An exploratory study of occupational health risks for beauty therapists who carry out massage and spray tanning treatments

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An exploratory study of occupational health risks for beauty therapists who carry out massage and spray tanning treatments

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This study explored the possible risks of musculo-skeletal and respiratory ill health for beauty therapists who deliver massage and spray tanning treatments. The delivery of these treatments was observed in three salons who also offered facials, waxing, manicures and pedicures.

The postural analysis of both massage and spray tanning treatments for this study indicated an overall medium risk level of developing MSDs. However, as the reported activity (treatment) durations were short and frequencies low, the risk may be lower than these assessments suggested. If these or other treatments involving similar postures or repetitive movements were carried out for more than two hours a day then further assessment and risk reducing action may be needed.

When delivering spray tanning treatments, the workers’ personal exposures to specific volatile and semi-volatile organic compounds were all low and the active ingredient in spray tan solution (dihydroxyacetate) was not detected. The bacterial/fungal contamination of the samples was very low and not considered to pose a risk to health.

It is acknowledged that the findings of this exploratory study may not be representative of the wider beauty therapy sector. Further study is recommended in order to gain a better understanding of the potential impact of the health issues identified.

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HSE Books
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EXECUTIVE SUMMARY

Objectives

The objective of this study was to explore the possible risks of musculo-skeletal and respiratory ill health for beauty technicians in connection with delivering massage and spray tanning treatments in a salon environment.

Main Findings

This study was exploratory in nature and only three salons were visited. In each of the three salons visited a massage and spray tanning treatment was observed. Consequently, it only represented a small number of beauty technicians, in small salon environments only, and it is acknowledged that the techniques used, postures adopted by technicians during treatments and the environments visited may not be totally representative of beauty therapists working in salons in the wider beauty industry sector. Each salon employed one or two beauty therapists and offered a wide range of beauty treatments including spray tanning, massage, facials, waxing, manicures and pedicures (see summary). Consequently, the findings should not be presumed to extrapolate to all beauty therapists.

Spray tanning: The exploratory study suggested that spray tanning did not pose a high risk of musculo-skeletal disease (MSD) as the postures adopted by the therapists (and the repetitive movements of the upper limbs) were of short duration and were repeated infrequently. However, the study only involved on three therapists working in small salon environments and if spray tanning treatments were repeated during a shift, or combined with other tasks that involved similar postures, then there may be more cause for concern.

The measured personal exposures to propylene glycol, ethoxydiglycol, phenoxyethanol and pentanediol were all low (less than 2 ppm). The active ingredient in spray tan solution (dihydroxyacetate) was not found in any of the samples taken during the study. The measurements were taken during a single spray tan in each of the salons. Given the short duration of the task and the relatively low volume of spray tans performed, the risk from these operations was considered to be minimal.

Only small amounts of bacterial/fungal contamination were observed in the samples of spray tan and moisturiser from each of the three salons. These contaminants are commonly encountered in air, so the low level of contamination was unsurprising. These contaminants could be potentially harmful if present in high numbers. However, the levels of contamination seen in these samples were very low and at these levels they do not pose a risk to health.

Massage: The postural analysis of massage treatments indicated a medium risk of developing MSDs. However, the short duration of the postures and low numbers of massages undertaken by the therapists during a working day suggests that there was no cause for concern. However, it should be noted that the beauty salons participating in this study were small, employing only one or two beauty therapists and where the therapists carried out a range of different treatments within a working day. It is not known whether this is typical of the beauty industry as a whole in the UK or whether there are a number of beauty therapists who carry out massage treatments on a more frequent basis, for example in larger establishments or in health spa environments, who may be at greater risk of developing work-related MSDs.
Recommendations

In order to better understand the issues identified in this exploratory study and whether they represent real concerns for those employed in the industry, the following recommendations are made:

- A study to investigate the prevalence of work-related musculoskeletal aches, pain or discomfort experienced by beauty therapists carrying out massage and spray tanning from the full range of salon environments (micro beauty salons, larger beauty salons and health spa environments).

- A study to investigate the work environment and the frequency with which massage, spray tanning and other treatments are carried out by beauty therapists working in larger salons and in health spa environments.

- A study to establish the frequency with which beauty therapists carry out other treatments, which, may involve non-neutral postures of the trunk, neck or upper limbs.

Summary of Beauty Salon Treatments

Manicure - this treatment designed to improve the appearance of the hands and nails. The skin is cleansed and moisturised, the nails are shaped and polished and the skin surrounding the base of the nail (cuticles) are moisturised and tidied up.

Pedicure - this treatment to improve the appearance of the feet, a pedicure usually incorporates a warm soak to relax the feet and softens the skin and finishes with a foot and or leg massage. Exfoliating and the use of rich creams and oils improve the skin condition.

Facial - a facial consists of several elements including, skin cleansing, exfoliation (removing surface dead skin cells), manual massage using different techniques is incorporated which may include; muscle manipulation, pressure point or lymph drainage massage. The products used will vary according to the client’s skin type and the techniques used by the beauty technicians. Masks may be used throughout the treatment for tightening, hydrating or firming purposes.

Body Massage - may be defined as a series of non invasive manual techniques that affect one or more structures of the body; muscles, joints, skin, fatty tissue, fasciae, blood and lymphatic vessels, in order to release pain, reduce swelling, enhance mobility of joints and alleviate emotional and mental tension. There are different forms of massage, which includes; Swedish, Aromatherapy and Hot Stone. Swedish massage is a deep manipulation of muscles and skin tissue, using oil or cream. It uses a combination of massage movements from superficial and soothing stroking movements to more vigorous deep pressure movements designed to remove tension nodules in the muscles and stimulate the blood circulation. Aromatherapy massage combines the therapeutic effect of a gentle massage with the specific effects of essential oils mixed into carrier or base oil. The essential oils have specific properties, which may be used to benefit the psychological and physical well being of the client. Hot Stone Massage employs a technique that uses smooth, heated basalt stones, which are placed on specific acupressure points on the body to melt away knots, tension and stress. It can also be applied as a relaxation technique using hot essential oils.

Spray Tanning - is the process by which tanning solution is sprayed in a fine mist onto the skin of the client using a lightweight, high volume low-pressure spray gun. Following the application, dihydroxyacetone (DHA) in the spray-tanning product reacts with amino acids in the dead cells layer on the skin surface to produce a brown colour change.

Waxing - is a method of semi-permanent hair removal, which removes the hair from the root. New hairs will not grow back in the previously waxed area for two to eight weeks. Areas most commonly waxed include, eyebrows, face, bikini area, under arms and legs. If waxing is done regularly for several years, permanent hair reduction may be achieved.
1 INTRODUCTION

1.1 BACKGROUND

The provision of beauty treatments is an expanding sector with many small businesses providing treatments such as massage and spray tanning (Habia, 2007). Data from Habia (2007) estimated that 13,000 beauty salons and consultant businesses (which employed around 33,500 people) were operating during 2007 in Great Britain (GB).

Massage can be defined as the manual manipulation of soft tissue with the intention of promoting health and well-being (Moyer et al., 2004). Within the beauty industry it is a commonly practiced therapy intended to promote feelings of relaxation for the client. There are a large variety of massage techniques commonly offered by beauty salons in the United Kingdom (UK). The common element of these massage treatments is the use of interpersonal touch in the form of soft tissue manual manipulation (Moyer et al., 2004).

Spray tanning is the process by which tanning solution is sprayed in a fine mist onto the skin of the client using a light weight, high volume low pressure spray gun attached to an air compressor. Following the application, dihydroxyacetone (DHA) in the spray-tanning product reacts with amino acids in the dead cells layer on the skin surface to produce a brown colour change. This process has become more popular as concerns over skin cancer caused by ultraviolet radiation from sun beds and sun bathing have grown. Salon spray tanning is intended to provide a natural looking temporary and safe but even tan.

Funding has been made available by the Health and Safety Commission for Local Authorities to use to explore how they can make increased use of science. Using this funding, focus groups conducted by the Health and Safety Laboratory (HSL) and reported ‘Identification and prioritisation of emerging health and safety issues in the beauty industry’ (JS2004691, CWH/06/07), concerns have been expressed by Local Authority Enforcement Officers regarding the risks of respiratory and musculoskeletal illness in beauty therapists carrying out beauty treatments. The beauty treatments of particular concern included massage and spray tanning treatments. Further support was requested by both Bath and North East Somerset Council and Amber Valley Borough Council explore these concerns.

An initial search of the literature identified little research specific to the beauty industry, particularly related to respiratory ill health associated with spray tanning treatments. No literature was identified related to musculoskeletal disorders (MSDs) amongst beauty therapists carrying out massage or spray tanning treatments. Manual therapy treatments such as massage are carried out by several professions in the health and complementary therapy sectors and a number of studies into MSDs in massage therapists, physiotherapists and chiropractors have found an association between work-related MSDs and delivering manual therapy treatments. These include pain in the low back, neck, shoulders, wrists and thumbs.

A high prevalence of work-related musculoskeletal pain and discomfort was identified in a survey of 502 Canadian massage therapists with 65% reporting low back pain, 62% shoulder pain and 83% wrist or thumb pain (Albert et al., 2008). Jang et al (2006) studied 161 massage practitioners in Taiwan and found 71% had at least one work-related MSD in a 12 month period with prevalence rates of 50% for fingers/thumb, 32% shoulder, 29% wrist, 25% neck, 24% arm/elbow, 24% forearm and 19% back. Similar high prevalence for MSDs has been found for chiropractors. Mior and Diakow (1987) found that 85% of chiropractors experienced low back pain and identified postural demands of the treatment technique, patient positioning and table height as risk factors in the development of back pain.
Camp et al (2008) in their prospective cohort study of American Physical Therapists found that 57% of respondents complained of work related MSDs and the one-year incidence rate was 20.7%. Disorders of the lower back (7%), wrist/hand (5%), neck (5%) and shoulder (3%) formed the largest proportions of the one year incidence rate in this study which identified patient transfers and positioning, bent or twisted postures, joint mobilisation, soft tissue work and job strain as factors that increased the risk of MSDs. Whilst MSDs relating to the lower back were associated with patient transfer and positioning, MSDs of the wrist and hand were found to be associated with soft tissue work and joint mobilisation. Similarly, Holder et al (1999) found that 32% of American Physical Therapists reported sustaining work-related MSDs; 62% of these concerned the lower back, 23% to the upper back and wrist. Performing manual therapy was reported as the main activity being carried out when injury occurred. Several studies of physiotherapists have found a high prevalence of thumb problems (65-83%) associated with manual therapy and soft tissue techniques (McMahon et al, 2006, Atkinson & Maher, 2004).

