Lab Safety
In Orthotics & Prosthetics

Presented by:
Steve Hill, CO
Lab safety in the workplace has become a very important issue in the O&P community within the past dozen or so years. Since we work with power equipment and hazardous chemicals daily, we should be very mindful of the dangers we face.
I’m sure we’ve all heard of OSHA, which is the acronym for the Occupation, Safety and Health Administration. They are the government agency responsible for writing the rules and regulations of safety in the workplace. A wealth of information regarding shop safety, dangerous chemicals and many other health and safety related information can be found at their website, www.osha.gov.
Various Hazards in O&P

• Chemicals/Dust

There are several different types of hazards we face in O&P. For the sake of convenience we’ve separated them into three categories. Chemicals and dust have been combined into one category since the prevention of both is about the same, for all intents and purposes.
Chemicals/Dust

• Carbon fiber

Dangers

Fiber strands and dust

Here are a few chemical and dust examples and their associated dangers. Sanding carbon fiber, found in sockets and laminated orthoses, adds abrasive carbon strands and dust into the air.
Chemicals/Dust

• Carbon fiber
  Fiber strands and dust

• Styrene
  Carcinogenic, soluble in many foods

Styrene has been found to be carcinogenic and is soluble in foods. For example, when you drink hot coffee out of a Styrofoam cup. Adding cream or milk to your coffee can exacerbate the release of styrene.
<table>
<thead>
<tr>
<th>Chemicals/Dust</th>
<th>Dangers</th>
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<tbody>
<tr>
<td>Carbon fiber</td>
<td>Fiber strands and dust</td>
</tr>
<tr>
<td>Styrene</td>
<td>Carcinogenic, soluble in many foods</td>
</tr>
<tr>
<td>Acetone</td>
<td>Minor irritant, highly flammable</td>
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</table>

Acetone, as you are probably well aware, is not only highly flammable but is also a skin irritant. Skin lotion helps a great deal in treating dry skin resulting from acetone exposure.
Chemicals/Dust

- Carbon fiber
- Styrene
- Acetone
- Toluene
- Methyl Ethyl Ketone

Dangers

- Fiber strands and dust
- Carcinogenic, soluble in many foods
- Minor irritant, highly flammable
- Harmful vapors, fumes, flammable.

Toluene and methyl ethyl ketone are found in various glues and cements. The vapors are harmful in many ways and have been shown to cause brain damage, cancer and neurological problems.
### Chemicals/Dust

<table>
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<tr>
<td>Methyl Ethyl Ketone</td>
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<tr>
<td>Metal dust</td>
<td>Major irritant, aluminum flammable</td>
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Metal dust is, of course, a major irritant in several ways. Breathing it in, swallowing it or just getting some in your eye can have serious long term effects. Also, aluminum can be flammable as a fine dust, and fine dust is what we wind up with when we sand metal uprights smooth.
Protection

• Rubber/plastic gloves and sleeves

Depending on the materials being used there are several types of hand and arm protection choices. For the different chemicals and glues you might choose either plastic or rubber gloves. For protection against heat and abrasion one might select a heat insulating terrycloth or leather glove.
Protection

- Eye protection

Protection against flying dust and small particles can usually be accomplished with simple protective glasses. However, when dealing with caustic fluids you might want to select something with more coverage, like a face shield.
Proper ventilation - whether wall mounted, bench-top or overhead - can dramatically control the amount of dust surrounding a work area. A good unit can all but eliminate the dust a technician breathes into his lungs.
Protection

• Breathing filtration/mask

Oftentimes we must supplement ventilation with filtration, especially when we’re working closely to the source of dust or chemical. There are many types to choose from but remember that you get what you pay for. If large dust particles are what you need to filter then the small, disposable type will do. If chemicals and small dust particles are the problem you may need to step up to a respirator with replaceable filters.
Protection

• Wash up thoroughly

Always be sure to wash up after using any chemicals or glues and after sanding any material, especially carbon fiber. Wash your face as well as your hands and both exposed arms. This not only takes it off of your hands but it helps to keep it out of your eyes and mouth through contact with your hands.
Styrene
(Laminating Resins)

