Tattoos

The Living Canvas

June 26, 2012

BCCDC Environmental Health Seminars

The Tattoo Machine Study: Investigating Organic contaminants on a bagged and unbagged Tattoo machines

Saad Jalili
BCIT Environmental Health Student

Vincent Crozier
PROJECT SUPERVISOR

Elwood
TATTOO ARTIST
OVERVIEW

- WHAT IS TATTOOING
- ASSOCIATED RISK
- GOVERNANCE
- TATTOO MACHINE
- STUDY DESIGN
- PROCEDURE
- RESULTS
- DISCUSSION
- LIMITATIONS
- IMPLICATIONS
INTRODUCTION
Tattooing was widely practiced in many cultures in the ancient world as a form of identification/tribal marking.

Today tattoos are almost always used just for decoration.

Any method of placing indelible ink or other pigments into or under the skin with needles or any other instruments resulting in permanent coloration of the skin.
In 2008, 14% of the American population had at least one tattoo

Estimated 20,000+ parlors operating in the United States

Growing industry
POPULARITY

LEGO Pirate

TokiDoki Barbie

Medical tattoos
ASSOCIATED RISK
ASSOCIATED RISK

- **Blood Borne Infections**
  - Hepatitis B
  - Hepatitis C
  - HIV

- **Skin Infections**
  - *Staphylococcus aureus*
  - *Pseudomonas aeruginosa*

- **Acute Inflammatory Reactions**
  - Allergic contact dermatitis
  - Photoallergic dermatitis
In 2005, 44 cases of antibiotic-resistant Staph infection were linked to unlicensed tattoo parlors practicing suboptimal infection control practices and using non-sterile equipment.

Canadian researchers estimated that tattooing nearly triples the likelihood of HCV infection overall.

In Canada, 12 to 25 per cent of hepatitis C infections among prisoners are associated with tattooed individuals, compared to six per cent of the general population.
Governance
TATTOO STUDIOS IN UNITED STATES

- All tattoo studios are required to be registered with the local Health Authority and tattooist are licensed

- Licensed tattooist
  - Bloodborne pathogens course
  - Prevention of disease transmission course
  - Infection control & aseptic techniques
  - 200 + hours of supervised experiences
Canadian Body Art Industry

- Several provinces have regulations & guidelines
  - Regulated Activities/ Personal Service Establishment Regulations
- Annual inspections & Approval letter
- Tattoo studios do not have to be registered with the Health Authority and tattooists are not licensed
Tattoo artist requirements
  - Vince (BCIT Instructor) is a “certified” tattooist

Apprenticeship
  - Complex
    - 6 - 24 months
    - Blood Borne Pathogen course
    - Infection control training
    - Portfolio (50 - 200 drawings)
    - Fake skin/Fruits/Free tattoos
  - Simple
    - 2-week intensive course of over 100 hours
    - Opportunity for a 1 week supervised training
3 types of tattoo machines

- Rotary
  - Utilizes rotary bearings
- Dual Coil
  - Uses electromagnets
- Pneumatic
  - Runs on air compression

Dual Coil is the most commonly used tattoo machine
The rotary type tattoo machine utilizes rotary bearings rather than springs to move the tattoo needle and deposit the ink into the skin.

- Quieter
- Less intimidating
- Not common
- New models are autoclave friendly

Stigma–Rotary® FLY
Pneumatic Machine

Pneumatic type tattoo machines run on air compression, rather than coils or bearings.

- Lighter, about 2oz
- Autoclave friendly
- Relatively new
Dual Coil Machine

The dual coil tattoo machines use wound copper coils that move the needle via springs. The mechanism is similar to that of a doorbell in that it uses electromagnetic current to force the needle down and up.

- Commonly found in parlors
- Greater precision
- Relatively cheap
- Two subtypes: Liner & Shader
CATEGORIZATION
TATTOO MACHINE
## STERILIZATION/DISINFECTION

<table>
<thead>
<tr>
<th>Item classification</th>
<th>Risk</th>
<th>Minimum level of treatment</th>
<th>Treatment used</th>
<th>Items at a tattoo parlor</th>
</tr>
</thead>
<tbody>
<tr>
<td>Non-critical</td>
<td>Low</td>
<td>Intermediate or Low level disinfectant</td>
<td>- 5.25% bleach - Quats - 3% hydrogen peroxide</td>
<td>- Spray bottle - Clip cord - Tattoo machine frame</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Semi-critical</td>
<td>Moderate to high</td>
<td>High level disinfectant</td>
<td>- 2% gluteraldehyde - 6% hydrogen peroxide</td>
<td>- Pigment/ink trays - Chuck/clamp</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Critical</td>
<td>Extremely high</td>
<td>Sterilization</td>
<td>- Steam autoclave - Dry autoclave</td>
<td>- Tattooing needles - Metal tube - Grip</td>
</tr>
</tbody>
</table>
TATTOO SETUP

We use disposable products whenever possible & disposable surface barriers to ensure a sterile environment at all times.

