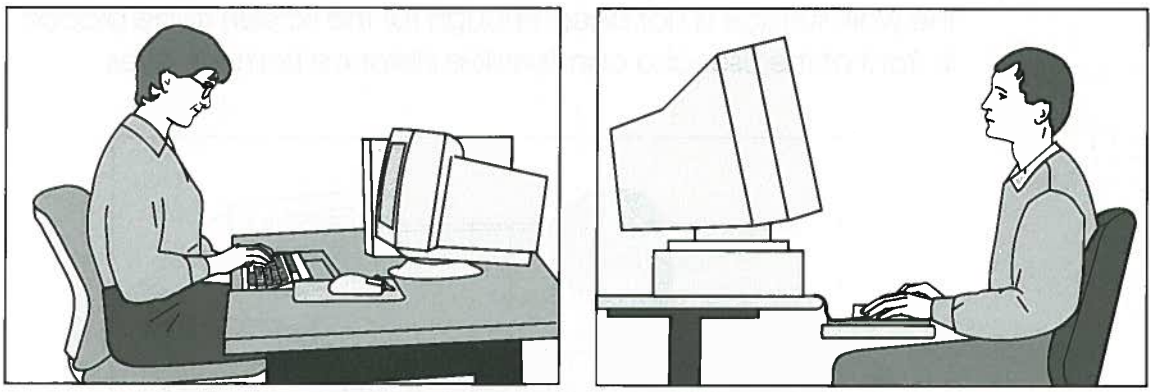
An outstretched arm, when the hand controls a mouse, produces static loads in the shoulder muscles. This results in an increased risk of fatigue and pain. Muscle tension develops due to the sustained static position, which is tiring for the shoulders.



In computer graphics, some workers use a mouse on a digitizer tablet; the surface area is quite large. This tablet, generally tilted so that the information entered can be seen, is placed beside the keyboard, or beside the screen if the keyboard is on a retractable keyboard tray. Under these circumstances, the mouse is too far away and too high. To move it, the worker has his arm outstretched, almost fully extended, with his shoulder raised. This posture can result in significant fatigue and pain in the shoulder, neck and upper back.

Keeping the head tilted

Tilting the head forward or backward for long periods requires static muscular effort. This posture can produce fatigue and pain in the neck and upper back.

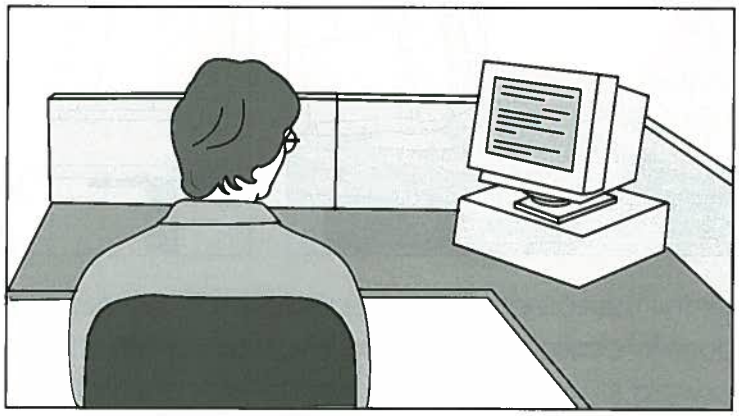


In data entry, the screens used are usually small in size. They are also frequently observed to be too low; workers have to tilt their heads forward to look at them. In image processing and page make-up (in what is commonly called the computer graphics department), the screens are considerably larger. When the screen height is not properly adjusted to the worker's size, the worker has to raise his head to look at the screen.

In both cases, the static loads generated by tilting the head forward or backward may explain the fatigue or pain felt in the neck and upper back.

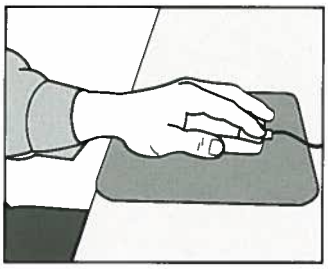
Keeping the head turned

Keeping the head constantly turned to the side produces muscle tension in the neck. This posture is observed in workers whose screens are placed to the side. This location is often used when the work surface is not deep enough for the screen to be placed in front of the user at a comfortable distance from the eyes.



Controlling the mouse

Image processing, design, graphical layout and page make-up are tasks requiring considerable precision. Most of this work is done using a mouse, and because of the nature of the tasks, the mouse must be handled and moved precisely, with frequent small movements.



Under these conditions, mouse control may produce significant static loads in the forearm, wrist and hand. The faster the pointer speed, the harder the mouse is to control. The muscles used are constantly contracted, which may explain the fatigue and pain felt in the forearm, wrist and hand.

RISK FACTORS
Constrained postures

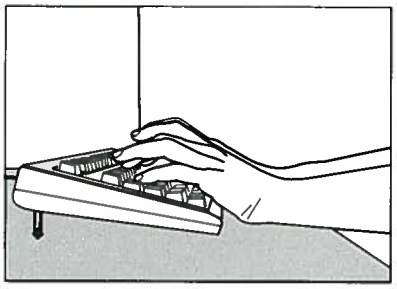
Some frequently repeated postures, even over short periods, may be uncomfortable; they produce tension that results in fatigue and pain. In VDT work, two postures seem particularly constrained: the head turned and tilted forward to read documents, and wrist extension in using the keyboard or the mouse.

Head turned and tilted

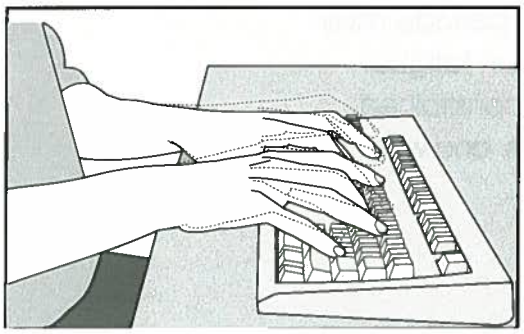
In data entry, the main activity consists of reading information on documents and entering it into a computer. When these documents are placed flat on the table, the worker must tilt and turn his head to read the text. The location of the documents is therefore an important factor which determines the head position adopted by the worker. Also, documents lying flat can produce reflection that reduces visibility. The worker then tilts his head in order to see better. In both these cases, head position may explain the discomfort felt in the neck.

Wrist extension

Some wrist positions can produce wrist and hand discomfort and injury. Wrist extension, a position frequently observed with people using a keyboard, is one example. This position makes the carpal tunnel smaller, which may in time result in irritation and inflammation of the tendons and compression of the median nerve, both of which pass through this smaller tunnel.



RISK FACTORS
Repetitive movements



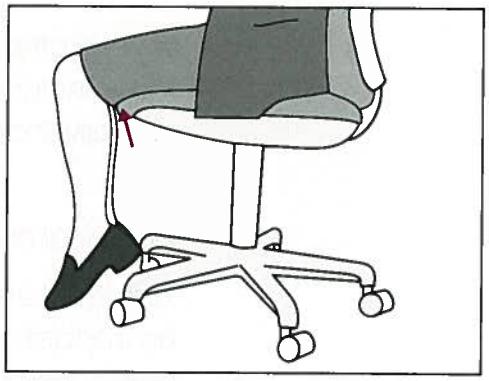
In data entry, workers rapidly enter text or data using a keyboard. Finger movements on the keyboard are repetitive and rapid; the same muscles work constantly. This repetition and speed may cause fatigue, pain and injury.