Styrene isn’t just found in laminating resins. Even the styrene that can leach out of a Styrofoam coffee cup (when the coffee is hot) can leave trace amounts in your system which can build up over time. But styrene may be the least of this technicians health worries.
Various Hazards in O&P

- Chemicals/Dust
- Machinery

The next category we’d like to address is machinery. No shop worth it’s salt doesn’t have some kind of power equipment. And anything that uses electricity will have at least one hazard to concern you.
Some of the most potentially dangerous machines we use in O&P are the ones that grind, cut or make holes. If it has a spinning blade it will most likely be able to do you some bodily harm. Besides the sanding and chopping they are designed to do, they can also grab a hold of hair, clothing and jewelry and rip them from you or use them to pull you into it. This is why most professional machinists won’t wear their wedding rings.
Machinery

- Grinder
- Router
- Drill press
- Band saw
- Oven

Dangers

- Motorized spinning, rotating, cutting machines.
- Loose hair & clothing, neckties, rings, necklaces and bracelets.
- Noise.

Ovens are usually only as dangerous as the person using them. If you don’t put your body parts on things that are hot you should be okay. Fumes, however, if not properly ventilated, can have adverse effects which can only be defined by the material making the fumes. And though rare, being so close to the heat source all day long can result in a loss of some fluids. Be sure to keep yourself hydrated.
The dangers of sewing machines are well documented. All it takes is for your hair to get caught in the belt wheel or the needle to get through your skin just once and the lesson is learned. Don’t let seemingly innocuous machines lull you into a false sense of security.
Machinery

• Grinder
• Router
• Drill press
• Band saw
• Oven
• Sewing machine
• Hand tools

Dangers

Motorized spinning, rotating, cutting machines.

Loose hair & clothing, neckties, rings, necklaces and bracelets.

Noise.


Spinning motor. Punctures. Hair.

Various, limited only by human ingenuity

Have you ever put out your eye with a screwdriver? Don’t laugh, I’ve seen it done and it’s easier than you think. Just because a tool isn’t powered by electricity doesn’t mean it can’t hurt you all the same. Use all tools with caution and give them the respect they deserve. Especially fresh razor knives.
Protection

- Tie hair back or cut it short

If you have long hair you should always tie it back and up to get it out of the way of machinery. Just putting it into a ponytail may not be enough. That only puts your hair behind you where you can’t see the danger coming. If you can, stuff it up under a hat or similar garment. Better yet, cut it short and eliminate the danger entirely.
Protection

• Remove or secure neckties and loose clothing

Just like your Mother always told you, tuck in your shirt tails. Unless you want to get a “raspberry” on your belly from the drum sander. If your job requires that you wear a tie, be sure to remove it or tuck it into your short before using machinery. Remove anything that can get caught in the equipment.
Protection

• Remove all jewelry (rings, necklaces and bracelets)

In general, it’s not a good idea to wear jewelry to work in the lab. Just like with hair and clothing, jewelry can get caught in equipment. Necklaces and bracelets can be torn from you or worse, pull you toward the cutting tool. The danger from wearing rings is not so readily apparent. When drilling holes in plastic or metal, the drill bit can easily get caught between the ring and your finger. The result is that usually your finger gives before the drill bit or the ring.
Protection

• Be mindful of your fingers (and other body parts) and always wear gloves.

It should go without saying that your body is not for sanding. To this end, be mindful of where your fingers and elbows are when working. Try to keep them out of harms way and protected with gloves or protective gear.
Protection

• Use guards on equipment

Nearly all power equipment comes with some form of guard or guide protecting you from the dangers inherent in that machine. Sadly though, these guards often times make the tool less useful and we find ourselves removing them. But one does this at his or her own peril. If you’ve removed the protective guards you might want to consider replacing them. It may one day save your finger (or more).
Various Hazards in O&P