The initial literature search did not identify any research concerning MSDs and spray tanning treatments in the beauty industry. Industrial paint spraying has some similarities and studies have identified risks of upper limb MSDs amongst manual spray painters in the woodworking industry (Bjoring & Hagg, 2000a). There was a lack of information available regarding respiratory ill health and microbiological content of spray tan.

1.2 AIMS AND OBJECTIVES

The aim of this study was to identify and assess the possible risks of musculo-skeletal and respiratory ill health for beauty technicians in connection with delivering massage and spray tanning treatments in a salon environment.

To achieve this aim, the study adopted the following objectives:

- Collect subjective feedback from beauty technicians about the range of treatments they carry out and the techniques they employ;
- Assess the working postures and movements beauty technicians adopt whilst carrying out massage and spray tanning treatments;
- Analyse the postures and movements using standardised tools such as Rapid Entire Body Assessment (REBA);
- Consider the ergonomics design of the work in conjunction with best practice and HSE guidance;
- Observe the practices of the beauty technicians when using equipment for spray tanning and look at the types of equipment used;
- Take samples of solutions used in the spray tanning process for microbiological analysis;
- Assess the potential for inhalation exposure to volatile and semi-volatile organic compounds;
- Assess the exposure control strategy and associated ventilation arrangements: and
- Make an assessment of the material safety data sheets of the solutions used for spray tanning.
2 METHODS

2.1 GENERAL INFORMATION

An Ergonomist from HSL collected the data for this exploratory study into the possible risk factors for MSDs amongst beauty therapists during visits to three beauty salons. The number of premises visited was limited as this was an exploratory study rather than a larger scale assessment. One therapist at each salon participated in the study and carried out both the spray tanning and massage treatment. The spray tanning treatment was split into two parts. First a simulated spray tan was undertaken, with air being blown through the spray gun without any spray tan solution. The volunteer used was fully dressed for this simulation and the therapist was asked to conduct the treatment in the same way as they would normally. Second an actual spray tanning was undertaken in the normal manner using spray tan solution in the spray gun. The spray tan was applied to a semi dressed mannequin (typical of what would be worn during a spray tanning) instead of a volunteer.

The body massage treatment was chosen, from the range offered at each of the beauty salons visited, to be representative of the range of body massage treatments commonly offered by beauty salons. A different technique was chosen from each of the three participating salons. On each occasion the therapist participating in the massage treatment was trained in, and fully familiar, with the process. The massage was carried out on a volunteer, the treatment observed by an Ergonomist and working postures video recorded. As for the spray tanning, the therapist was asked to carry out the treatment in the normal manner.

2.2 ETHICS

In order to undertake this study an ethics proposal was submitted and subsequently approved by the HSE Research Ethics Committee on the 26 March 2008. The reference given for the ethics submission was ETHCOM/REG/08/02.

The salons visited were in Buxton, Sheffield and Bakewell. To maintain confidentiality the salons involved in the study, they will be referred to as Salons A, B and C for the purposes of this report.

2.3 EXPLORING MSD RISK FACTORS

2.3.1 Observation

At each salon the simulated spray an Ergonomist observed tanning and the massage performed on the volunteer and the working postures video recorded using a single camera. Where possible, within the restrictions of the environment, the video footage was taken to provide the best view of trunk and upper limb postures.

2.3.2 Duration of Postures

Following the visits the videotape footage was reviewed from the three participating salons. The main sub-tasks were noted; the main postures adopted were identified and the durations that the therapists were in these postures were estimated.

The entire spray tanning treatments from all three salons visited were analysed. The massage treatments took between 20-60 minutes to complete. Whilst the whole duration of the treatment was observed and the common and extreme postures noted, the dynamic and repetitive nature of the massage did not make it feasible to analyse all of the massage treatment. For this reason a
15-minute section of the massage treatment, which, included a back massage was chosen for detailed analysis. The back massage formed part of all three of the massage treatments and was observed to involve the widest range of postures and types of manipulation.

2.3.3 Postural Analysis Using REBA

Rapid Entire Body Assessment (REBA) was used to analyse event driven postures captured on video footage and still photographs of beauty therapists carrying out spray tanning and massage treatments. This method of posture analysis was chosen, as it is suitable for use in field observations and for the assessment of dynamic and unpredictable working postures. It provides a scoring system for muscle activity during dynamic, static and rapidly changing postures (Hignett & McAtamney, 2000) and was used here to demonstrate where adverse postures and forces were adopted and repeated. From the video footage, a posture snapshot was sampled at 15-second intervals for each treatment and assessed using the REBA score sheet.

REBA combines two scores, one for body (Score A for Group A) and a second for hand/arm posture (Score B for Group B). These are then amalgamated to give an overall score, which provides a risk assessment for the posture.

**Figure 1: Group A - body posture scoring for REBA**

The score for Group A is determined from individual trunk, neck and leg postures in the Group A tables (Figure 1) with load/force added to take account of the physical force being applied. The score for Group B is determined from individual upper arm, lower arm and wrist postures on the Group B table (Figure 2). If visible, both arms are coded and the arm with the highest score is selected. Where the holding of a load is observed a coupling score is added. This ranges from 0 (a well fitting handle) to 3 (an unacceptable, awkward unsafe grip).
Figure 2: Group B - body posture scoring for REBA

For the entire body an overall risk score, Score C, is obtained from Score A and B using Table C (Figure 3) and an activity correction of +1 is applied for static posture, repeated small actions or a large change in posture. This produces a REBA score, with an associated level of risk and urgency for action (Table 1). Figure 3 provides an example of a REBA score sheet for a posture.

Figure 3: Table C and Activity Score for REBA
Table 1: REBA score and associated action levels

<table>
<thead>
<tr>
<th>REBA Score</th>
<th>Risk Level</th>
<th>Action (further assessment)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Negligible</td>
<td>None necessary</td>
</tr>
<tr>
<td>2-3</td>
<td>Low</td>
<td>May be necessary</td>
</tr>
<tr>
<td>4-7</td>
<td>Medium</td>
<td>Necessary</td>
</tr>
<tr>
<td>8-10</td>
<td>High</td>
<td>Necessary soon</td>
</tr>
<tr>
<td>11-15</td>
<td>Very High</td>
<td>Necessary NOW</td>
</tr>
</tbody>
</table>

Figure 4: REBA posture score for performing a task

In the example noted in Figure 4, the REBA score 8 corresponds to a high level of risk, whereby further assessment is "necessary soon".

The REBA scores for the posture samples at each salon were used to identify possible levels of risk for the development of MSDs in the working postures observed in beauty therapists carrying out spray tanning and massage treatments.
2.3.4 Informal Interviews

Informal interviews were held with the beauty therapists following the treatments to establish the range of treatments they carried out, the frequency of these, their working hours, level of experience and training. During the visits the Ergonomist occasionally interacted with the beauty therapist to clarify the nature of the treatment techniques being used and details that could not be observed, such as the amount of force being applied.

2.4 EXPLORING EXPOSURE RISK FACTORS

Monitoring was carried out for volatile and semi-volatile organic compounds, using pumped Chromosorb 106 sorbent Automated Thermal Desorption (ATD) tubes. The flow rate used was 50 ml.min\(^{-1}\). The sampling strategy was the same for all three salons. A single personal sample, positioned in the spray tan operators breathing zone, was taken during a simulated spray tan on a mannequin. A further four samples as static measurements were taken at various points around the spray tan operation. Following sampling, tubes were end capped and sent to the Organic Measurement Team within the Analytical Sciences Unit at HSL’s Buxton laboratory. Samples were analysed by an in-house (OMS-001) utilising automated thermal desorption and gas chromatography with mass selective detection (ATD-GC/MS). For salon A the sampling time was 2.33 min for the personal sample and 5.75 min for the static samples. For salon B all sampling times were 10 min and for salon C all sampling times were 9.5 min.

A specific suite of analytes, based on scrutiny of the materials safety data sheets (MSDS) was drawn up, which included:

- Dihydroxyacetone (DHA) - the active ingredients within all spray tanning solutions
- Propylene glycol (PPG)
- Ethoxydiglycol (EDG)
- Phenoxyethanol (PE)
- Pentanediol (PD)

Additionally the analysts inspected the chromatogram obtained to pick up on any other volatile components present in significant amounts.

2.5 EXPLORING MICROBIOLOGICAL RISK FACTORS

A total of nine samples of tanning liquid and three samples of moisturiser were taken from the three salons visited. The moisturiser samples were solid when received and were therefore initially re-suspended in 10 ml phosphate buffered saline (PBS). All of the samples were subsequently diluted in PBS and plated onto the following media: nutrient agar - to assess total viable bacterial counts; malt agar - to assess total viable fungal counts; and blood agar - to assess numbers of potentially pathogenic bacteria. Nutrient plates were incubated at 37°C and 25°C; malt plates were incubated at 40°C and 25°C; and blood plates were incubated at 37°C. All plates were incubated aerobically. For each type of plate under each incubation condition, duplicate plates were prepared. The plates were observed after 2 and 7 d, for numbers and types of colonies.
3 RESULTS

3.1 GENERAL INFORMATION

Each of the beauty salons participating in the study employed one or two beauty therapists and offered a wide range of beauty treatments including spray tanning, massage, facials, waxing, manicures and pedicures (Appendix 1). All the therapists participating in the study were qualified to carry out the full range of treatments on offer. In an average day or week they carried out a number of different treatments including spray tanning, massage, waxing and nail work (Appendix 2). The therapists reported working 38-45 hours per work.

The therapists received training either through formal college courses or in-salon training into specific techniques, usually offered by the equipment suppliers. The age range of the therapists was between 21-40 years and they had been working as beauty therapists for between 19 months and 9 years.