These constantly working muscles do not have the time to recover. When tissues do not have time to recover, repetitive movements may produce irritation and inflammation of the tendons and sheaths around them, resulting in fatigue and pain and even injury in the wrists, hands, forearms and elbows.

RISK FACTORS
Pressure on body tissues

A seat that is too high, too short or too deep may be a source of discomfort and pain.

Constant pressure under the thighs compresses the blood vessels, impeding blood flow. This may produce discomfort which can be felt as numbness or swelling in the legs.



Several other factors may indirectly cause fatigue, tension or pain. These include personal characteristics, working methods, noise and psychological factors.

Individual characteristics

Individual characteristics, different from person to person, have an impact on the human body. Age, gender, types of body tissues, height, weight, lifestyle and physical condition are examples. Discomfort occurs when the risks exceed the capacity of the musculoskeletal system to withstand them. Tolerance thresholds vary from one person to the next.

Prepress work involves significant visual effort. Visual acuity is therefore important for VDT workers. When a worker suffers from a reduction in visual capacity, an eye specialist should be consulted to correct the problem. Reduced visual capacity may cause fatigue.

Working methods

Working methods may also have an impact on discomfort.

The method used to perform a task may determine the posture adopted, the static loads, or the rapidity of finger movements. Workstation design or layout, available equipment, habits, production requirements or experience may explain the different working methods adopted by workers.

Noise

Prepress workers frequently mention ambient noise as a source of annoyance or difficulty in their work. This noise comes from conversation, or employee or equipment movement. Even attenuated, this noise can be irritating to the point of affecting the workers' attention and concentration, and may even reduce their efficiency. In time, it may create significant psychological and physical stress.

Psychological factors

Some aspects of the work also have an impact on the worker's psychological state by affecting his physical or mental health. Working conditions may produce stress, leading to adverse reactions and considerable muscle tension.

The constant changes in data processing are one example. The new programs or software do not always meet the needs of their users. Workers must adapt quickly, often in a work situation. Errors, system crashes, or excessive work may result, possibly contributing to increased stress and worry.

The social environment can also represent a source of stress and worry. The working climate, production pressures and difficult communications are some examples.

WHERE CHANGES CAN BE MADE

There are different areas where action can be taken to reduce or eliminate risk factors. The main ones are workstation design, work organization, training and individual action. This section presents these areas and proposes solutions.

The solutions presented are practical suggestions taken from different documents dealing with VDT work, or based on general ergonomic principles and on corrections made in companies in the industry, or suggested following ergonomic interventions carried out by the Association sectorielle.

It is important to remember that most of the time, ergonomics is a case-by-case situation. Proposed solutions must therefore be adapted to the characteristics of the people involved, the tasks performed, the equipment used, and the work environment. The whole problem must always be studied before proposing and adopting solutions.

WHERE CHANGES CAN BE MADE
Workstation design

When we talk about workstation design, we are of course talking about the equipment used, but also about the layout of the workstation and the environment in general.

Chair

Prepress VDT workers spend most of their time seated. Task requirements may even require a sustained posture for long periods. A static posture is a major source of fatigue which can cause back problems, particularly if the position maintained is unsuitable.

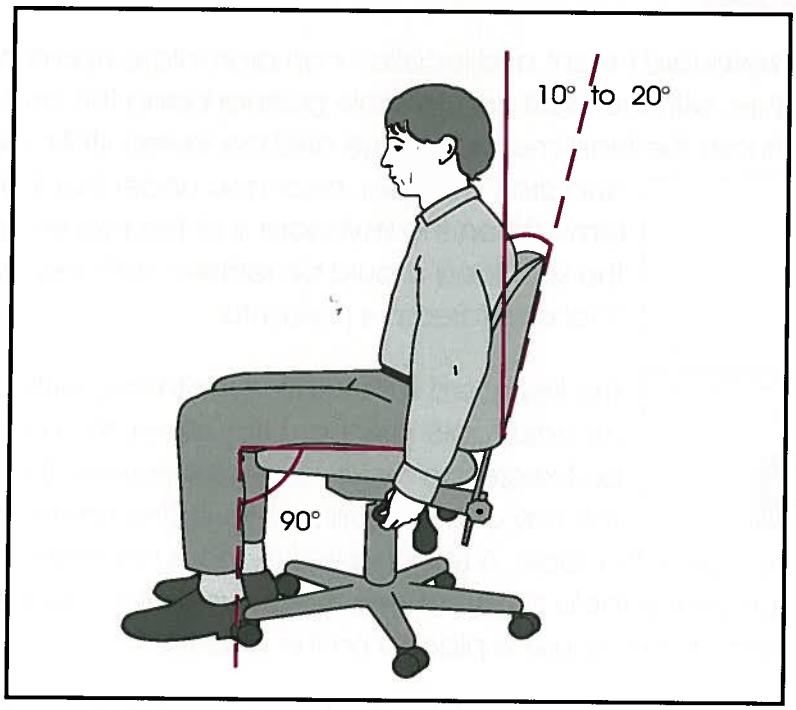
The chair's characteristics have a direct impact on the sitting posture adopted and its effects. The chair must reduce static loads by promoting changes in position. It must also reduce disk pressure and dorsal muscular activity. A chair should therefore be chosen that has a system for adjusting the seat and backrest to the user's size. The seat and backrest height and angle must also be adjustable.

If several people use the same workstation, each one must be able to make these adjustments. The adjustment levers should be accessible from a sitting position and be easy to use.

Chair characteristics that promote a comfortable posture

Characteristics	Adjustments	Purpose
Seat height	To give an angle of 90° at the knees when the feet are flat on the floor and the legs are perpendicular to the floor	Body weight is supported at the feet and reduces the risk of pressure under the thighs
Seat depth and width	Should be large enough to support the pelvis The edge of the seat must not exert pressure behind the knees	Promotes a stable position and provides a ssufficiently large support surface to allow changes in position
Seat pan angle	Should be parallel to the floor	A slight forward angle reduces the load on the spine but increases the risk of sliding forward A slight backward angle makes the backrest easier to use
Backrest height	Upper edge at the shoulder blades, particularly for continuous VDT work	Supports the entire back without interfering with shoulder mobility
Backrest width	Should be wide enough to support the entire back without interfering with upper limb movement	Supports the back
Backrest angle	Should be 10° to 20° from the vertical	Reduces disk pressure and back muscle activity by transferring part of the weight from the upper body to the backrest without interfering with visual work
Backrest with a lumbar support	Should be located in the lumbar region and have a curvature of 1.5 to 2 cm	Maintains the natural curvature of the lumbar region and reduces disk pressure
Inside shape of the backrest	Should be convex from top to bottom (lumbar support), and concave from one side to the other	Provides proper support by fitting the anatomy of the back

Comfort angles and adjustments



Other characteristics

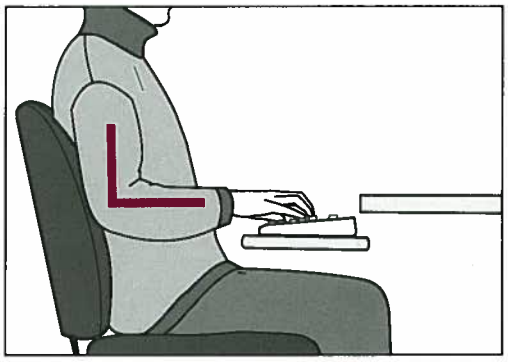
A firm and permeable upholstery provides good support and stability, makes changes in position easier, prevents sliding, and provides better air circulation.