- Autoclavable nalgene bottles with single use disposable covers.
- Digital power supply with single use disposable surface barrier film applied.
- Single use disposable clip chord sleeve/cover.
- Single use disposable medicine cup.
- Single use disposable medical grade surface barrier.
- Single use disposable tattoo needles in sealed sterile packaging, opened in front of client.
- Single use disposable tools in sealed sterile packaging, opened in front of client.
- Sterile medical tool tray.
Body Modification Workshop
The divide between tattoo artist

Bagged Machine
- The needle bar oscillates 50 - 3000 times /min. The rapid movement creates an electrostatic charge which attracts contaminants

Uncovered Tattoo Machine
- Leaving the machine uncovered allows blood and contaminated ink to settle onto the machine.
### Infection Control Among Professional Tattooists Study

<table>
<thead>
<tr>
<th>Practice (Recommendation)</th>
<th>Percent reporting use of recommended practice</th>
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<tbody>
<tr>
<td>Reuse needles (Never)</td>
<td>87</td>
</tr>
<tr>
<td>Break needles off bars using my hands (Never)</td>
<td>97</td>
</tr>
<tr>
<td>Discard used ink cups after finishing a tattoo (Always)</td>
<td>98</td>
</tr>
<tr>
<td>Change rubber bands on machine after each client (Always)</td>
<td>52</td>
</tr>
<tr>
<td><strong>Cover machine with a disposable plastic cover when tattooing (Always)</strong></td>
<td><strong>34</strong></td>
</tr>
<tr>
<td>Wear gloves on both hands during tattooing (Always)</td>
<td>100</td>
</tr>
<tr>
<td>Use the same setup to tattoo a husband and wife (Never)</td>
<td>97</td>
</tr>
<tr>
<td>Use a steam heat autoclave (Yes)</td>
<td>93</td>
</tr>
<tr>
<td>Autoclave equipment in sealed bags (Yes)</td>
<td>91</td>
</tr>
<tr>
<td>Use color dots on autoclave bags to monitor the autoclave (Yes)</td>
<td>98</td>
</tr>
<tr>
<td>Spore test the autoclave (Yes, monthly)</td>
<td>45</td>
</tr>
</tbody>
</table>

BAGGED TATTOO MACHINE
WHAT IS THE HAZARD

- Personalized Tattoo machines
- Machine cannot be autoclaved
  - Damp-wiped with disinfectant
- Duration of procedure
- Post-procedure
<table>
<thead>
<tr>
<th>Province</th>
<th>BC</th>
<th>AB</th>
<th>ON</th>
<th>SK</th>
<th>MB</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Preparation and Handling of Instruments and Equipment</strong></td>
<td>All clip cords and spray bottles should have triggers and grasped areas protected by plastic bag or wrap which is disposed of after each client</td>
<td>The tattoo machine (motor frame), clip cord and spray bottles should be covered with a disposable plastic sheath. The plastic sheath should be disposed after each client.</td>
<td>Re-usable equipment/instruments and work contact surfaces that cannot be adequately cleaned, disinfected or sterilized (i.e. tattoo machines, spray bottles etc.) shall be covered with single use, disposable covers and the cover shall be discarded after each use.</td>
<td>The tattoo machine, clipcord, and spray bottle should be covered with plastic. Any other surfaces that are touched with contaminated gloves should be covered with plastic, The plastic should be replaced after the treatment of one client and before the next one.</td>
<td>Multi-use items that can not be properly cleaned and disinfected or sterilized may be prohibited (i.e. piercing gun that does not have a disposable sterile cartridge) Refer to Health Canada Infection Prevention guidelines</td>
</tr>
<tr>
<td><strong>Single-use cover recommended for clipcord/ plastic bottle</strong></td>
<td>YES</td>
<td>YES</td>
<td>YES</td>
<td>YES</td>
<td>YES</td>
</tr>
<tr>
<td><strong>Single-use cover recommended for tattoo machine</strong></td>
<td>NO</td>
<td>YES</td>
<td>YES</td>
<td>YES</td>
<td>YES</td>
</tr>
</tbody>
</table>
Comparing the organic contaminants on bagged tattoo machine against the organic contaminants on unbagged tattoo machine to assess whether covering the machine has a change in organic load.
METHODOLOGY

Material & Equipment

- Ultrasnap™ ATP Surface Test
- SystemSURE II™ ATP Hygiene Monitoring System

Why use ATP Hygiene Monitoring System:

- Easy to use
- Reliable
- Inexpensive
- Self calibration
The frame of the machine and electromagnets was dry swabbed using the Ultrasnap swab (R1)

