Accelerators in Rubber Surgical Gloves

By Milt Hinsch

Background

The first Goodyear rubber surgical gloves made for Dr. Halsted and his nurse Carolyn Hampton in 1894 and subsequent rubber surgical gloves were expensive, thick, reusable, reprocessed, resterilized and looked more like rubber housekeeping gloves. In 1961, accelerators enabled manufacturing of the first, thin, disposable gloves.¹

With lower manufacturing and material costs, surgical gloves were less expensive and could be disposable. Thinner surgical gloves were also more comfortable and provided greater tactile sensitivity. In addition, accelerators provided faster and better crosslinking of the isoprene molecules than other sulfur-containing compounds, which improved elasticity, strength and stabilized the rubber for long-term glove storage.

Today, rubber accelerators are used in latex (NRL) and synthetic rubber surgical gloves (Neoprene/polychloroprene and polyisoprene). Recently introduced synthetic rubber gloves designated as ‘made without typical rubber accelerators’ use accelerators that dissociate during vulcanization.

Rubber accelerators typically used to manufacture natural (NRL) and synthetic (PI, Polychloroprene) rubber surgical gloves:

Thiurams

Thiurams often cause Type IV delayed contact dermatitis, and, because of their propensity to cause allergic reactions, they are not used in major US surgical glove brands today

- Tetramethyl thiuram disulphide (TMTD)
- Tetramethylthiuram monosulfide (TMTM)
- Ten other thiurams can be used for rubber manufacture

¹ US Medical Glove Timeline by Regent Medical/Mölndlycke Health Care
Thiozoles

Thiozoles can also cause Type IV delayed contact dermatitis, but sensitization is lower than thiurams

- Zinc Mercaptobenzothizole (ZMBT)

Carbamates:

Dithiocarbamates (DTC) are even less sensitizing than thiurams and thiozoles. (DTC is used in all Biogel® Surgical Gloves except Biogel® NeoDerm™)

- Dithiocarbamate (DTC)
- Zinc Diethylcarbamate (ZDEC)
- Zinc Dimethylcarbamate (ZDMC)

Guanidine

- Diphenylguanidine (DPG)

Thiourea

- Diphenylthiourea (DPTU)

What is the Prevalence of Type IV (Allergic Contact Dermatitis) Allergic Reactions to Accelerators and Glove Chemicals?

More than 4,000 chemicals have been identified as contact allergens. Of those, rubber glove chemicals are among the most frequent cause of type IV allergic contact dermatitis in healthcare staff, usually as a result of frequent glove use.

With increasing rubber glove use in US Health Care during the past 30 years, the number of contact allergies to rubber glove accelerators have also likely increased. Between 1996 and 2000, registered nurses were found to have the absolute highest rate of occupational contact

References:


dermatitis among patients patch-tested by members of the North American Contact Dermatitis Group (NACDG).^5^

A study of 1,255 healthcare staff were patch-tested and the following allergic contact dermatitis (ACD) reactions were found^6^:

<table>
<thead>
<tr>
<th>Accelerator</th>
<th>NACDG *</th>
</tr>
</thead>
<tbody>
<tr>
<td>Thiuram mix 1%</td>
<td>8.87%</td>
</tr>
<tr>
<td>Carba mix 3%</td>
<td>5.43%</td>
</tr>
<tr>
<td>MBT 1%</td>
<td>0.72%</td>
</tr>
<tr>
<td>Mercapto Mix 1%</td>
<td>0.40%</td>
</tr>
<tr>
<td>Mixed dialky thioureas 1%</td>
<td>0.32%</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>15.74%</strong></td>
</tr>
</tbody>
</table>

*Note that some healthcare staff react to more than one accelerator, so the prevalence is perhaps somewhere between 8.87% and 15.74%. The study failed to provide accelerator type IV prevalence among healthcare staff.

US surgical glove manufacturers do not use thiuram accelerators. So, why are US healthcare workers experiencing such a high number of allergic reactions to thiurams?

Some speculate that the reason for the high levels of allergic contact dermatitis to thiurams in Europe is that thiurams are still widespread in the production of cheap latex or nitrile gloves outside of Europe [and the US].

In addition, some of the test data partly dates back to a time when thiurams were generally the most common accelerators in medical protective gloves.^7^

Finally, owing to their close chemical relationship and the chemical changes that rubber accelerators undergo during vulcanization, immunological cross-reactions between thiurams and dithiocarbamates are probable.^8^,^9^

---


Those aforementioned reasons might apply to type IV US test results as well.

Biogel® Powder-free Surgical Gloves are washed and leached more than once to remove mold-release powder, which also reduces the water-extractable protein, accelerator(s) and chemicals levels. The results are Biogel® Powder-free, NRL, PI and Polychloroprene Surgical Gloves have reduced levels of water-extractable accelerators and chemicals.

**TYPE IV ALLERGIES AND RUBBER CHEMICALS/ACCELERATORS**

Even though Biogel® Surgical Gloves have minimal amounts of extractable chemicals, some people develop Type IV allergy from wearing examination gloves, housekeeping gloves, industrial rubber gloves or surgical gloves containing high levels of extractable accelerators. The alternative surgical glove today for people with a Type IV allergy is the Biogel® NeoDerm®, which does not contain any of the common surgical glove accelerators.

Biogel® NeoDerm® uses an accelerator that dissociates during the vulcanization process.

However, there are many OR products such as adhesives, bone cement, rubber tubing etc. that also might cause skin irritation that can be mistaken for a surgical glove accelerator allergy. Something as simple as handwashing soap can also contain chemicals and dyes.

In addition, all surgical gloves contain other chemicals such as antioxidants, which might cause skin irritation or allergic reaction, so Biogel NeoDerm gloves might fail to help everyone with skin irritation and/or existing Type IV allergy.

It is important to know what is causing the ACD to know if Biogel NeoDerm will help eliminate the skin irritation problem.