To avoid tipping and to prevent falls, the chair should have a 5 arm base with a rather large surface area. Casters make chair movements easier, while a pivoting system makes body and upper limb movement easier.

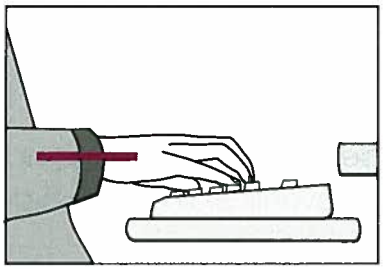
If the chair has armrests, they should be at elbow level when the user's arms are vertical. When the armrests are in the correct position, the user's shoulders can rest without being thrust forward; armrests make it easier to go from a sitting to a standing position (or from standing to sitting). However, they should not prevent the user from bringing the chair close to the table, while keeping his back supported by the backrest.

Keyboard

The keyboard height and location can promote a comfortable posture, with the most comfortable posture being the one that produces the least muscle fatigue and the fewest static loads and arm, shoulder, neck and upper back problems. When the keyboard is at the proper height, the shoulders should be relaxed, with the arms vertical and forearms horizontal.

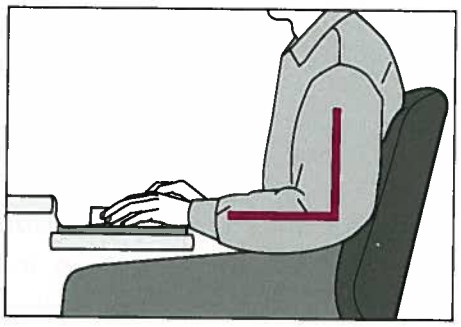


The keyboard should be lower than a writing table. An adjustable keyboard tray allows the keyboard to be lowered to the level appropriate for the user. This tray can be removable (sliding under the table) or be part of the table. A removable tray does not reduce the space on the table but increases the distance the user's arm has to reach if the mouse is placed on the work table.



The keyboard angle can have an impact on wrist position, and should be reduced so that the wrist is a natural extension of the forearm. Most keyboards are equipped with feet for changing the angle.

Mouse



Many prepress work tasks require frequent use of a mouse. The user should adopt a posture that produces the least muscle fatigue and fewest static loads and arm, shoulder, neck or upper back problems. The posture adopted should allow the user to keep his shoulders relaxed, upper arms vertical and close to his body, and his forearms horizontal.

The location of the mouse can help achieve this posture. The mouse should be lower than a writing table. A sufficiently large adjustable keyboard tray could also hold the mouse. A mouse that is placed lower and in front of the shoulder controlling it will promote a comfortable position that is less likely to cause problems.

Depending on the equipment available, it is not always possible to place the mouse on the same retractable tray as the keyboard. A surface that supports the forearm controlling the mouse could be installed.

The mouse's properties can also be adjusted. The relationship between the distance the mouse travels and that of the pointer on the screen can be selected by the user. When the pointer speed is too fast, the mouse is too difficult to control; when the pointer is too slow, the mouse has to be lifted more often.

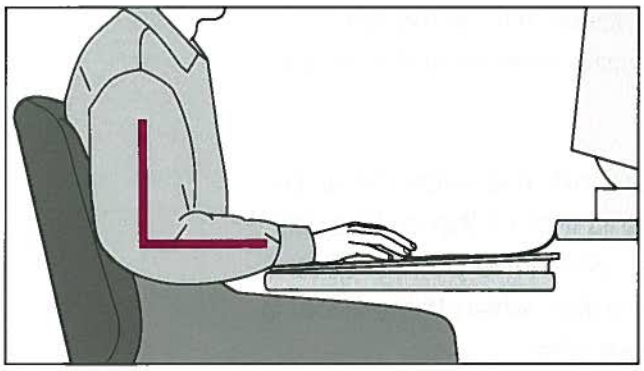
Footrest

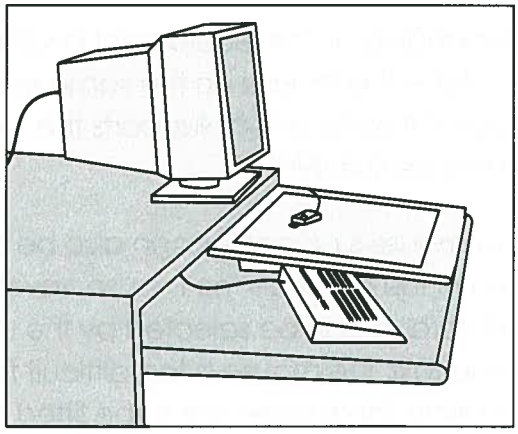
When a comfortable upper limb position cannot be achieved (i.e., keyboard or mouse placed too high), the chair can be raised and a footrest used. A footrest supports the feet, relieves pressure under the thighs, and also allows the user to change leg position.

Digitizer tablet

People who use a mouse on a digitizer tablet should find a comfortable arm position for controlling the mouse. The layout of a workstation with a digitizer tablet is more complex because it requires a larger work surface.

The digitizer tablet could be placed between the worker and the screen, in front of the shoulder of the arm controlling the mouse. The surface supporting the tablet could be height adjustable. This would allow the mouse to be lowered. This lower position would improve visibility of the information written on the tablet and allow the tablet's angle to be reduced, thereby providing a more comfortable position for the arm.





Digitizer tablets are often covered with a transparent film. To avoid reflection from this film, a matte rather than a shiny finish should be chosen.

Screen

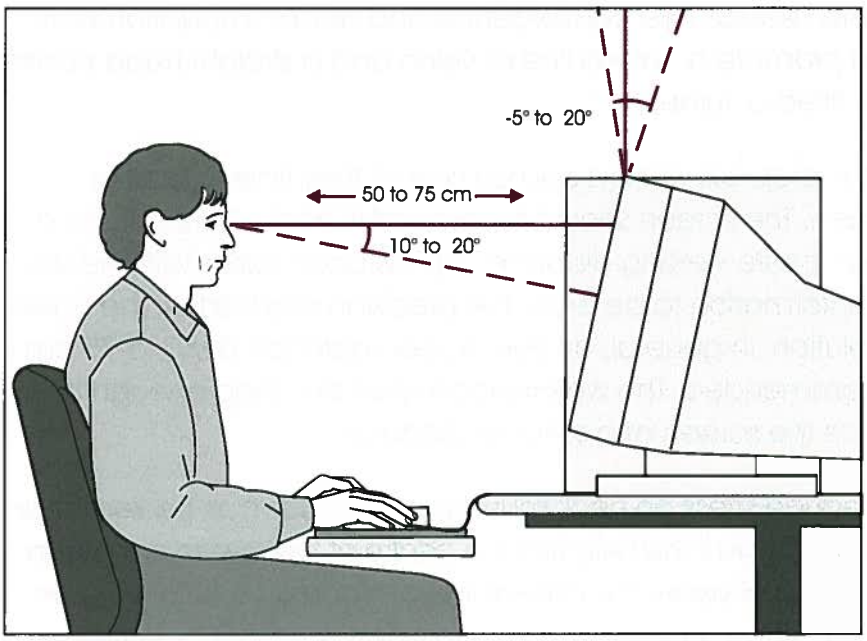
In VDT work, there is a risk of eye and neck fatigue. These can be prevented by adjusting the screen's height, angle and distance. These adjustments should make the displayed information more visible, reduce eye convergence and accommodation work, and promote a natural line of vision and a straight head position (not tilted or turned).