3.2 SPRAY TANNING

3.2.1 Process Description

All of the salons visited comprised of a number of rooms in which a variety of beauty treatments were performed. The spray tanning was performed in a single room at each of the participating salons, which did not appear to constrain the therapist or affect the postures they chose. The spray tanning room in salon A measured 3.2 m by 2.06 m by 2.36 m high. The room had no opening windows, but did have an extractor fitted in the ceiling approximately 1.5 m from the door. The extractor was approximately 100 mm in diameter, typical of what you may find in a domestic bathroom (Photograph 1). The room used in salon B measured 3 m by 1.9 m by 2.5 m high and was naturally ventilated, whereas the room in salon C measured 3.7 m by 3 m by 2.65 m high and had one window, which was closed at the time of the visit. However, we were informed that this window was sometimes opened depending upon room temperature.

The spray tan system in use at salons A and C was Su-Do™ and at salon B St Tropez™, both systems are recognised as market leaders. Both manufacturers supply the spray tanning solution applied and the ingredients for the spray tan solutions used in the study are included in Appendix 3. For all three salons the solution comes in 3.78 litre (1 US gallon) containers. This quantity was reported to be sufficient for at least 50 spray tans, although the exact amount used varies depending on the size of the persons receiving the spray tan. The liquid is poured from the container straight into the gun reservoir (about 80 ml total capacity). The spray tan process in salon A consisted of a single application to both front and back. Salon B and C consisted of an initial application to both front and back, with a couple of minutes or so pause followed by a second lighter application front and back. Any spray tan solution left over would be returned to the main container for re-use at a later time. For salon A the total time between the spray first starting and finishing was less than 3 min, salon B was around 6.5 min and salon C around 4 min. The spray tan operator would typically spend slightly longer than this in the spray tan room, including time to “pat” the recipient dry.

For all three salons the volume of spray tanning work a beauty technician would carry out is heavily dependent upon the time of year, summer and Christmas time typically being the busiest periods. Certainly it would be highly unlikely that one of the beauty technicians participating in this study would on average perform more than two spray tans daily.
3.2.2 Exposure Control

3.2.2.1 Ventilated booth

During application of the spray tan in all three salons the customer stands at the face of a ventilated booth, typically as seen in photograph 2. The booth should control any overspray that may be produced during the spray tan application. In salon A the booth was approximately 1.9 m high by 1.22 m wide and 0.79 m deep, salon B measured approximately 1.9 m high by 1.05 m wide and in salon C the booth had an open front with no upper surface fitted. In salons A and B extraction panels at the rear of the booth measured 0.41 m by 0.41 m and 1.86 m x 0.24 m respectively. The extraction panel in salon C was fitted to the lower rear of the booth measuring 1 m high by 0.3 m wide. In salon A the air was extracted via a gap around the perimeter of the panel (see photograph 3). For salon A, based on air velocity measurements taken behind the panel the volume flow extracted by the booth was calculated to be 0.33 m$^3$s$^{-1}$. This is equivalent to an inward velocity at the face of the booth of approximately 0.14 ms$^{-1}$. For salon B and C, from a number of air velocity measurements made at the face of the panel, the average air velocity was calculated to be 0.38 ms$^{-1}$ and 0.58 ms$^{-1}$ respectively. Taking the blockage of the panel grill into account the volume flow rate extracted by the booth was calculated to be 0.085 m$^3$s$^{-1}$ for salon B and, for salon C, approximately 0.087 m$^3$s$^{-1}$. This is equivalent to a velocity at the face of the booth of approximately 0.04 ms$^{-1}$ for salon B and found to be between 0.1 and 0.15 ms$^{-1}$ for salon C. Air extracted from the booth passed through a foam filter (course filter salon C) positioned just behind the panel grill before being returned back into the room. For salon A it was not possible to determine if the air was filtered before being returned to the room, but discoloration could be seen on a panel lent on the wall behind the booth close to the extractor outlet. For salon B and C it was not possible to state filtration efficiency of the foam filter, as this would depend upon the particle size distribution produced by the spray gun.

Photograph 2: Spray tanning booth
To investigate the efficiency of the booths in all three salons it was important to consider the contaminant source strength, in this case the jet of spray tan mist produced by the spray gun (see photographs 4 and 5). To see the full extent of the spray mist (which may contain particles that are more-or-less invisible under normal lighting), a floodlight was positioned behind the operator. Particles in the beam of the flood lamp scatter light forward allowing the smallest of particles to be seen. Photograph 6, 7 and 8 show photographs of the spray mist created during spraying. From the spray tan mist investigation a small amount of spray mist could be seen escaping from the booth particularly around the perimeter. The airflow was further visualised by releasing smoke into the booth. In all cases the booth failed to control the smoke, leaking it around the perimeter of the booth in salons A and C and leaking it back in the room in salon B (see photograph 9). No specific PPE or RPE was worn in any of the salons visited for the spray tan work. Health and safety information is included within the information pack obtained with the equipment.

Photograph 3: Extractor in spray tan booth

Photograph 4: Spray tanning gun and reservoir

Photograph 5: Spray tanning gun and reservoir
Photograph 6, 7 and 8: Visualisation of the jet of spray tan mist created by the spray-tanning gun

Photograph 6

Photograph 7

Photograph 8

Photograph 9: Airflow visualisation using smoke, the snake can clearly be seen leaking from the top edge of the booth
### 3.2.2.2 Exposure measurements

Inhalation/Background air measurements are shown below in table 2 for salon A, table 3 for salon B and table 4 for salon C.

**Table 2: Inhalation/background air measurements for salon A**

<table>
<thead>
<tr>
<th>HSL sample number</th>
<th>Sample details</th>
<th>DHA</th>
<th>PPG</th>
<th>EDG</th>
<th>PE</th>
<th>PD</th>
</tr>
</thead>
<tbody>
<tr>
<td>08-04085</td>
<td>Personal sample</td>
<td>&lt; 0.01</td>
<td>0.08</td>
<td>0.02</td>
<td>&lt; 0.01</td>
<td>&lt; 0.01</td>
</tr>
<tr>
<td>08-04086</td>
<td>Static- on radiator to RHS of booth</td>
<td>&lt; 0.01</td>
<td>0.43</td>
<td>0.12</td>
<td>&lt; 0.01</td>
<td>&lt; 0.01</td>
</tr>
<tr>
<td>08-04087</td>
<td>Static, rear of booth in extract</td>
<td>&lt; 0.01</td>
<td>0.49</td>
<td>0.21</td>
<td>&lt; 0.01</td>
<td>&lt; 0.01</td>
</tr>
<tr>
<td>08-04088</td>
<td>Static, on table to LHS of booth</td>
<td>&lt; 0.01</td>
<td>0.28</td>
<td>0.10</td>
<td>&lt; 0.01</td>
<td>&lt; 0.01</td>
</tr>
<tr>
<td>08-04089</td>
<td>Static, on sink to RHS of booth</td>
<td>&lt; 0.01</td>
<td>0.03</td>
<td>0.01</td>
<td>&lt; 0.01</td>
<td>&lt; 0.01</td>
</tr>
<tr>
<td>08-04090</td>
<td>Blank</td>
<td>&lt; 0.01</td>
<td>&lt; 0.01</td>
<td>&lt; 0.01</td>
<td>&lt; 0.01</td>
<td>&lt; 0.01</td>
</tr>
</tbody>
</table>

**Table 3: Inhalation/background air measurements for salon B**

<table>
<thead>
<tr>
<th>HSL sample number</th>
<th>Sample details</th>
<th>DHA</th>
<th>PPG</th>
<th>EDG</th>
<th>PE</th>
<th>PD</th>
</tr>
</thead>
<tbody>
<tr>
<td>08-04073</td>
<td>Personal sample</td>
<td>&lt; 0.01</td>
<td>&lt; 0.01</td>
<td>0.55</td>
<td>0.02</td>
<td>0.27</td>
</tr>
<tr>
<td>08-04074</td>
<td>Static- Window ledge</td>
<td>&lt; 0.01</td>
<td>&lt; 0.01</td>
<td>0.90</td>
<td>0.05</td>
<td>0.45</td>
</tr>
<tr>
<td>08-04075</td>
<td>Static, floor level, LHS of booth</td>
<td>&lt; 0.01</td>
<td>&lt; 0.01</td>
<td>1.41</td>
<td>0.08</td>
<td>0.74</td>
</tr>
<tr>
<td>08-04076</td>
<td>Static, rear of booth, RHS of extract</td>
<td>&lt; 0.01</td>
<td>&lt; 0.01</td>
<td>1.13</td>
<td>0.06</td>
<td>0.64</td>
</tr>
<tr>
<td>08-04077</td>
<td>Static, rear of booth, LHS of extract</td>
<td>&lt; 0.01</td>
<td>&lt; 0.01</td>
<td>1.43</td>
<td>0.10</td>
<td>0.08</td>
</tr>
<tr>
<td>08-04078</td>
<td>Blank</td>
<td>&lt; 0.01</td>
<td>&lt; 0.01</td>
<td>&lt; 0.01</td>
<td>&lt; 0.01</td>
<td>&lt; 0.01</td>
</tr>
</tbody>
</table>
Table 4: Inhalation/background air measurements for salon C

<table>
<thead>
<tr>
<th>HSL sample number</th>
<th>Sample details</th>
<th>Measured airborne concentration (ppm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>08-04079</td>
<td>Personal sample</td>
<td>&lt; 0.01 0.91 0.26 &lt; 0.01 &lt; 0.01</td>
</tr>
<tr>
<td>08-04080</td>
<td>Static- on table to RHS</td>
<td>&lt; 0.01 0.57 0.13 0.03 &lt; 0.01</td>
</tr>
<tr>
<td>08-04081</td>
<td>Static, to RHS of booth</td>
<td>&lt; 0.01 0.04 0.01 &lt; 0.01 &lt; 0.01</td>
</tr>
<tr>
<td>08-04082</td>
<td>Static, near exhaust vent</td>
<td>&lt; 0.01 0.06 0.01 &lt; 0.01 &lt; 0.01</td>
</tr>
<tr>
<td>08-04083</td>
<td>Static, to LHS of booth</td>
<td>&lt; 0.01 0.39 0.13 &lt; 0.01 &lt; 0.01</td>
</tr>
<tr>
<td>08-04084</td>
<td>Blank</td>
<td>&lt; 0.01 &lt; 0.01 &lt; 0.01 &lt; 0.01 &lt; 0.01</td>
</tr>
</tbody>
</table>

3.2.2.3 Microbiological analysis

The results of the microbiological analysis of the samples are shown in Table 5. It should be noted that the detection limit of this analysis is 5 colony-forming units (cfu) per ml liquid sample. The following contaminants were tentatively identified by eye: Bacillus cereus, Bacillus simplex, Pseudomonas, Aspergillus fumigatus and Aspergillus Niger.