The tattoo machine was bagged using a plastic cover

The client was tattooed and the duration of the tattooing procedure was recorded (Time)

The plastic cover was removed after the procedure

The frame of the machine and electromagnets was dry swabbed using a fresh Ultrasnap swab (R2)

The tattoo machine was disinfected using QUATS
The frame of the machine and electromagnets was dry swabbed using the Ultrasnap swab (R1)

The client was tattooed and the duration of the tattooing procedure was recorded (Time)

The frame of the machine and electromagnets was dry swabbed using a fresh Ultrasnap swab (R2)

The tattoo machine was disinfected using QUATS
SAMPLES

- Electromagnets & machine frame
- Swabs refrigerated
- 10 mins RTP before sample collection
STUDY DESIGN
TRAINING

- Safety concerns
- Training
  - SystemSURE II™ ATP Monitoring System Operator’s Manual
  - Ultrasnap™ ATP swab guide
  - Guide to ATP Hygiene Monitoring
  - BCIT, FOOD 3020 - Lab 6 Surface Sampling Methods
- Follow up
INCLUSION & EXCLUSION

• Inclusion criteria
  Any tattoo procedure performed by (1) & (2) using the dual coil tattoo machine at the tattoo studio

• Exclusion criteria
  • Minors (18 and below)
  • Intoxicated clients
  • Lesions, wounds or any other observable skin condition
  • Swabs that came in direct contact with blood or ink
  • Tattoo machines that were not disinfected using QUATS
VALIDITY & RELIABILITY

- Self Calibration
- Calibration Kit
- Training & Equipment Manual
- Follow-up
- Sampling area (frame and electromagnets)
- Before and After swabs
PROPOSED TIMELINE

- 16 week sampling:
  - 60 tattoo procedures
    - 30 bagged machine
    - 30 unbagged machine

- Jan 2nd: ATP Monitoring System Calibration
- Jan 5th: Training Elwood & Co.
- Jan 8th: Pilot Project
- Jan 10th: Sampling Begins
- Apr 10th: 13 weeks of sampling – 60 tattoo procedures
- May week 1: Result analysis and report submission
ACTUAL TIMELINE

- 6 week sampling:
  - 38 tattoo procedures
    - 19 bagged machine
    - 19 unbagged machine

Jan 19th: ATP Monitoring System Calibrated
Jan 25th: Trained Elwood & Co.
Jan 26th: Pilot Project
Jan 29th: Sampling Begins
Feb 6th: Tattoo shop Renovation
Apr 19th: Tattoo Shop Reopens – Sampling Resumed
May 15th: 38 Tattoo procedures performed
RESULTS
Organic Contaminants on Unbagged Tattoo Machine before and after the procedure

Tattoo Procedure

RLU

Before
After
# Unbagged Tattoo Machine

## Descriptive Stats

<table>
<thead>
<tr>
<th>Descriptive Statistics</th>
<th>Before</th>
<th>After</th>
<th>Difference</th>
</tr>
</thead>
<tbody>
<tr>
<td>RLU</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mean</td>
<td>123</td>
<td>154</td>
<td>32</td>
</tr>
<tr>
<td>Standard Error</td>
<td>7</td>
<td>5</td>
<td>7</td>
</tr>
<tr>
<td>Median</td>
<td>131</td>
<td>154</td>
<td>24</td>
</tr>
<tr>
<td>Mode</td>
<td>82</td>
<td>184</td>
<td>4</td>
</tr>
<tr>
<td>Standard Deviation</td>
<td>32</td>
<td>24</td>
<td>29</td>
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<tr>
<td>Sample Variance</td>
<td>995</td>
<td>559</td>
<td>863</td>
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<tr>
<td>Kurtosis</td>
<td>-2</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>Skewness</td>
<td>0</td>
<td>0</td>
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<tr>
<td>Range</td>
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<td>95</td>
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<tr>
<td>Minimum</td>
<td>79</td>
<td>103</td>
<td>4</td>
</tr>
<tr>
<td>Maximum</td>
<td>164</td>
<td>198</td>
<td>118</td>
</tr>
<tr>
<td>Sum</td>
<td>2329</td>
<td>2931</td>
<td>602</td>
</tr>
<tr>
<td>Count</td>
<td>19</td>
<td>19</td>
<td>19</td>
</tr>
<tr>
<td>Confidence Level (95.0%)</td>
<td>15</td>
<td>11</td>
<td>14</td>
</tr>
<tr>
<td>95% Confidence Interval</td>
<td>108-138</td>
<td>143-165</td>
<td>18-46</td>
</tr>
</tbody>
</table>
Ho: There is no difference in organic load (contaminant) on an unbagged tattoo machines before and after the tattoo procedure.