Many prepress workers spend most of their time in front of a screen. The screen should be placed in front of the user, at an appropriate viewing distance. This distance varies with the size of the information to be read, the precision required, or the screen's resolution. In general, an eye–screen distance of 50 to 75 cm is recommended. The work surface must be deep enough to place the screen at a suitable distance.

To reduce stress on neck muscles, the head must be kept straight. This is possible if the height of the centre of the screen corresponds to the line of vision. The natural line of vision is 10 to 20 degrees below a horizontal line at eye level. The screen should be lower for workers wearing progressive lenses or bifocals.

In prepress work, screens vary considerably. Screens used for image processing, layout and imposition are generally larger than those for data entry. The upper part of a small screen is often at eye height. This is not the case for the large screens used in computer graphics. Screens must be adjusted in relation to the line of vision.

A natural line of vision can be achieved and reflection on the screen can be reduced by adjusting the screen angle to between –5 and 20 degrees from the vertical.



Consulted documents

In text or data entry, the documents are looked at much more than the screen and should therefore be placed in such a way as to promote a comfortable head position. They should be in front of the worker, just beside the screen. There are two objectives: to reduce head movement between the screen and documents, and to avoid having to read the documents with the head tilted forward.

Eye–document distance also depends on the document's visual characteristics (i.e., character size and sharpness).

Copy holder

A copy holder allows the documents to be placed just beside the screen, in front of the user. An adjustable copy holder allows the user to adjust it easily to the most suitable height and distance.

Ambient lighting

Lighting that is too bright reduces contrast and visibility and increases the risk of visual discomfort. For VDT workstations, it is often recommended that the ambient lighting be less than that required for general office tasks. The recommended ambient lighting level varies from 200 to 500 lux.

The lighting must take into account the type of task to be performed on the screen. For example, people who look at the screen and the documents during data entry must be able to read both easily. Comfortable ambient lighting, and supplementary lighting for reading documents, may be one way of obtaining the appropriate amount of light for the tasks.

Other screen tasks, such as image processing, require considerable visual acuity. For these tasks, the recommended lighting is between 200 and 300 lux, which gives the impression that the room is dark. When documents must also be consulted, supplementary lighting is recommended.

A lux is the unit of measure in lighting, meaning the luminous flux density that reaches a surface. It is measured with a light meter.

Workstation layout

All reflecting or direct light that blinds or bothers workers must be avoided or reduced as much as possible. Workstations should therefore be arranged so that the different sources of lighting, including windows, are parallel to the line of vision, beside the screen. The light will then be directed towards the work surface rather than the workers' eyes. If this layout is difficult to achieve, partitions or blinds can be used to block the light. Light fixtures equipped with diffusers distribute the light more evenly and reduce the risk of glare.

Supplementary lighting can also be a source of glare and must therefore be directed towards the documents rather than the workers' eyes.

Anti-glare filters

Filters are available that eliminate glare when installed on the screen. However, they can also reduce screen contrast, which has a direct impact on the visual effort required. Anti-glare filters are an alternative that is inappropriate for prepress work because image quality is an essential aspect of this task. Anti-glare filters could make the work more difficult.

Excessive visual effort can result in eye fatigue. One way of resting the eyes is to look elsewhere, outside the immediate work area.

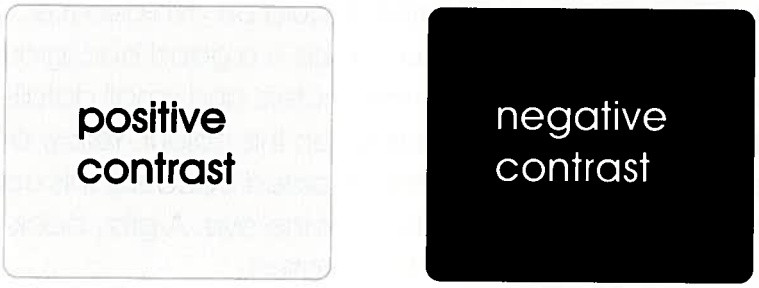
Screen contrast

Screen contrast is the difference in brightness between the characters and background. In other words, it is the relationship between background brightness and character brightness.

There are generally two types of screen displays: positive contrast (dark characters on a light background) and negative contrast (light characters on a dark background). Properly adjusted, both can provide suitable contrast. However, each has advantages and disadvantages.

Positive contrast is what we generally find on printed documents. Going from a positive contrast screen to a positive contrast document is therefore easier on the eyes. A light screen also has the advantage of making reflection less visible, but if the background is too light, there is an increased risk of glare.

Negative contrast offers a better background-character relationship. It also makes flicker less noticeable.



Many computerized systems offer a choice of screen contrast and brightness. It is important to take the time to choose and adjust both the screen's brightness and contrast; characters and images will be clearer and sharper.

Contrast on documents

Proper contrast makes consulted documents easier to read, thus increasing work efficiency. Reading is also easier on matte paper than on glossy paper. When carbon copies or photocopies are used, they should be of good quality.

Colours

Colours can improve the perception and processing of visual information, but if used excessively or inappropriately, can result in eye fatigue and discomfort.

In prepress work, screen colours are generally chosen for artistic purposes or by the client; these requirements must therefore be respected. However, in text or data entry, workers can choose the display colours.

Whenever possible, a limited number of colours should be used in order to reduce the risk of eye fatigue and discomfort. Furthermore, all colour combinations are not appropriate. Studies have shown that low or extreme contrast should be avoided (i.e., yellow and white, blue and red). Although blue is a good background colour, it should be avoided for characters and small details because the eye has difficulty focusing on this colour. Yellow on a green background should also be avoided because this combination creates an oscillation effect for the eye. A gray background provides good colour identification.

Acoustic partitions

Acoustic partitions can help reduce ambient noise and thereby make it easier for the worker to concentrate. Tasks that require concentration should be performed away from traffic areas.

WHERE CHANGES CAN BE MADE
Work organization

Some aspects of work organization can have an impact on exposure to risk. Task duration and distribution, required performance, and work breaks are a few examples.

Like any type of work that requires a sustained posture, continuous work in front of a screen can cause major tension and fatigue problems. Work should be organized in such a way that workers can periodically rest their eyes and the muscles that are repeatedly used.

Whenever possible, tasks should be organized so that workers can alternate screen work with other activities. However, if the work to be done is only in front of a screen, small rest breaks are recommended for the eyes and muscles. The frequency and duration of these breaks depend on the type of task and its intensity. Even short breaks help recovery by eliminating some tension or fatigue, and therefore have a positive impact on performance.

Training does not solve the problems, but is a complementary approach to the other types of interventions.

Training makes the company's different players (i.e., workers, supervisors, managers, committee members) aware of VDT-related pain, fatigue or tension problems. Training increases knowledge about occupational health and safety and ergonomics, and may also have an impact on other areas of intervention such as workstation design, work organization or working methods.

With appropriate training, workers can make enlightened choices. They can review their workstation layout and their working methods, while considering the means at their disposal, their own physical condition and their knowledge.

To prevent the fatigue, tension or pain related to prepress VDT work, a training program should include information on:

- Body structures and functions
- Fatigue, tension and pain
- Risk factors
- Possible solutions

Each individual can contribute to improving or maintaining his physical condition and his eyesight.