Table 5: Microbiological Analysis of Samples (shown in cfu/ml)

<table>
<thead>
<tr>
<th>Salon</th>
<th>Sample</th>
<th>Description</th>
<th>Nutrient 37°C</th>
<th>Nutrient 25°C</th>
<th>Malt 40°C</th>
<th>Malt 25°C</th>
<th>Blood 37°</th>
</tr>
</thead>
<tbody>
<tr>
<td>Salon A</td>
<td>Sample 1</td>
<td>Tanning Liquid</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>Salon A</td>
<td>Sample 2</td>
<td>Tanning Liquid</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Salon A</td>
<td>Sample 3</td>
<td>Tanning Liquid</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Salon B</td>
<td>Sample 1</td>
<td>Tanning Liquid</td>
<td>10</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>10</td>
</tr>
<tr>
<td>Salon B</td>
<td>Sample 2</td>
<td>Tanning Liquid</td>
<td>15</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Salon B</td>
<td>Sample 3</td>
<td>Moisturiser</td>
<td>5</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Salon B</td>
<td>Sample 4</td>
<td>Moisturiser</td>
<td>0</td>
<td>0</td>
<td>5</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Salon B</td>
<td>Sample 5</td>
<td>Tanning Liquid</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>Salon C</td>
<td>Sample 1</td>
<td>Tanning Liquid</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Salon C</td>
<td>Sample 2</td>
<td>Tanning Liquid</td>
<td>0</td>
<td>15</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Salon C</td>
<td>Sample 3</td>
<td>Moisturiser</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Salon C</td>
<td>Sample 5</td>
<td>Tanning Liquid</td>
<td>5</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>
3.2.3 Overview from Ergonomic Observations

The therapists held the spray gun in their right hand throughout the task and operated the trigger in bursts of 5-10 seconds whilst moving the gun in sweeping repetitive motions to direct the spray across or up and down the volunteer’s body. During the process, the therapists gave instructions and sometimes demonstrated to the volunteer the postures to adopt, for example, raising arms above head and facing the back of the booth.

3.2.3.1 Duration and frequency

Two of the three therapists used very similar techniques, in that they sprayed the upper body and legs from each angle: front, left side, right side, back, and then repeated the process for a second, quicker “pass” in order to ensure that all parts of the body had been covered fully. The third therapist sprayed all angles of the upper body first and then sprayed all angles of the volunteer’s legs without carrying out a second pass.

The spray-tanning task was completed in an average time of just less than seven minutes. At salon A the task was carried out considerably faster (4 minutes 52 seconds) than at salons B (8 minutes 8 seconds) and C (7 minutes 36 seconds) as a second pass was not completed.

3.2.4 Postural Analysis

3.2.4.1 Postures Adopted

The three therapists observed during the study changed their posture frequently during the task. Postures were held for an average of eight seconds with the longest duration being 39 seconds (see Appendix 4). This continual movement reflected the nature of the task, as they were moving to direct the spray gun to produce a fine even covering of the tanning solution over the exposed skin of the volunteer.

All three therapists undertook most of the spray tanning process from a standing posture (58-73%). This reflected the longer time spent spraying the volunteer’s torso and upper limbs. The therapist at salon A adopted standing postures more than the other therapists (73%). This may be because the volunteer was standing on a small platform so that more of the lower body could be sprayed from a standing posture. In contrast the therapist at salon C was tall in comparison with the volunteer and chose to spray the lower part of the torso from a squatting or kneeling position and subsequently spent less time standing (58%).

The therapist at salon B adopted a squatting position (photograph 11) to spray the volunteer’s legs. Whilst in this position, the therapist would move to the side (by repositioning her feet) in order to spray further to the side of the volunteer’s legs and on two occasions she bent forward and sideways whilst in a squatting position. The squatting position was adopted eight times during the task and held for an average of 17.5 seconds. In total this therapist spent 35% of the task time in a squatting position, of which 6% was squatting with lateral and forward trunk flexion.

At salon C the therapist adopted a combination of squatting and kneeling on one-knee postures (photograph 12 and 13) to spray the volunteer’s lower body and limbs. A greater percentage (42%) of the total task time was spent in these postures than for the other two therapists. Squatting postures were adopted for 8% of the task duration at salon C, and kneeling postures for 27%. The therapist at salon C did not reposition her feet whilst squatting or kneeling but
chose to bend forward and/or to the side whilst in this position to reach to the side of the volunteer’s lower limbs (lateral and forward trunk flexion adopted for 7% of time).

The therapist at salon A chose to bend forward and down to spray the volunteer’s legs rather than squatting or kneeling (photograph 14). Consequently, 26% of the task time was spent in postures with moderate or severe trunk flexion.

Photograph 10: Standing posture
Photograph 11: Squatting posture
Photograph 12: Kneeling posture
Photograph 13: Kneeling with trunk flexed
Whilst the majority of standing postures (41-55%) involved the upper limbs being held below shoulder height (photograph 10), some of the time the therapists stood with one or both arms at or above shoulder height (photograph 15). This posture was adopted when spraying the face, neck or under the volunteer’s arms. The therapists at salons A and C held their left arm above shoulder height when they moved the volunteer’s hair off the face or neck, or when they lifted the volunteer’s arm up. The therapist at salon B did not physically position the volunteer’s arms nor did she lift the volunteer’s hair out of the way, therefore she adopted a raised arm posture less than the therapists at salons A and C.

3.2.4.2 **REBA Postural Analysis**

At two of the three salons, the majority of the postures held were assessed using REBA as a medium risk for developing MSDs (Salon C: 53%, Salon A: 50%). The majority of the postures adopted by the therapist at Salon B were assessed as low risk (53%) described in Table 6.

Between two and four (6-13%) of the sampled postures were assessed as high risk at each salon using REBA. At salons B and C these high-risk postures were associated with squat/kneel
postures with a lateral and forward bend (photograph 13). At salon A the two high-risk postures were associated with the severe trunk bending with some lateral trunk bend whilst spraying the volunteer’s legs.

The medium risk postures were common to all three salons involved:

- Standing with one or both arms raised at or above shoulder height;
- Squatting or kneeling on one knee with the trunk relatively straight;
- Bending forward without bending to the side or twisting the trunk;
- Standing with a moderate lateral trunk bend.

A REBA score of 4-7 indicates a medium risk level (see table 1), which suggests that action including further assessment is necessary. However, it should be noted that the postures adopted were held for very short periods of time (an average of 8 seconds), the duration of the entire task was less than 10 minutes and was carried out infrequently by the therapists in this study (3-10 times a week).

<table>
<thead>
<tr>
<th>Action Level</th>
<th>REBA Score</th>
<th>Risk Level</th>
<th>Action</th>
<th>Salon A</th>
<th>Salon B</th>
<th>Salon C</th>
<th>Total number at risk level</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>1</td>
<td>Negligible</td>
<td>None</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>1</td>
<td>2-3</td>
<td>Low</td>
<td>May be necessary</td>
<td>8 (40%)</td>
<td>17 (53%)</td>
<td>7 (23%)</td>
<td>32</td>
</tr>
<tr>
<td>2</td>
<td>4-7</td>
<td>Medium</td>
<td>Necessary</td>
<td>10 (50%)</td>
<td>13 (41%)</td>
<td>19 (63%)</td>
<td>44</td>
</tr>
<tr>
<td>3</td>
<td>8-10</td>
<td>High</td>
<td>Necessary soon</td>
<td>2 (10%)</td>
<td>2 (6%)</td>
<td>4 (13%)</td>
<td>6</td>
</tr>
<tr>
<td>4</td>
<td>11-15</td>
<td>Very High</td>
<td>Necessary now</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Total Number of Postures Sampled</td>
<td>20</td>
<td>32</td>
<td>30</td>
<td>82</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

3.2.4.3 Data From Informal Interviews

The therapists reported that before and after the spray-tanning task, they left the room to allow the client to get undressed and dressed in their own time. Therefore, even if the therapist were carrying out one spray tanning treatment after another, there would be several minutes of recovery time for the therapist between the spraying parts of the task.

The therapists reported carrying out between 3-10 spray tanning treatments each week in the spring and summer months and fewer in the autumn and winter (see Appendix 2). This equates to the therapists spending less than 16 minutes (3%) of a working day carrying out this task.

3.2.4.4 Force and Load

The force involved in the spray-tanning task involved supporting the weight of the spray gun and in depressing the trigger of the spray gun. The weight of the equipment at each salon was not measured but the equipment is lightweight with similar spray tanning equipment weighing between 300-400 g. The therapists involved in this study did not report any pain, discomfort or fatigue in their upper limbs from holding the spray gun for the duration of the spray-tanning task.
Trigger forces were not measured during this study. The therapists did not report any problems operating the trigger or any pain, discomfort or fatigue associated with this.

3.3 MASSAGE

3.3.1 Overview From Observations

The three beauty salons visited in this study offered a range of body massage treatments including aromatherapy, full body, back, Indian head and hot stone massages. The massages observed during the visits to the three salons were a hot stone massage at salon A; a full body massage at salon B and a back massage at salon C.

3.3.1.1 Massage Techniques/Movements

The three therapists studied employed similar techniques and massage manipulations. The therapist at salon A used additional movements in working with the hot stones. The main massage techniques observed are described below:

1) Light pressure movements

These movements involved long, light pressure, gliding movements over the skin, usually with both palm and fingers in contact with the skin (photograph 16). These strokes are often used at the beginning of massage to promote feelings of relaxation and warmth.

![Photograph 16](image16.png)

2) Medium pressure movements

These movements are similar to the long gliding movements but are often shorter in length, concentrated on a smaller area of the body and usually performed with one hand over the other to work deeper into the soft tissue (photograph 17).