Paired T-Test

- Skewness Normality: Reject normality
- Probability Level: 0.000131
- Reject H₀: YES
- Power: 0.999934

- Significant
- Low alpha error
- High Power
- Small sample size
Organic Contaminants on Bagged Tattoo Machine before and after the procedure

RLU

Before
After

Tattoo Procedure

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19
### Bagged Tattoo Machine

**Descriptive Stats**

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<thead>
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<td><strong>RLU</strong></td>
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<tr>
<td><strong>Mean</strong></td>
<td>112</td>
<td>96</td>
<td>-15</td>
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<td><strong>Standard Error</strong></td>
<td>6</td>
<td>6</td>
<td>3</td>
</tr>
<tr>
<td><strong>Median</strong></td>
<td>108</td>
<td>94</td>
<td>-13</td>
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<td>94</td>
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<tr>
<td><strong>Standard Deviation</strong></td>
<td>27</td>
<td>27</td>
<td>12</td>
</tr>
<tr>
<td><strong>Sample Variance</strong></td>
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<td>745</td>
<td>140</td>
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<tr>
<td><strong>Kurtosis</strong></td>
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<td>-1</td>
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<tr>
<td><strong>Skewness</strong></td>
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<td>0</td>
<td>-1</td>
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<tr>
<td><strong>Range</strong></td>
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<td>113</td>
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<td><strong>Minimum</strong></td>
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<td><strong>Maximum</strong></td>
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<td><strong>Count</strong></td>
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<td>99-125</td>
<td>83-109</td>
<td>(-21) - (-9)</td>
</tr>
</tbody>
</table>
**BAGGED TATTOO MACHINE**

**INFERENTIAL STATS**

**Ho:** There is no difference in organic load (contaminant) on a bagged tattoo machines before and after the tattoo procedure.

**Paired T-Test**
- Skewness Normality: Cannot reject normality
- Probability Level: 0.000011
- Reject H₀: YES
- Power: 0.999679

- Paired T-Test
  - Significant
  - Low alpha error
  - High Power
  - Small sample size
## COMPARISON
### DESCRIPTIVE STATS

<table>
<thead>
<tr>
<th>DESCRIPTIVE STATISTICS</th>
<th>BAGGED</th>
<th>UNBAGGED</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>RLU</td>
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<td>14</td>
</tr>
<tr>
<td><strong>95 % Confidence Interval</strong></td>
<td>21* - 9*</td>
<td>18 - 46</td>
</tr>
</tbody>
</table>

* Absolute values
Ho: There is no difference in organic load (contaminant) between a bagged tattoo machine and an unbagged tattoo machine after the tattoo procedure.

<table>
<thead>
<tr>
<th>Skewness Normality</th>
<th>Cannot reject normality</th>
</tr>
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<tbody>
<tr>
<td>Probability Level</td>
<td>0.00000</td>
</tr>
<tr>
<td>Reject $H_0$</td>
<td>YES</td>
</tr>
<tr>
<td>Power</td>
<td>0.999993</td>
</tr>
</tbody>
</table>

- **Independent T-Test**
  - Significant
  - Low alpha error
  - High Power
  - Small sample size

- 3 fold increase when machine left unbagged
3 fold difference
- The electrostatic charge on the plastic cover attracts contaminants
- The removal of the plastic cover cleaned the machine of organic contaminants
- The plastic cover acts like a protective barrier

More studies required
LIMITATIONS

- Time & budget constraints
  - 6 months + $100/student

- Sample collection
  - Bias

- Sample population
  - Only 2 tattoo artists
FURTHER STUDIES

- Larger sample population
  - Include more tattoo parlor
  - More tattoo artist
  - Controls

- Plastic cover

- Disinfection
  - Collect samples after disinfecting

- Correlation: Time vs Contamination
CONCLUSION

- Significant difference in organic load
- 2 level of safety
  - Barrier + Disinfectant = safer
- Limits disease transmission
- Recommendations
  - Guidelines
  - EHO/PHI
ACKNOWLEDGMENT

Vincent Crozier
BCIT Instructor

Elwood and friends
All About Elwood Co.

Bobby Sidhu
BCIT Instructor

Fred Shaw
BCIT Technical Staff

Ayesha Khan
University at Buffalo MPH Student

Laura Chow
BCIT Environmental Health Student

Aniqa Naz
Mother
QUESTIONS
REFERENCES

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- Dual Coil Machine http://www.livestrong.com
- Pneumatic Machine http://www.livestrong.com
- Bagged tattoo machine http://thebacksofmyeyelids.blogspot.com
- Tattoo set up http://mementomoristudios.ca
- Study Design http://philippeleroyersphotostream.flickr.com
- Elwood : http://ivanchan.flickr.com
- Questions : http://edlondonphotography.flickr.com