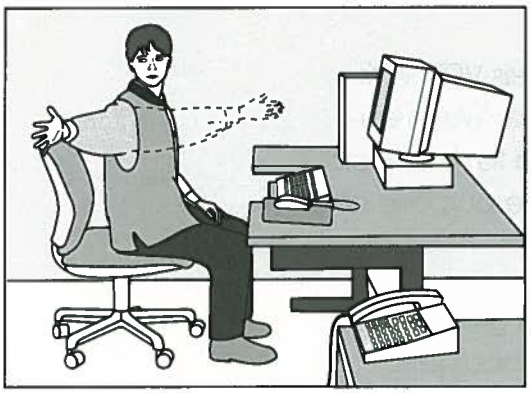
Even with the best possible workplace layout, prepress VDT work involves major static loads and repeated muscle use. We therefore believe it is essential that the body be prepared for this effort and that tension be relieved following work. This is the purpose of our exercise program.

The proposed exercises were chosen for the muscle groups used in this work. The first series prepares the back, torso, shoulders, wrists and fingers for the efforts in VDT work. These exercises can be repeated at the end of each work period to relieve the accumulated muscle tension, and should take approximately 5 minutes.

The second series relieves muscle tension after the work period, and should take about 10 minutes.

One or more of the proposed exercises can be done, depending on the time available and also on the muscle tension felt. For each exercise, we present its objectives, description, and the precautions to be taken. The exercises can easily be done at your workstation in a few minutes.

Shoulders



To prepare your pectoral muscles for the effort required for a sustained arm position

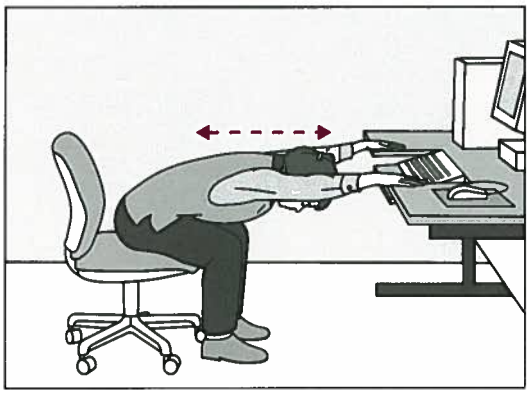
- While inhaling, extend your arm in front of your chest.
- While inhaling, swing your arm towards the back.
- Hold the stretch position for 15 seconds.
- Do this exercise once with each arm.

Note: You shouldn't feel any tingling in your fingers while stretching.

To prepare your shoulders for the effort required to support your arms

- Bring your hands together behind your back; if they don't touch, just bring them as close to each other as possible.
- Hold the stretch position for 15 seconds, breathing normally.
- Do this exercise once with each arm.

Note: You shouldn't feel any tingling in your fingers while stretching. Do not force your shoulders; just keep them relaxed.



To prepare your shoulders and back for the effort required for supporting your arms and for sitting

- Place both of your hands on top of your desk.
- Push your chair back and bend forward with your back flat and straight.
- Inhale and then exhale while pushing your hands on the desk.

Note: You shouldn't feel any tingling in your fingers while stretching. Don't force your shoulders; just keep them relaxed. You shouldn't feel tension in your lower back. Don't bend your back; keep it flat.

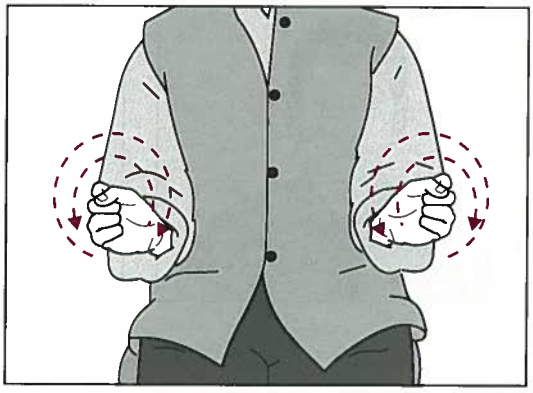
WHERE CHANGES CAN BE MADE
Preparing for effort and relieving tension

Wrists, hands and fingers

To prepare your wrists for the hand movements and support efforts required in using a mouse and keyboard

- Make fists with both hands.
- Rotate your wrists in one direction and then the other.
- Do this slowly 8 times in one direction and then 8 times in the other.
- Breathe normally during the exercise.

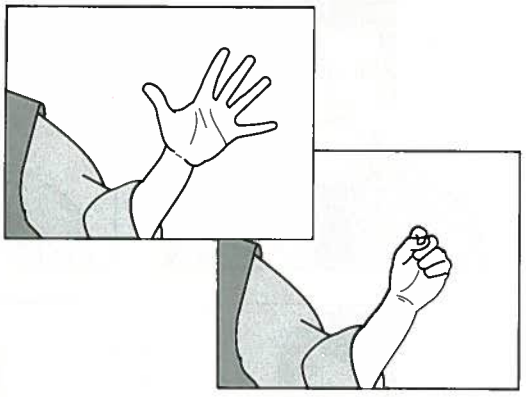
Note: Don't move your forearms. Keep your elbows next to your body and keep your fists tightly closed.



To prepare your hands and fingers for the movement and support efforts required in using a mouse and keyboard

- Make fists, inhale and hold for 2 seconds.
- Open your fingers wide, exhale and hold for 2 seconds.
- Repeat for 1 minute.

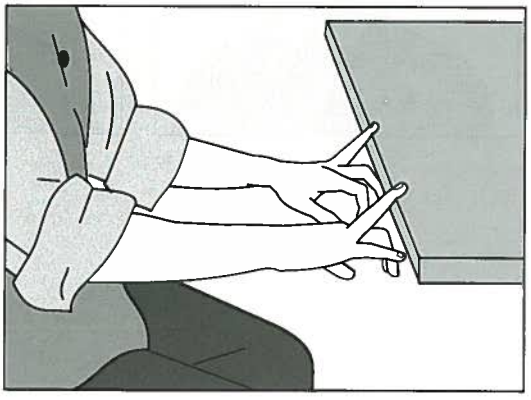
Note: Keep your forearms close to your body. Open your hands wide.



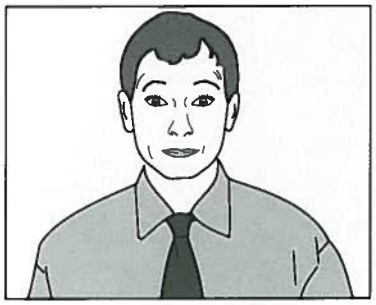
To prepare your fingers for the repetitive movements on the keyboard

- Stretch each finger by placing the tip on the edge of the desk, with your wrists lower than the desk.
- Press lightly with each finger for 6 seconds, breathing normally during the stretches.

Note: Don't move your forearms, and keep your elbows close to your body and your hands relaxed.



Eyes



To rest your eyes and strengthen your eye muscles after VDT work

- Open your eyes wide and then close them tightly.
- Repeat 8 to 10 times, breathing normally.

Note: Keep your face relaxed and your neck straight.

To rest your eyes and strengthen your eye muscles after VDT work

- With your hand covering one eye, look upwards, downwards, right and left with the other eye, holding it several seconds in each position.
- Do this exercise for one minute with each eye, breathing normally.

Note: Cover your eye well with your hand and keep your face muscles relaxed.