![Photograph 17](image17.png)

3) Deep pressure movements
These are small, slow movements concentrated in a small area of the body. The thumb, fingers, knuckles or heel of the hand are commonly used to apply quite heavy pressure to the soft tissues (photograph 18).

Photograph 18

The beauty therapist at salon B spent similar durations of the massage task carrying out each of the main three massage manipulations: 36% of the duration using light pressure, gliding movements, 28% in deep pressure, small manipulations, and 30% in medium pressure movements with one hand over the other. In contrast the therapist at salon C spent more of the massage duration carrying out deep pressure manipulations (61%) with only 20% of the time on light pressure, gliding movements. The therapist at salon A utilised the hot stones in some of the light, gliding movements, with the stone held flat in the palm of the hand (photograph 19) and in some of the deep pressure work, applying the pressure using the edge of the stone (photograph 20). Light gliding movements formed 43% of the massage duration (33% with stones) and deep pressure manipulations formed 40% of the duration (17% with stones).

Photograph 19: Light pressure with stones  Photograph 20: Deep pressure with stones

3.3.1.2 Postural Analysis

The massages were carried out with the therapist standing at the head or to the side of the massage table. The therapist was continually moving and changing posture depending on the speed, force and direction of the massage movement. The therapists rarely held any one posture for more than a few seconds. For example, whilst administering long gliding massage movements from the shoulders to the lower back, the therapists tended to start the movement standing in mild trunk flexion with their hands on the volunteer’s shoulders and slide their hands forward and down to the volunteer’s lower back. During this movement the flexion in the therapist’s trunk increases as the therapist reaches down towards the lower back (photograph 21). Each gliding movement takes one to two seconds and may be repeated four to eight times before the therapist changes to a different stroke or a different part of the body. In some of these postures the therapists changed their leg position to stand with one foot in front of the other in a position that allowed them to move their weight from the back leg to the front leg at the top of the gliding movement.
3.3.1.3 Trunk, Neck and Lower Limb Postures and Durations

Analysis of the video footage of a portion of the massage task at each beauty salon identified that the therapists spent the majority of the massage task carrying out manipulations where most of the movement involved postures where the neck and trunk were in non-neutral positions (84-94%) as described in Appendix 5. Because of the dynamic nature of the massage techniques, the estimated duration in postures reflects a wide range of degrees of trunk flexion (10-60 degrees). Postures involving severe trunk and neck flexions were rarely observed during the massage task and the beauty therapists were rarely in static postures.

Some of the massage movements involved the therapist standing at the side of the massage table but directing the massage stroke along the volunteer’s back towards their head. To do this, the therapists had to twist as well as flex their trunk (photograph 22). Manipulations performed with the therapist’s trunk both flexed and twisted were carried out between 33-60% of the duration of the massage. The therapist at salon B may have adopted these postures for longer because she carried out more light pressure, long, gliding movements than the other therapists.

The beauty therapist at salon A adopted three postures for small amounts of the massage time (2-10%), which, were not observed at the other two salons. The first of these was a posture with severe trunk flexion when bending down to retrieve the stones from the hot water bath, which,
was located on a low step at the back of the room. The second was a squatting posture whilst delivering deep pressure massage with the edge of the hot stones to the outer thigh of the volunteer. The third of these postures was standing with mild trunk flexion whilst rolling the hot stones in her hands to transfer the heat (Examples of these postures are shown in photograph 23).

Photograph 23: Postures involved in retrieving hot stones, rolling hot stones in hands and massage with edges of stone

3.3.1.4 Upper Limb Postures and Durations

Hand/Wrist Postures

The majority of the massage manipulations involved the therapists moving their hands continually across the body of the volunteer. This continual posture change meant that it was not feasible to analyse the durations that the wrists were in non-neutral positions with a great degree of accuracy from the video footage. However, the massage movements that were observed to involve most non-neutral wrist postures were the medium and deep pressure manipulations. During most of these movements, the therapists worked with their wrists in deviated and/or extended wrist postures (photograph 24). The wrist postures during light pressure, gliding movements appeared to be more often in a neutral position as the wrist was kept in line with the forearm for more of the movement. As the therapists carried out medium or deep manipulations for an average of 64% of the massage task, it is likely that they would be working with wrists in a non-neutral position for a significant proportion of that time.

Photograph 24: Examples of non-neutral wrist postures
Shoulder/Elbow Postures

As for the trunk posture, upper limb postures varied during each dynamic massage movement. Extreme postures of the upper limbs were not observed in the massage treatments. The majority of the movements were carried with the upper arms in a position of mild or moderate flexion (0-45 degrees). Occasionally the therapists worked with some abduction to their shoulder (photograph 25). The lower arms were straightened at the top of long, gliding strokes (photograph 26) but generally were held in neutral positions (between 60-100 degrees).

Photograph 25: Shoulder abduction

Photograph 26: Shoulder/elbow position during long, gliding movements

3.3.1.5 REBA Postural Analysis

As shown in Table 7, the majority (91%) of the sample postures from the massage tasks at all of the three salons were assessed as of medium risk level for MSDs which would indicate that action including further assessment is necessary. These related to postures with moderate trunk flexion with or without a twist. There were relatively few (3%) of the sampled postures, which were assessed as high risk using REBA. None of the postures from the sample at salon B were assessed as high risk while two postures at salon C and three at salon A were assessed as high risk. The high-risk postures were associated with severe trunk flexion with a twist, upper arm abduction and non-neutral wrist postures (Examples of some of these postures are shown in photograph 27).
Similarly there were few postures assessed as low risk (6%). These were mainly standing postures whilst walking to another side of the massage table or transferring oil to their hands.

As the massage movements were mainly dynamic, no posture was held for more than a few seconds. However, the postures were repeated frequently throughout the duration of the massage.

**Table 7: REBA analysis of massage postures**

<table>
<thead>
<tr>
<th>Action Level</th>
<th>REBA Score</th>
<th>Risk Level</th>
<th>Action</th>
<th>Salon A</th>
<th>Salon B</th>
<th>Salon C</th>
<th>Total number at risk level</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>1</td>
<td>Negligible</td>
<td>None</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>1</td>
<td>2-3</td>
<td>Low</td>
<td>May be necessary</td>
<td>1 (2%)</td>
<td>5 (10%)</td>
<td>4 (7%)</td>
<td>10 (6%)</td>
</tr>
<tr>
<td>2</td>
<td>4-7</td>
<td>Medium</td>
<td>Necessary</td>
<td>55 (93%)</td>
<td>47 (90%)</td>
<td>53 (90%)</td>
<td>155 (91%)</td>
</tr>
<tr>
<td>3</td>
<td>8-10</td>
<td>High</td>
<td>Necessary soon</td>
<td>3 (5%)</td>
<td>0</td>
<td>2 (3%)</td>
<td>5 (3%)</td>
</tr>
<tr>
<td>4</td>
<td>11-15</td>
<td>Very High</td>
<td>Necessary now</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Total Number Sample Postures</td>
<td></td>
<td></td>
<td></td>
<td>59</td>
<td>52</td>
<td>59</td>
<td>170</td>
</tr>
</tbody>
</table>

The trunk position was assessed as being in a non-neutral posture in 73% of the sample postures using REBA’s criteria of trunk flexion greater than 20 degrees with or without a twist/lateral bend. The neck was in a non-neutral position (defined as more than 20 degrees of flexion) in 75% of the sample postures (see Appendix 6).

With the upper limb scores using REBA, the therapist’s upper arm/shoulder position was assessed as being non-neutral for 81% of the postures sampled. This included postures where the upper arm was in more than 20 degrees of flexion and/or raised, rotated or abducted. The lower arm was in a non-neutral position (less than 60 or more than 100 degrees of elbow flexion) for 72% of the postures and the wrist was in non-neutral positions (more than 15 degrees of flexion/extension and/or deviated/twisted) for 68% of the postures.
3.3.1.6  **Data From Informal Interviews and Observations**

The duration of the massage treatments was dependent on the type of massage being carried out. For example, a full body massage took 60 minutes to complete, a back massage took 30 minutes and a hot stone massage took 60 minutes.

The therapists involved in this study reported that they carried out massage sessions infrequently. The most common massage treatments they carried out were back massages (2-5 times a week) and short duration face/neck massages as part of facial treatments (see Appendix 2).

The therapists reported working 38-45 hours per week over five or six days and it is estimated that they would carry out around 60 minutes of massage per shift on average (13% of their working day).

3.3.1.7  **Repetition of movement**

Movements, especially small movements of the hands, fingers and thumbs, were performed repeatedly every few seconds during massage treatments. However, the therapists participating in this study carried out long massage treatments (30-60 minutes) relatively infrequently therefore these repetitive movements would not be performed for more than two hours consecutively or more than two hours cumulatively in any one shift period.

3.3.1.8  **Force**

The force or pressure that was applied during soft tissue manipulations, as part of the massage treatments, was not measured. The force varied with the massage technique and the therapist. The therapist at salon C carried out more deep pressure manipulations than the other two therapists. By the nature of manipulating deep into the soft tissues, more force would need to be applied by the therapist. The therapist at salon C applied the pressure mainly using her thumbs. This therapist described herself as “heavy” when giving a massage and reported that most of her clients come to her because they like to have a deep pressure massage. The other two therapists observed appeared to apply less pressure than the therapist in the salon C.

3.3.1.9  **Working Environment**

The massages were carried out in relatively small rooms. In salons A and B it was felt that the environment constrained the posture of the therapist occasionally due to the space between the massage table and walls or furniture within the room (photograph 28).
The massage table height played an important part in the postures that were adopted. At salons B and C the massage table was a fixed height. The massage table at salon C had been permanently raised on blocks (at the therapists request). At salon A there was a hydraulic adjustable height massage table, which the therapist adjusted prior to the massage. The beauty therapists participating in this study carried out the massage on a table at the following heights: salon A – 660 mm, salon B – 720 mm and salon C – 850 mm. The water bath used to heat the stones at salon A was kept on a low step at the back of the massage room and the beauty therapist had to bend over to get the stones out of this as shown in photograph 23.
4 DISCUSSION

4.1 SPRAY TANNING

4.1.1 MSD

During this exploratory study, we found that at two of the participating salons the majority of the postures were assessed as medium risk for MSD and at the other salon the majority were low risk. The medium risk postures included standing with arms raised, squatting, kneeling on one knee or bending forward.