- Chemicals/Dust
- Machinery
- Noise
<table>
<thead>
<tr>
<th>Noise</th>
<th>Dangers</th>
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<tbody>
<tr>
<td>Grinders</td>
<td>Exposure to decibel (dB) levels over time.</td>
</tr>
<tr>
<td>Routers</td>
<td></td>
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<tr>
<td>Drills</td>
<td></td>
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<tr>
<td>Vacuum pump</td>
<td></td>
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<tr>
<td>Air compressor</td>
<td></td>
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<tr>
<td>Co-workers practicing for American Idol</td>
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</table>

All of these things are noise hazards. Grinders and routers make quite a bit of noise, but drills are less offensive. A vacuum pump isn’t as loud as an air compressor, generally speaking, but both can be damaging. And co-workers who sing at the top of their lungs might be the most offensive kind of noise. The real danger here is mostly the prolonged exposure to various levels of noise.
Protection
• Hearing attenuation (muffs or plugs)

There are three ways you can protect against noise and all three should be employed in concert as best as possible. Generally speaking, for areas of noise that exceed about 90 dB, always wear ear protection. There are many types and all work fairly well. There are even some over-the-ear types that employ electronic attenuation to allow conversational sound through but cut off when it senses loud sounds. This type is more expensive but far safer for the user since background sound is still heard.
Protection

- Limit exposure

The second thing you should do is to limit the amount of time you are exposed to loud sounds. This makes sense since the effects of noise are cumulative.
Protection

• Isolate noisy equipment

Whenever possible, isolate the noisiest equipment. Having a separate and removed area for the air compressor & vacuum pump will eliminate about half of the noise problem in any shop. Another separate room for the sanding equipment will have two positive results; the isolation of noise and the confinement of dust.
The important thing about noise is how loud it is versus how long you’re exposed to it. The three main factors being: Exposure, or how long you are exposed to the noise. Frequency or pitch of the sound. And the Decibel of that sound, meaning how loud it is.
### Noise

<table>
<thead>
<tr>
<th>OSHA’s Permissible Noise Levels</th>
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<tbody>
<tr>
<td>90 dB</td>
<td>8 hours</td>
</tr>
<tr>
<td>92 dB</td>
<td>6 hours</td>
</tr>
<tr>
<td>95 dB</td>
<td>4 hours</td>
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<tr>
<td>97 dB</td>
<td>3 hours</td>
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<tr>
<td>100 dB</td>
<td>2 hours</td>
</tr>
<tr>
<td>102 dB</td>
<td>1.5 hours</td>
</tr>
<tr>
<td>105 dB</td>
<td>1 hours</td>
</tr>
<tr>
<td>110 dB</td>
<td>30 minutes</td>
</tr>
<tr>
<td>115 dB</td>
<td>15 minutes</td>
</tr>
</tbody>
</table>

Here is a list of what OSHA has decided is an acceptable amount of noise over the course of your day. That’s all well and good, but what exactly is a decibel? How can we measure it?
Decibel Level Examples

0dB  Faintest sound heard by human ear.

30dB  Whisper, quiet library.

60dB  Normal conversation, sewing machine, typewriter.

90dB  Lawnmower, shop tools, truck traffic; 8 hours per day is the maximum exposure to protect 90% of people.

100dB  Chainsaw, pneumatic drill, snowmobile; 2 hours per day is the maximum exposure without protection.

115dB  Sandblasting, loud rock concert, auto horn; 15 minutes per day is the maximum exposure without protection.

140dB  Gun muzzle blast, jet engine; noise causes pain and even brief exposure injures unprotected ears. Maximum allowed noise with hearing protectors.

Short of using a decibel meter to test everything in your lab, here are some examples of comparative decibel levels.
Is Your Lab Ready?

- MSDS Book

Is your lab ready should one of these hazards come your way? There are many things you can do to prevent an accident from shutting you down. Not to mention government agencies like OSHA writing you up with potentially expensive violations. One of the first and easiest things you can do is put together a “Material Safety Data Sheets” book. This is a collection of MSD sheets that should come with nearly all of your O&P supplies.
Is Your Lab Ready?