Neck

To relax the muscles at the back of your neck

- Put your hands behind your head and bend your head slightly forward while keeping your back straight.
- Hold this position for 30 seconds, exhaling regularly and deeply.

Note: Keep your back straight, and don't bend your head forward too much. You shouldn't feel any pinching at the back of your neck.

To relax the muscles at the back of your neck

- Tilt your head to the left with your left hand on your right ear.
- Hold this position for thirty seconds, exhaling regularly and deeply.
- Repeat this exercise by tilting your head to the right with your right hand on your left ear.

Note: Keep your back straight, and tilt only your head. You shouldn't feel any pinching at the back of your neck.

To relax the muscles at the back of your neck

- Turn your head to the right, cross your left hand over your right, and place your hands on your knees.
- Hold this position for 15 seconds, breathing normally.
- Repeat the exercise by turning your head to the left, crossing your right hand over your left, and placing your hands on your knees.

Note: Keep your back straight, and don't turn your shoulders. You shouldn't feel any pinching at the back of your neck.

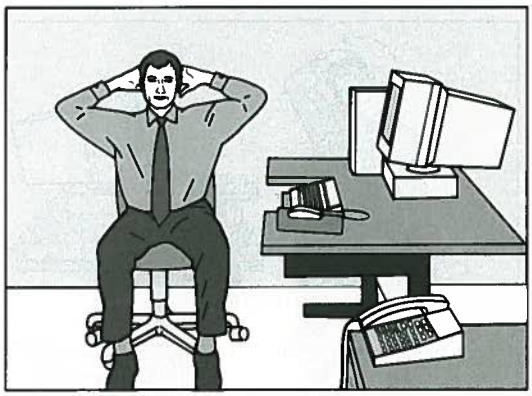
WHERE CHANGES CAN BE MADE
Relieving tension after effort

Upper back

To relax your upper back muscles

- Cross your hands over your chest, hold your shoulders and curl your upper back forward.
- Hold for 15 seconds, breathing normally.
- Return to the starting position.

Note: Keep your lower back straight without having your body touch your thighs.



To strengthen your upper back muscles

- Place your hands behind your head.
- Rest your head against your hands while lowering your shoulders with your back straight, elbows to the side.
- Exhale while resting your head against your hands.
- Repeat 3 times, holding for 15 seconds each time.

Note: Hold your stomach in, keep your back straight, and keep your shoulders down.

To relax and strengthen the muscles between your shoulder blades

- Bend your elbows at face level, bring them close together and hold this position for 15 seconds.
- Repeat the exercise 3 times.

Note: Hold your stomach in, keep your back straight and your shoulders down, and don't bend forward or backward.

Lower back

To relax and stretch your lower back muscles

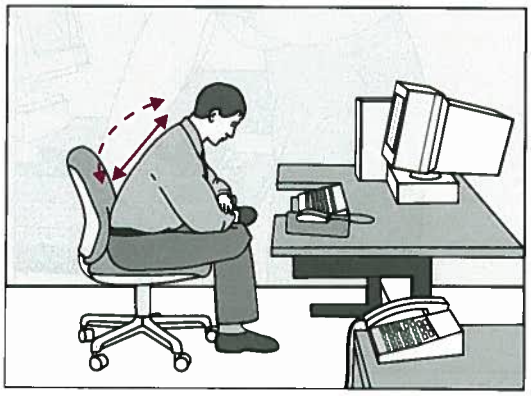
- Have your feet parallel and flat on the floor, with your hands behind your head.
- Curl your chest toward your thighs, exhaling slowly.
- Hold this position for a moment on your thighs.
- Straighten up with your hands on your thighs, and your back straight.

Note: Hold your stomach in and keep your buttocks firmly supported by the seat. Use your hands for support when straightening up.

To relax and stretch your lower back and pelvic muscles

- Place your right foot on your left leg, with your right knee bent.
- Inhale while bending forward.
- Exhale while straightening your back and holding it straight for 15 seconds.
- Repeat this stretch 3 times.
- Repeat with your other leg, placing your left foot on your right knee.

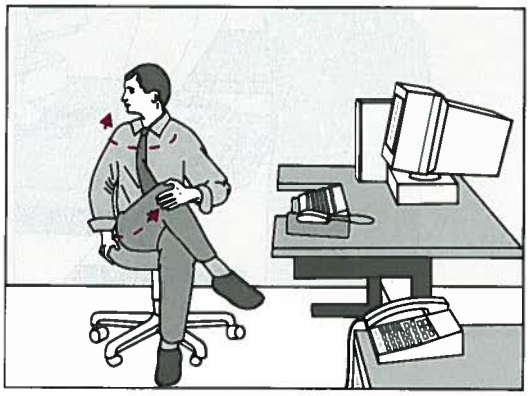
Note: Hold your stomach in and keep your back straight and your buttocks firmly supported by the seat.



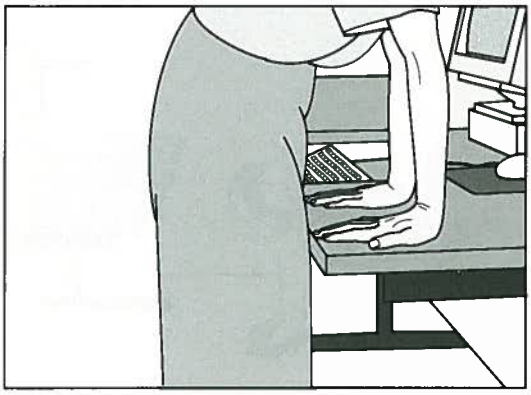
To relax and stretch your lower back and pelvic muscles

- Cross your right leg over your left leg.
- Inhale and exhale, bringing your right knee towards your left shoulder.
- Stretch the outside of the thigh, holding this position for 15 seconds.
- Repeat this stretch 3 times.
- Repeat this exercise, crossing your left leg over your right leg.

Note: Hold your stomach in and keep your back straight and your buttocks firmly supported by the seat.



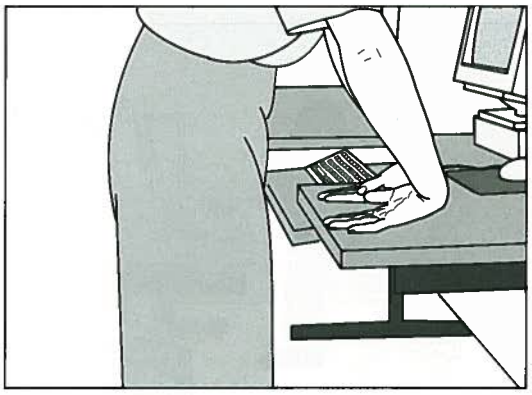
Forearms and wrists



To relax and stretch your forearm muscles

- Stand with your feet parallel and your knees bent and aligned with the centre of your feet, body bent forward, arms outstretched, with the palms of your hands flat on the table.
- Stretch your wrists for 15 seconds, while inhaling and exhaling.

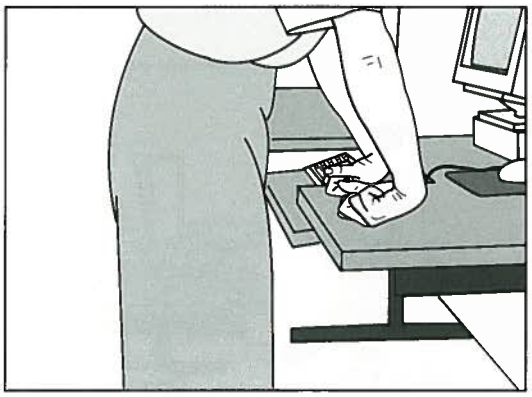
Note: Hold your stomach in and don't force the stretch.