The high-risk postures at each of the salons were associated with either squatting/kneeling with the trunk flexed forward and sideways, or with severe trunk bending with a twist or sideways bend. There were fewer high-risk postures at salon B probably because the therapist chose to keep her back straight whilst in the squatting position and repositioned her feet in order to avoid excessive trunk bending or twisting. Similarly, because the therapist at salon A was standing and bending over she was able to move her feet to avoid twisting or lateral bending. The small platform that the volunteer stood on in the booth at salon A, and the height difference between the therapist and the volunteer, also may have avoided the therapist having to bend her trunk more to spray the volunteer’s lower limbs.

It is unclear whether there is less risk of MSDs to bend, squat or kneel on one knee. Under the REBA analysis all three postures were scored between 5-7, depending on the severity of the trunk bend. It has been suggested that occupational kneeling or squatting can be a risk factor for lower limb MSDs (Jensen & Friche, 2008, Baker et al., 2003, Chung et al., 2001). The occupational groups in these studies were carrying out the tasks frequently throughout a shift, in contrast to the short duration, infrequent occurrence of the spray-tanning task for the three beauty therapists participating in the study.

The postures were not held for more than a few seconds (average of 8 seconds, maximum of 39 seconds), the task was of short duration (5–8 minutes) and it was repeated infrequently (usually less than twice a day). In these circumstances, it was felt that spray tanning did not pose a high risk of MSDs. However, if spray tanning treatments were repeated more frequently during a shift (10-15 times) or combined with other tasks that involved similar postures, then there may be more cause for concern. The need to bend, squat or kneel and to get up from these postures frequently during the task may be of concern if the therapist had pre-existing knee or back problems as considerable knee and hip flexion are required to perform these moves or maintain these postures.

Whilst the therapists carried out repetitive movements of the upper limbs in directing the spray and operating the trigger, the short duration and frequency of the treatments suggested that it was unlikely to give cause for concern for upper limb disorders. The Health and Safety Executive’s (HSE) guidance on tackling work-related upper limb disorders suggests that a full risk assessment would only be necessary if this task was performed for more than two hours total per shift (HSE, 2002).

The initial literature search did not identify any research concerning MSDs and spray tanning treatments in the beauty industry. Industrial paint spraying has some similarities and studies have identified risks of upper limb MSDs amongst manual spray painters in the woodworking industry (Bjoring & Hagg, 2000a). However, the spray gun equipment utilised in the woodworking industry was heavier (535-660g) compared to the estimated weight of the tanning spray guns of 300-400g (Bjoring & Hagg, 2000b) and the spray painting task was carried out for
significantly longer and more frequently (three hours a day on average (Bjoring & Hagg, 2000a).

4.1.2 Exposure

For all of the salons visited the spray gun generated a jet of spray mist, which was produced outside of the booth, but directed towards it. The energy of the air jet is designed to carry the spray mist into the booth, which although it does not capture the contaminant; it would only have to empty as quickly as it is being filled to prevent the spray mist spilling into the room. This type of booth is described as a receptor. However, when the spray impinges onto a person positioned at the face of the booth, it may not enter the booth at all. This was seen to a small extent during illumination of the spray mist. The face velocity of the booth was calculated to be approximately 0.14 ms\(^{-1}\) for salon A, 0.04 ms\(^{-1}\) for salon B and 0.1 ms\(^{-1}\) for salon C. These velocity levels are very low, being typical of general random air movement within a room for salon A and lower than typical air movement found in any room for salons B and C. Therefore room air movement alone would potentially cause the booth to leak. This was found to be the case during the smoke tests.

The measured personal exposures were all less than one ppm for salons A and C and two ppm for salon B. The active ingredient DHA was not detected in any of the samples. There is no specific Workplace Exposure Limits (WEL) in place for any of the five compounds in the analysis suite. Exposure levels were not significantly different in the ventilation extract from the other areas within the room, perhaps indicative of the filtration not removing/trapping any the volatile compounds. Given the extremely low levels involved this is not of concern.

The measurements were taken on a single spray tan and given the short duration of the task and the relatively low volume of spray tans performed the risk from these operations was considered to be minimal.

4.1.3 Mircobiological

In four of the twelve samples, no bacterial or fungal contamination was detected. In the remaining eight samples, there was a very low level of bacterial or fungal contamination. The types of contaminants observed are commonly encountered in air and therefore it is unsurprising that small numbers of these bacteria and fungi have been detected in this study, due to the commonly employed handling methods for tanning liquids and moisturisers in salons. These contaminants could be potentially harmful if present in high numbers. However, the levels of contamination seen in these samples were very low and at these levels they do not pose a risk to health.

4.2 MASSAGE

4.2.1 Non-Neutral Postures

The findings of this exploratory study suggest that, during massage treatments, the beauty therapists carried out movements that included a significant proportion of time working in non-neutral postures. These included an estimated 90% in non-neutral neck/trunk postures and 64% in non-neutral wrist postures. The REBA analysis of the sample postures assessed 73% of trunk, 75% of neck, 81% of shoulder and 68% of wrist postures as non-neutral. On a positive note, the majority of these postures were mild or moderate postures, were not held for more than a few seconds at a time due to the continual movement of the therapist, and few extreme postures were adopted at any stage during the massage treatments.
Laboratory studies into the biomechanical demands of massage treatments have also found a high percentage of non-neutral postures. Albert et al (2006) found that during massage, the trunk was required to be flexed away from neutral for an average of 50%, the neck for 60% and the upper limbs for 70% of the massage. Similarly, Buck et al (2007) found that table massages resulted in around 50% of the massage duration being spent in non-neutral trunk postures and more than 80% of the time in non-neutral wrist postures. The higher results for most of the non-neutral postures in this beauty therapy study may be due to wider criteria for non-neutral postures being utilised here and the limitations of subjective postural assessment from single camera video footage in the a confined space in the field. The studies by Albert et al (2006) and Buck et al (2007) were able to take more accurate measures as they were conducted in laboratory conditions using multiple cameras and posture matching software in the former and electromyography in the latter.

The REBA analysis assessed 91% of the sample postures as medium risk level, which suggests that action (including further assessment) is necessary to reduce the risk of therapists developing MSDs. However, the beauty therapists in this study reported carrying out body massages relatively infrequently, perhaps once a day on average. Albert et al (2006) concluded that the significant time that the massage therapists spent working in mild trunk flexion was a cause for concern for an increased risk of back disorders where the therapists were carrying out four or five 45 minute body massages per day. At the low frequency of massage treatments being carried out by the beauty therapists in this study, the high proportions of the time that they are working in non-neutral postures may not be of cause for concern, especially as there are few severe or high risk postures adopted, and there is job rotation and time for rest between treatments. It should be noted that the beauty salons participating in this study were small, employing only one or two beauty therapists and where the therapists carried out a range of different treatments within a working day. It is not known whether this is typical of the beauty industry in the UK or whether there are a number of beauty therapists who carry out massage treatments on a more frequent basis, for example in larger establishments or health spas, who may be at greater risk of developing work-related MSDs.

Whilst the therapists in this study were working in non-neutral postures during massage treatments for only around 10% of their average working day, it is possible that other beauty treatments undertaken during the course of the day may also involve a significant proportion of time working in non-neutral positions. If this is the case, the risk of beauty therapists developing MSDs may be greater as the cumulative effect of time spent working in non-neutral postures has been linked with an increased risk of back disorders (Punnett et al, 1991).

4.2.2 Force

It was not within the scope of this exploratory study to measure the hand forces involved in massage techniques. However, in a recent biomechanical study of massage therapy, hand forces during various massage techniques were measured at between 4 N for light strokes to 10 N for deeper manipulations (Albert et al, 2006). Studies with physical therapists have reported a high prevalence of work related thumb pain linked with performing deep soft tissue manipulations and have estimated a force of 12N at the thumb joint during manipulations (McMahon et al 2006, Atkinson & Maher 2004).

Atkinson and Maher (2004) suggest that manual therapy techniques that put pressure though the thumbs should be avoided and other parts of the hand used to apply the pressure. The use of the hot stones at salon A in this study or other massage aids to apply pressure on the soft tissue may also be a means of reducing the risks of thumb pain. Albert et al (2008) reported a lower incidence of thumb and/or wrist pain in massage therapists using massage aids. However, the use of massage aids appears controversial as some physiotherapists have expressed concerns
regarding the ability to accurately gauge the force and depth of pressure when using a massage aid (Atkinson & Maher 2004).

4.2.3 Environment and Equipment

In studies of massage therapists and chiropractors, the massage table height was considered to be an important factor as this affects the postures adopted during treatments (Albert et al., 2006, Lorme & Naqvi, 2003). Incorrect table height has been found to be a factor in work-related back pain for chiropractors (Mior & Diakow 1987). Lorme and Naqvi (2003) in their study of chiropractors found that workstation height affected lumbar spine loading which is a known risk factor for the development of MSDs of the low back. They recommended that variable height tables be used and adjusted according to which area of the body is being worked on or the depth of pressure being applied. However, unlike chiropractors, massage therapists utilise a number of techniques and work on a number of areas of the body within one massage session. It may be impractical to adjust the height of the table once the volunteer is positioned on it (Albert et al., 2006).

The student massage therapists in Albert et al. (2006) study chose to set the table height at between 40-43% of their standing heights where the table height was between wrist and extended fingertip height as suggested by their training manual. The beauty therapists in this study worked on tables which were between 42-49% of their working heights which were within the wrist to fingertip range at two of the salons but higher than this recommended range for the therapist at salon B. The therapist at salon B was working on a standard fixed height table of 720 mm. Had all the therapists in this study used a table of this standard height, they would have been working at a height, which was outside the recommended range for all of them. This may have increased their risk of developing low back problems. Studies with a wide range of occupations including physiotherapists, chiropractors and massage therapists have recommended that variable height tables be used and training given in setting them to the correct height (Lorme & Naqvi, 2003, Albert et al., 2006, Glover, 2002, Cromie et al., 2002).