• MSDS Book

1) Chemical Product & Company ID
2) Composition/Information on Ingredients
3) Hazards Identification
4) First Aid Measures
5) Fire Fighting Measures
6) Accidental Release Measures
7) Handling and Storage
8) Exposure Control/Personal Protection
9) Physical & Chemical Properties
10) Stability & Reactivity
11) Toxicological Information
12) Ecological Information
13) Disposal Consideration
14) Transport Information
15) Regulatory Information
16) Other information

This is a list, by section, of what you’ll find on an MSD sheet. In the event that an accident occurs involving a given material, valuable information can be found on these sheets whether it be first aid treatment, reactive elements or fire fighting measures. This book should be kept handy and available in case of emergencies. If you don’t have all of the MSD sheets for the chemicals and such in your lab, downloadable and printable MSD sheets can be found on the Southern Prosthetic Supply website at www.spsco.com.
Is Your Lab Ready?

• Chemical Storage

Storing flammable chemicals in approved cabinets is very important. Though not fireproof, these cabinets are specially designed to resist infiltration by sparks and flame. Another important feature is that they are grounded so they redirect static electricity, greatly reducing accidental combustion. Besides, keeping all of your combustible chemicals in one place cuts down the chance of ignition by simply reducing the number of places they are.
Is Your Lab Ready?

• Eyewash Stations

One of the most common accidents, beside grinding knuckles off, is foreign material getting into the eyes. It's usually plaster or foam dust, but it can also be acetone or toluene. In either event you'll be well served with an eyewash station. They come in several forms from a plastic bottle with a specially shaped spout to a dedicated, double faucet unit. There's even one that can be attached to an existing faucet and sink that is kept out of the way until it's needed. Each of these alternatives are inexpensive and can save your eyesight.
If the dust or fume isn’t around, it can’t do any harm, right? So it makes sense to evacuate any offensive particles before they get the chance to be drawn into your lungs. To that end we can use various types of ventilation. To the left is a ceiling mounted unit that can move allot of air quickly. Since many fumes rise, this is a good place for ventilation. The unit on the right is a workbench with ventilation built in to it. Most of your gluing and cleaning can be done right here and greatly reduce the chances of fume infiltration and combustion.
Is Your Lab Ready?

• Fire Extinguishers

Of course, no shop will be complete without several fire extinguishers placed where they can be seen and used. Exact placement and other requirements can be found on the www.osha.gov website and can vary depending on your lab. Be sure to have them available to each worker (within 75 ft), in places where fires are most likely to occur (chemical storage, electrical equipment) and where there are people gathered (conference and break rooms). Mark the location of each extinguisher with a sign placed so that it can be clearly seen. Check each extinguisher regularly to make sure it’s charged and working properly.
Is Your Lab Ready?

• Evacuation Plan

The lab, just like the patient fitting rooms, must have evacuation plans posted where they can be seen. There may be new employees or visitors who are not familiar with the location of the nearest exit.
Is Your Lab Ready?

• First Aid Station

A well stocked and centrally located First Aid Station is another must for any shop, home or office. In fact, anywhere you find people you should also be able to find a first aid kit of some kind. It’s important to keep them full of the things that you might need in the event of a medical emergency. There are several companies that will come by at specified times and keep it stocked so you don’t have to. Or, you might want to designate a shop safety officer to institute a comprehensive safety plan, including updating the first aid kit.
Is Your Lab Ready?

• Guides & Guards on Equipment

Manufacturers are required to make their goods to be safe. These seemingly obstructive safety devices are there for a reason and should not be removed. Many body parts have been lost to modified equipment.
Safety Review

• Flammables stored away from sparks
• Proper spacing between machines
• Location of ventilation to equipment
• Mark all exits clearly
• Fire extinguishers throughout lab, especially where fires most likely to occur
• Well stocked & centrally located first aid kit
• CPR & first aid courses
Safety Review

• Safety Policy & Procedures
• Dedicated Grinding/Sanding Area
• Dedicated Lamination Area
• Annual Safety Review
• MSD Sheets Updated Annually
Resources

- www.osha.gov
- www.labsafety.com
- www.nsc.org
Don’t be this guy. Think Safety!!
Lab Safety
In Orthotics
& Prosthetics

To receive CE credits, send test & payment to:
Delphi Ortho
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