To relax and stretch your forearm muscles

- Stand with your feet parallel and your knees bent and aligned with the centre of your feet, body bent forward, arms outstretched, with your hands on the table and your palms upward.
- Stretch your wrists for 15 seconds, while inhaling and exhaling.

Note: Hold your stomach in and don't force the stretch.



To strengthen your forearms, wrists and hands

- Stand with your feet parallel and your knees bent and aligned with the centre of your feet, body bent forward, arms outstretched, and your hands on the table and palms upward.
- Make fists with both hands.
- Hold this position for 15 seconds, while exhaling normally.

Note: Hold your stomach in and don't force the stretch.

WHAT CAN BE DONE?

Prepress VDT work can cause fatigue, tension and pain. Due to the nature of the tasks performed, many risk factors are involved. Ergonomics is therefore proposed for identifying the sources of risk and for implementing the appropriate corrective or preventive measures.

Preventive action is possible. How? An individual approach is used when a person decides to analyze his own work situation. When the risk factors involved in prepress VDT work are specifically considered, individual action is very important.

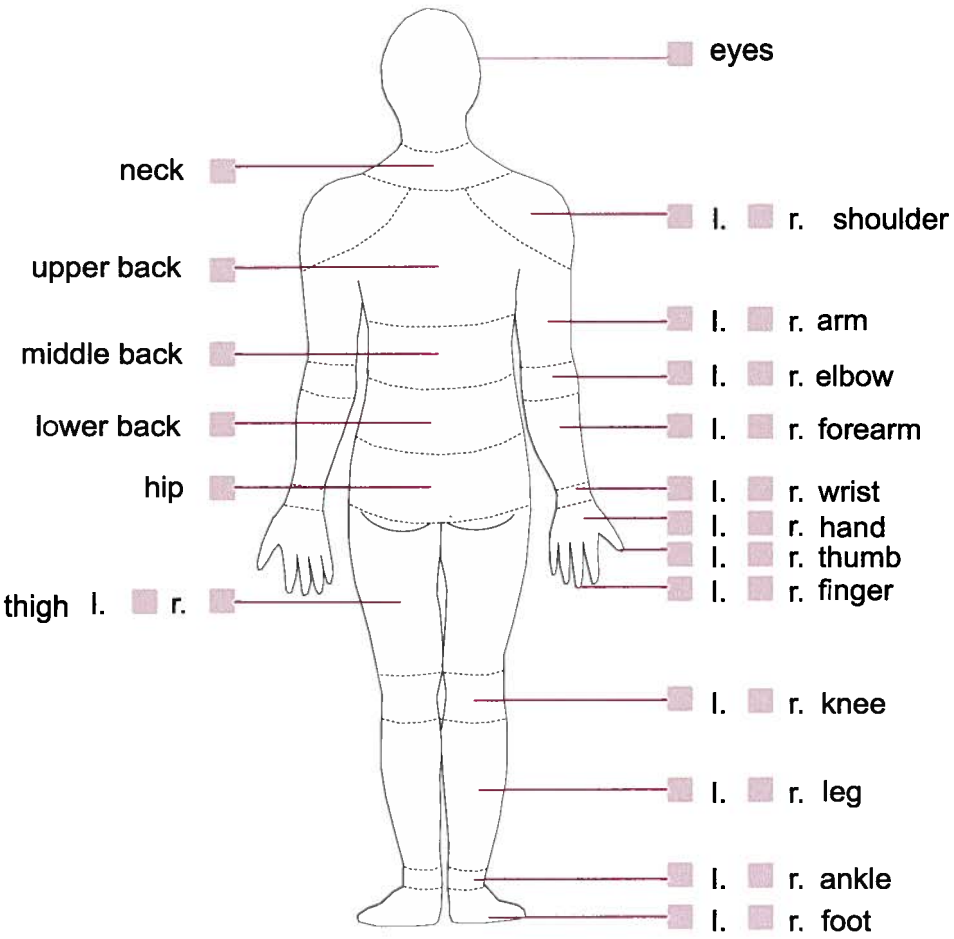
A collective approach can be applied when there are several people involved and the company's internal resources can be used. In complex situations, ergonomic specialists can be consulted.

WHAT CAN BE DONE?
Individual approach

In printing, ergonomics is used to improve working conditions. The objective is to reduce the risk of work-related musculoskeletal disorders. As we have seen, the tasks involve a certain number of risk factors that can result in pain, tension or fatigue.

Individual preventive action can be taken by analyzing your own work situation. To help you, we suggest that you first complete the following questionnaire.

Identification of affected areas



WHAT CAN BE DONE?
Individual approach

After identifying all the areas where you feel fatigue, discomfort or pain, try to understand the reasons.

1. How long have you been feeling pain? _____

2. When does it bother you the most?

   a) during your work shift
      ...at the start ☐
      ...in the middle ☐
      ...at the end ☐

   b) during the day ☐
   c) during the evening ☐
   d) during the night ☐
   e) any time ☐

3. Can you associate the pain, discomfort or fatigue with specific aspects or steps in your work? Which ones?

   _____

   _____

4. How many hours do you work using a screen during a normal work day? _____

   What is the approximate percentage of time that you use a mouse and keyboard?

   Keyboard _____ Mouse _____

5. Does screen work alternate with other activities?

   Yes ☐ No ☐

6. Your work rate is

   Imposed ☐ Not imposed ☐

7. Which, if any, visual conditions interfere with your work?

   ☐ reflection or glare
   ☐ ambient lighting
   ☐ flicker on screen
   ☐ size of characters on the screen
   ☐ clarity of documents consulted
   ☐ screen contrast
   ☐ screen brightness
   ☐ contrast on documents

WHAT CAN BE DONE?
Individual approach

8. Is the eye–screen distance suitable for you? If not, specify.

   Screen too far ☐ Screen too close ☐

9. Is your chair comfortable?

   Yes ☐ No ☐

10. Identify the possible adjustments to your chair.

    Seat height ☐ Backrest height ☐

    Seat pan angle ☐ Backrest angle ☐

    Are the adjustments easy to do?

    Yes ☐ No ☐

11. Does the location of some equipment bother you? If so specify.

    - Keyboard too high ☐ Too low ☐ Too far ☐
    - Mouse too high ☐ Too low ☐ Too far ☐
    - Screen too high ☐ Too low ☐ Too far ☐

      Excessive angle ☐ Insufficient angle ☐
    - Consulted document are too far away ☐ Lying flat ☐

12. Is the mouse easy to control?

    Yes ☐ No ☐

13. Do you take breaks during your work day? If so, specify the frequency (number of times) and duration.

	Frequency	Duration
Formal breaks	_____	_____
Informal breaks	_____	_____

14. What changes would you make or suggest to improve your working conditions?

    _____

    _____

    _____

WHAT CAN BE DONE?
Collective approach

A collective approach is required when more than one person suffers from injuries, fatigue or discomfort (i.e., visual discomfort for many workers in computer graphics). One of the best ways is to set up a committee called an ergo-group.

This ergo-group consists of worker representatives, team leaders, or production, technical services and company maintenance department foremen. Together they try to understand the work to be done, the work activities performed, the related risks (risk factors) and the determining factors in order to decide where to take preventive action.