Two of the three therapists carried out the massage treatments in rooms where there was limited space around the massage table due to the small size of the room and additional furniture and equipment. The confined space appeared to occasionally affect the postures that the therapist adopted and lack of working space has been found to be a contributory factor in MSDs (Engkvist, 2004, Ballard, 1994). Repositioning the furniture in the room to allow the massage table to be positioned further from the wall at one salon and placing the water bath at a higher level may have enabled the therapists to adopt more neutral postures during the massage treatment.
5 CONCLUSIONS

The postural analysis of both massage and spray tanning treatments carried out by the three beauty therapists participating in this study indicates overall a medium level of risk of developing MSDs. However, as the reported durations are short and frequencies low, the risk is likely to be lower than this assessment suggests. The spray tanning appeared to be less of a cause for concern for MSDs than the massage treatments as only 54% of the postures were assessed as medium risk compared to 91% of the massage postures sampled, as well as forming only 3% of their working day in comparison to 13% for massage treatments.

If spray tanning treatments were being carried out more frequently by any beauty therapist (for example 15 times a day), then further assessment and action to reduce the risk of MSDs would need to be considered as the repetitive movements would be carried out for more than two hours per working day. Similarly, if massage treatments were being carried out for more than two hours a day then further assessment and risk reducing action may be needed. It is not known whether some beauty therapists (perhaps in larger beauty salons or health spa environments) may be reaching these frequency levels for massage and spray tanning treatments. If they are, then the cumulative time spent working in non-neutral neck, trunk and wrist postures, whilst carrying out a range of treatments, is a cause for concern and may require further investigation.

This study was exploratory in nature and only three salons were visited. In each of the three salons visited a massage and spray tanning treatment was observed. Consequently, it only represented a small number of beauty technicians, in small salon environments only, and it is acknowledged that the techniques used, postures adopted and the environments visited may not be totally representative of beauty therapists working in salons in the wider beauty industry sector. The percentage of time in each posture only represents the current study and should not be presumed to extrapolate to all beauty therapists. However, it is known that micro-businesses, like those participating in this study, predominate in the beauty therapy sector and it is estimated that 65% of beauty therapy businesses employ less than five people (Habia, 2007).

The confined environment and the nature of the treatments that were carried out posed some difficulties for the postural analysis. Ideally for postural analysis the postures should be video recorded with the camera positioned at 90 degrees to give a clear picture of the trunk, neck and upper limb positions. The small rooms in which the treatments were carried out, the dynamic nature of the massage treatments and the need to capture both trunk/neck and wrist/hand postures with one camera, compromised the aim to record at the optimum angle at times. Consequently postural analysis more was difficult and this possibly reduced the reliability of the analysis. However, it is felt that the results of this initial study were sufficient to meet the aims of exploring the possible risk factors for MSDs.

This study has focussed on the physical work risk factors for MSDs such as working in bent/twisted head and neck postures, repetitive arm and wrist movements and working with wrists in non-neutral postures. Previous studies into the risk factors associated with MSDs have found that psychosocial risk factors are related to MSDs (Devereux et al., 2004). Psychosocial risk factors were not addressed in this exploratory study but should be considered in future research into MSDs amongst beauty therapists.

The exposure measurements were taken on a single spray tan and given the short duration of the task and the relatively low volume of spray tans performed the risk from these operations is considered minimal. The levels of contamination seen in the samples of spray tanning products analysed for microbiological growth were very low and at these levels they do not pose a risk to health.
6 RECOMMENDATIONS

In order to better understand the issues identified in this exploratory study and whether they represent real concerns for those employed in the industry, the following recommendations are made:

• A study to investigate the prevalence of work-related musculoskeletal aches, pain or discomfort experienced by beauty therapists carrying out massage and spray tanning from the full range of salon environments (micro beauty salons, larger beauty salons and health spa environments).

• A study to investigate the work environment and the frequency with which massage, spray tanning and other treatments are carried out by beauty therapists working in larger salons and in health spa environments.

• A study to establish the frequency with which beauty therapists carry out other treatments, which, may involve non-neutral postures of the trunk, neck or upper limbs.


8 APPENDICES

8.1 APPENDIX 1 - SUMMARY OF BEAUTY SALON TREATMENTS

Manicure - this treatment designed to improve the appearance of the hands and nails. The skin is cleansed and moisturised, the nails are shaped and polished and the skin surrounding the base of the nail (cuticles) are moisturised and tidied up.

Pedicure - this treatment to improve the appearance of the feet, a pedicure usually incorporates a warm soak to relax the feet and softens the skin and finishes with a foot and or leg massage. Exfoliating and the use of rich creams and oils improve the skin condition.

Facial - a facial consists of several elements including, skin cleansing, exfoliation (removing surface dead skin cells), manual massage using different techniques is incorporated which may include; muscle manipulation, pressure point or lymph drainage massage. The products used will vary according to the client's skin type and the techniques used by the beauty technicians. Masks may be used throughout the treatment for tightening, hydrating or firming purposes.

Body Massage - may be defined as a series of non invasive manual techniques that affect one or more structures of the body; muscles, joints, skin, fatty tissue, fasciae, blood and lymphatic vessels, in order to release pain, reduce swelling, enhance mobility of joints and alleviate emotional and mental tension. There are different forms of massage, which includes; Swedish, Aromatherapy and Hot Stone. Swedish massage is a deep manipulation of muscles and skin tissue, using oil or cream. It uses a combination of massage movements from superficial and soothing stroking movements to more vigorous deep pressure movements designed to remove tension nodules in the muscles and stimulate the blood circulation. Aromatherapy massage combines the therapeutic effect of a gentle massage with the specific effects of essential oils mixed into carrier or base oil. The essential oils have specific properties, which may be used to benefit the psychological and physical well being of the client. Hot Stone Massage employs a technique that uses smooth, heated basalt stones, which are placed on specific acupressure points on the body to melt away knots, tension and stress. It can also be applied as a relaxation technique using hot essential oils.

Spray Tanning - is the process by which tanning solution is sprayed in a fine mist onto the skin of the client using a lightweight, high volume low-pressure spray gun. Following the application, dihydroxyacetone (DHA) in the spray-tanning product reacts with amino acids in the dead cells layer on the skin surface to produce a brown colour change.

Waxing - is a method of semi-permanent hair removal, which removes the hair from the root. New hairs will not grow back in the previously waxed area for two to eight weeks. Areas most commonly waxed include, eyebrows, face, bikini area, under arms and legs. If waxing is done regularly for several years, permanent hair reduction may be achieved.
## APPENDIX 2 - FREQUENCY AND DURATION OF TREATMENTS

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Salon A</th>
<th>Salon B</th>
<th>Salon C</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Full body massage</strong></td>
<td>1 per month (60 mins)</td>
<td>2 per month (60 mins)</td>
<td>2-3 per week (60 mins)</td>
</tr>
<tr>
<td><strong>Back massage</strong></td>
<td>2 per week (30 mins)</td>
<td>4-5 per week (30 mins)</td>
<td>3-4 per week (20-30 mins)</td>
</tr>
<tr>
<td><strong>Aromatherapy massage</strong></td>
<td>Rarely</td>
<td>Rarely</td>
<td>Rarely</td>
</tr>
<tr>
<td><strong>Hot stone massage</strong></td>
<td>1 per month (60 mins)</td>
<td></td>
<td>Rarely (30-60 mins)</td>
</tr>
<tr>
<td><strong>Indian head massage</strong></td>
<td></td>
<td>1 per week (30 mins)</td>
<td>1 per month (40 mins)</td>
</tr>
<tr>
<td><strong>Hydrotherm massage</strong></td>
<td>1 per month (45 mins)</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Facials (with massage)</strong></td>
<td>5 per week (15 mins)</td>
<td>2 per day (10 mins)</td>
<td>1-2 per week (15 mins)</td>
</tr>
<tr>
<td><strong>Spray Tanning</strong></td>
<td>10 per week</td>
<td>7-8 per week (summer)</td>
<td>3-4 per week</td>
</tr>
<tr>
<td><strong>Manicure/gel nails</strong></td>
<td>5-6 per week</td>
<td></td>
<td>4-5 per day (60-90 mins)</td>
</tr>
<tr>
<td><strong>Waxing</strong></td>
<td>Daily</td>
<td>Daily</td>
<td>Rarely</td>
</tr>
</tbody>
</table>
8.3 APPENDIX 3 - SPRAY TAN SOLUTION INGREDIENTS

Salon A

Ingredients of spray tan solution used – Su-Do Professional Airbrush Tan - Bronze.
As listed on product information sheet.

Aqua
Dihydroxyacetone
Propylene glycol
Ethoxydiglycol
Glycerin
Glycereth-26
Erythulose
PEG-40-hydrogenated castor oil
Castor oil
Aloe Bardendensis
Panthenol
Parfum
Phenoxyethanol
Diazolidinyl urea
Methylparaben
Citric acid
Butylparaben
Ethylparaben
Isobutylparaben

Salon B

Ingredients of spray tan solution used - St Tropez Bronzing mist.
As listed on product information sheet.

Aloe Barbadensis leaf juice
Dihydroxyacetone
Ethoxydiglycol
Pentylene Glycol
Glycerin
PPG-5-ceteth-20
Phenoxyethanol
Methylparaben
Butylparaben
Ethylparaben
Propylparaben
Sodium Bisulfite
Fragrance
Citric acid
Blue 1 [CI 42090]
Red 4 [CI 14700]
Yellow 5 [CI 19140]
Salon C
Ingredients of spray tan solution used – Su-Do Vibrance Spray Tan - Bronze.
As listed on product information sheet.