In a collective approach, the same questions must be answered as in an individual approach. What is the problem? How does it occur? What are the possible causes? What can be done to correct the situation? Since the problem affects a group of people, it is important that each person's point of view be understood if solutions are to be implemented that take into account each worker's needs or limitations.

WHAT CAN BE DONE?
Ergonomic intervention

More complex problems require the intervention of specialized ergonomic resources, particularly when individual or collective action has not identified the problems or provided satisfactory solutions.

In their interventions, ergonomists must understand the entire work activity, meaning the worker himself, the work performed, and the environment. They must consider the variations in the work situations, production conditions or in the workers themselves.

There are three main steps in an ergonomic intervention: the preliminary diagnosis, risk factor analysis, and the development of recommendations to correct the situation.

Preliminary diagnosis

The preliminary diagnosis identifies the potential risk factors and the aspects that may have an impact on them. The problem must be documented by identifying the hazardous tasks, the most difficult work activities, the sources of difficulty, and the areas of pain and fatigue felt by the workers. This information is collected through questionnaires, individual interviews and on-site observations.

WHAT CAN BE DONE?
Ergonomic intervention

Risk factor analysis

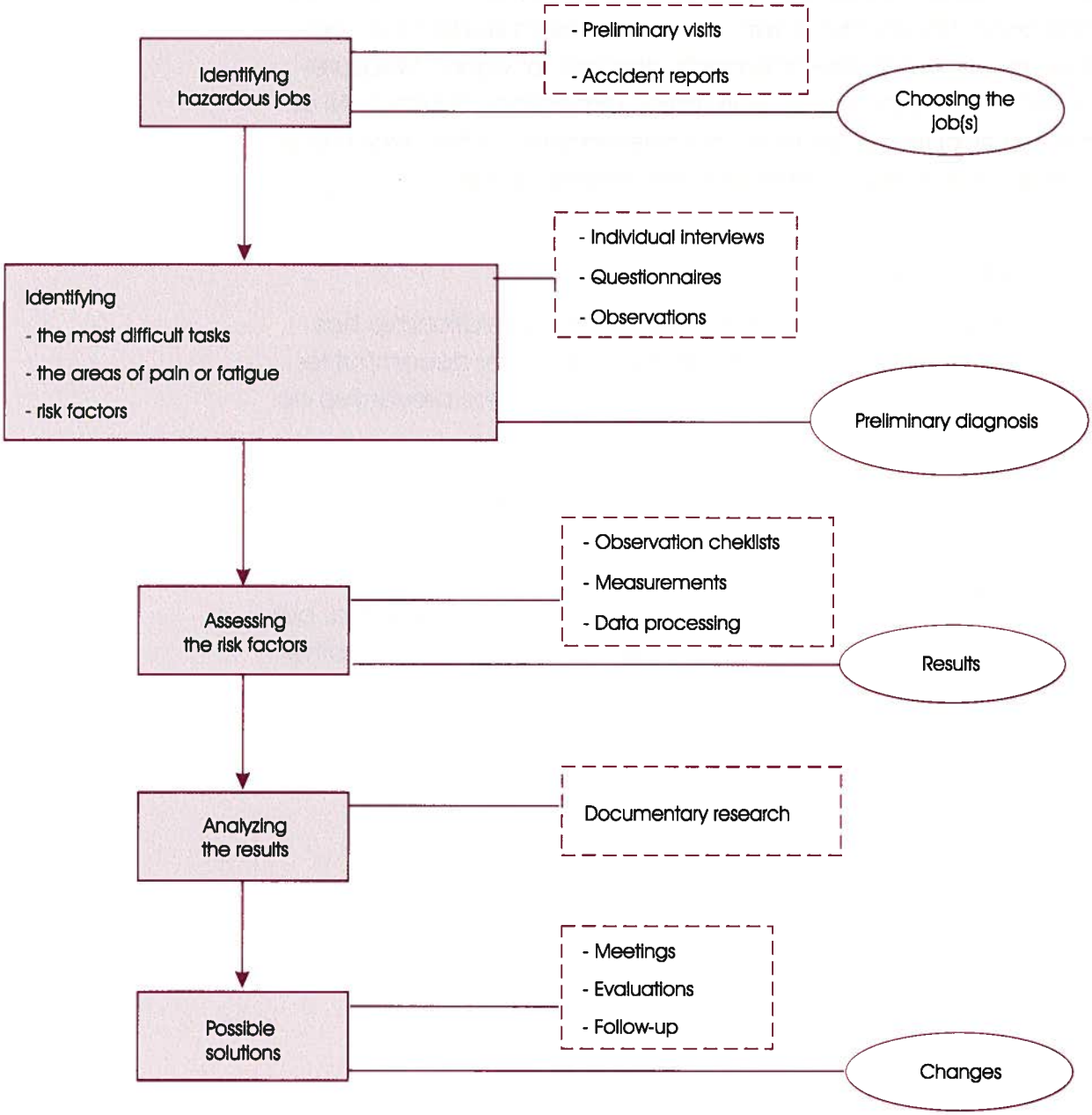
Each potential risk factor must be evaluated to determine its significance. Observations vary with the problem studied (i.e., posture, movements, displacements, direction of vision). Measurements can be taken (i.e., workstation dimensions, lighting). All of the results obtained provide an understanding of the overall work activity and its repercussions on the workers' health.

Finding solutions

Determining factors can be identified once a relationship has been established between the injuries, fatigue or discomfort reported and the work activity. These indicate where preventive action must be taken.

At this step, the collaboration of company representatives (i.e., workers, foremen, members of technical services) is essential in finding the most appropriate solutions. The fact that the contemplated solutions can be implemented has to be established, but also that the proposed corrective measures do not create other sources of risk.

WHAT CAN BE DONE?
Ergonomic intervention



CONCLUSION

Our objective in producing this guide was to provide you with a better understanding of the fatigue, tension and pain felt by pre-press VDT workers. By knowing the main risk factors identified, you will be better able to take preventive action. The information contained in this guide is summarized in table form inside the back cover.

The risk factors and the means described in this document are not absolute rules, but are instead ways of finding solutions to the existing problems. We drew from the many observations and ergonomic interventions carried out in companies within the industry. The information contained in this document is intended for you to use while taking into account the particular characteristics of your own work environment.

We hope that this guide will help you find ergonomic solutions. With the various constraints that companies have to face, perfect workstations are rare. However, we believe that with compromises, workstations can be greatly improved.

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Affected areas	Risk factors	Determining factors
Eyes	Excessive visual effort	- Fixed gaze - Glare and reflection - Intensity of lighting - Document and screen characteristics - Screen location (eye-screen distance)
Neck *Upper back* *Shoulders*	Outstretched arm	- Mouse location
	Raised shoulder	- Keyboard height - Mouse height
	Head tilted	- Screen height
	Head turned	- Screen location
	Head turned or tilted	- Location of consulted documents
Back	Sustained sitting posture	- Work organization
	Unsupported back	- Visual conditions - Screen location - Chair characteristics
Wrists *Hands* *Elbows*	Holding and controlling the mouse	- Working method - Work requirements - Mouse configuration
	Wrist extension	- Keyboard angle - Keyboard height
	Repetitive finger movements on keyboard	- Work organization (work rate or method)
Legs	Pressure under the thighs	- Chair characteristics and adjustments

Adjustments to a workstation with computer screen