Aqua 65 – 90 %
Dihydroxyacetone 3 – 8 %
Propylene glycol 2 – 7 %
Ethoxydiglycol 2 – 7 %
Polysorbate 20 0.1 – 1 %
Parfum < 0.5 %
Disodium EDTA < 0.5 %
PEG-40-hydrogenated castor oil < 0.5 %
Panthenol < 0.5 %
Phenoxyethanol < 0.3 %
Methylparaben < 0.05 %
Butylparaben < 0.02 %
Ethylparaben < 0.02 %
Propylparaben < 0.01 %
Cl 42090 < 0.1 %
Cl 19140 < 0.15 %
Cl 16035 < 0.2 %
## APPENDIX 4 - SPRAY TANNING: DURATION OF POSTURES ADOPTED

<table>
<thead>
<tr>
<th>Posture</th>
<th>Salon A</th>
<th>Salon B</th>
<th>Salon C</th>
</tr>
</thead>
<tbody>
<tr>
<td>Standing (arms below shoulder height)</td>
<td>Duration (secs): 149</td>
<td>270</td>
<td>185</td>
</tr>
<tr>
<td></td>
<td>No. of periods: 36</td>
<td>21</td>
<td>28</td>
</tr>
<tr>
<td></td>
<td>% total duration: 51%</td>
<td>55%</td>
<td>41%</td>
</tr>
<tr>
<td></td>
<td>Average duration (secs): 4.1</td>
<td>13</td>
<td>6.6</td>
</tr>
<tr>
<td></td>
<td>Max duration (secs): 11</td>
<td>39</td>
<td>16</td>
</tr>
<tr>
<td>Standing (arm(s) above shoulder height)</td>
<td>Duration (secs): 66</td>
<td>33</td>
<td>80</td>
</tr>
<tr>
<td></td>
<td>No. of periods: 13</td>
<td>2</td>
<td>11</td>
</tr>
<tr>
<td></td>
<td>% of total duration: 23%</td>
<td>7%</td>
<td>18%</td>
</tr>
<tr>
<td></td>
<td>Average duration (secs): 5.1</td>
<td>16.5</td>
<td>7.3</td>
</tr>
<tr>
<td></td>
<td>Max duration (secs): 11</td>
<td>19</td>
<td>17</td>
</tr>
<tr>
<td>Upper body/limb spraying</td>
<td>73%</td>
<td>62%</td>
<td>58%</td>
</tr>
<tr>
<td>Squatting</td>
<td>Duration (secs): 0</td>
<td>140</td>
<td>35</td>
</tr>
<tr>
<td></td>
<td>No. of periods: 8</td>
<td>29%</td>
<td>8%</td>
</tr>
<tr>
<td></td>
<td>% of total duration: 0%</td>
<td>17%</td>
<td>11.7</td>
</tr>
<tr>
<td></td>
<td>Average duration (secs): 27</td>
<td>27</td>
<td>14</td>
</tr>
<tr>
<td>One knee kneeling</td>
<td>Duration (secs): 0</td>
<td>0</td>
<td>124</td>
</tr>
<tr>
<td></td>
<td>No. of periods: 0</td>
<td>0</td>
<td>8</td>
</tr>
<tr>
<td></td>
<td>% total duration: 0%</td>
<td>27%</td>
<td>8</td>
</tr>
<tr>
<td></td>
<td>Average duration (secs): 0</td>
<td>0</td>
<td>27</td>
</tr>
<tr>
<td></td>
<td>Max duration (secs): 0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Squatting/one knee with trunk bend forward/side</td>
<td>Duration (secs): 0</td>
<td>29</td>
<td>32</td>
</tr>
<tr>
<td></td>
<td>No. of periods: 2</td>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>% of total duration: 6%</td>
<td>7%</td>
<td>7%</td>
</tr>
<tr>
<td></td>
<td>Average duration (secs): 15.5</td>
<td>15.5</td>
<td>8</td>
</tr>
<tr>
<td></td>
<td>Max duration (secs): 18</td>
<td>18</td>
<td>10</td>
</tr>
<tr>
<td>Trunk bending (moderate to severe)</td>
<td>Duration (secs): 77</td>
<td>16</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>No. of periods: 11</td>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>% total duration: 26%</td>
<td>3%</td>
<td>7%</td>
</tr>
<tr>
<td></td>
<td>Average duration (secs): 7.0</td>
<td>8</td>
<td>8</td>
</tr>
<tr>
<td></td>
<td>Max duration (secs): 11</td>
<td>10</td>
<td>10</td>
</tr>
<tr>
<td>Lower limb spraying</td>
<td>26%</td>
<td>38%</td>
<td>42%</td>
</tr>
<tr>
<td>Total</td>
<td>Duration (secs): 292 (4mins 52s)</td>
<td>488 (8mins 8s)</td>
<td>456 (7mins 36s)</td>
</tr>
<tr>
<td></td>
<td>No. of periods: 60</td>
<td>35</td>
<td>54</td>
</tr>
<tr>
<td></td>
<td>Average duration (secs): 4.9</td>
<td>13.9</td>
<td>8.4</td>
</tr>
<tr>
<td></td>
<td>Max duration (secs): 11</td>
<td>39</td>
<td>27</td>
</tr>
</tbody>
</table>
## APPENDIX 5 - ESTIMATED DURATION IN NON-NEUTRAL POSTURES DURING MASSAGE TREATMENTS

<table>
<thead>
<tr>
<th>Description</th>
<th>Salon A</th>
<th>Salon B</th>
<th>Salon C</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Trunk Posture</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Standing or walking around table</td>
<td>19 (2%)</td>
<td>10 (1%)</td>
<td>48 (5%)</td>
</tr>
<tr>
<td>Massage movement in with neutral neck/trunk</td>
<td>87 (10%)</td>
<td>57 (7%)</td>
<td>9 (1%)</td>
</tr>
<tr>
<td>Neutral trunk flexion</td>
<td>106 (12 %)</td>
<td>67(8%)</td>
<td>57 (6%)</td>
</tr>
<tr>
<td>Standing to side of table facing head or foot Mild/moderate trunk flexi plus twist/lateral bend</td>
<td>290 (33%)</td>
<td>489 (60%)</td>
<td>355 (39%)</td>
</tr>
<tr>
<td>Standing to side of table facing side Mild/moderate trunk flexion (no twist)</td>
<td>248 (29%)</td>
<td>103 (13%)</td>
<td>261 (28%)</td>
</tr>
<tr>
<td>Standing at head of table facing head Mild/moderate trunk flexion (no twist)</td>
<td>193 (22%)</td>
<td>160 (20%)</td>
<td>245 (27%)</td>
</tr>
<tr>
<td>Standing moderate trunk flexion</td>
<td>731 (83.9%)</td>
<td>752 (91.8%)</td>
<td>861 (93.8%)</td>
</tr>
<tr>
<td>Bending to remove stones from water bath Severe trunk flexion</td>
<td>16 (2%)</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Squat to deliver deep pressure massage Mild trunk flexion</td>
<td>18 (2%)</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Other trunk/lower limb postures</td>
<td>34 (4%)</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td><strong>Hand Posture/ Massage Movement</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Light, gliding, long strokes</td>
<td>89 (10%)</td>
<td>294 (36%)</td>
<td>187 (20%)</td>
</tr>
<tr>
<td>Deep pressure, small movements with thumbs or fingers</td>
<td>194 (22%)</td>
<td>226 (28%)</td>
<td>563 (61%)</td>
</tr>
<tr>
<td>Medium pressure, one hand over other</td>
<td>0</td>
<td>250 (31%)</td>
<td>96 (11%)</td>
</tr>
<tr>
<td>Medium pressure, small movements, heel of hand.</td>
<td>14 (2%)</td>
<td>39 (5%)</td>
<td>24 (3%)</td>
</tr>
<tr>
<td>Light, gliding, long strokes, holding hot stone.</td>
<td>283 (33%)</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Deep pressure, small movements, using edges of stone, stone in pinch grip.</td>
<td>151 (17%)</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Light pressure manipulations</td>
<td>372 (43%)</td>
<td>294 (36%)</td>
<td>187 (20%)</td>
</tr>
<tr>
<td>Medium pressure manipulations</td>
<td>14 (2%)</td>
<td>289 (35%)</td>
<td>120 (13%)</td>
</tr>
<tr>
<td>Deep pressure manipulations</td>
<td>345 (40%)</td>
<td>226 (28%)</td>
<td>563 (61%)</td>
</tr>
</tbody>
</table>

| Total duration of massage analysed (seconds) | 871 | 819 | 918 |
## APPENDIX 6 - REBA ASSESSMENT BY BODY PART

<table>
<thead>
<tr>
<th></th>
<th>Salon A</th>
<th>Salon B</th>
<th>Salon C</th>
<th>Totals</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Trunk</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Upright</td>
<td>1</td>
<td>5</td>
<td>2</td>
<td>8 (5%)</td>
</tr>
<tr>
<td>0-20</td>
<td>5</td>
<td>15</td>
<td>17</td>
<td>37 (22%)</td>
</tr>
<tr>
<td>20-60 (or &lt;20 + twist/side flex)</td>
<td>28</td>
<td>30</td>
<td>31</td>
<td>89 (52%)</td>
</tr>
<tr>
<td>&gt;60 (or 20-60 + twist/side flex)</td>
<td>25</td>
<td>2</td>
<td>9</td>
<td>36 (21%)</td>
</tr>
<tr>
<td><strong>Neck</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0-20 flexion</td>
<td>20</td>
<td>12</td>
<td>10</td>
<td>42 (25%)</td>
</tr>
<tr>
<td>&gt;20 flexion or extension</td>
<td>39</td>
<td>40</td>
<td>49</td>
<td>128 (75%)</td>
</tr>
<tr>
<td><strong>Legs</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bilateral weight bearing</td>
<td>57</td>
<td>52</td>
<td>59</td>
<td>168 (99%)</td>
</tr>
<tr>
<td>Bilateral + 20-60 knee flexion</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Bilateral + knees &gt;60</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td><strong>Upper arms</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>20 flexion to 20 extension</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>6 (4%)</td>
</tr>
<tr>
<td>&gt;20 extension, 20-45 flexion</td>
<td>5</td>
<td>12</td>
<td>8</td>
<td>25 (15%)</td>
</tr>
<tr>
<td>45-90 flexion</td>
<td>34</td>
<td>29</td>
<td>31</td>
<td>94 (55%)</td>
</tr>
<tr>
<td>&gt;90 flexion</td>
<td>19</td>
<td>9</td>
<td>17</td>
<td>45 (26%)</td>
</tr>
<tr>
<td><strong>Lower arms</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>60-100 flexion</td>
<td>20</td>
<td>20</td>
<td>7</td>
<td>47 (28%)</td>
</tr>
<tr>
<td>&lt;60 flexion or &gt;100 flexion</td>
<td>39</td>
<td>32</td>
<td>52</td>
<td>123 (72%)</td>
</tr>
<tr>
<td><strong>Wrists</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0-15 flexion/extension</td>
<td>19</td>
<td>22</td>
<td>13</td>
<td>54 (32%)</td>
</tr>
<tr>
<td>&gt;15 flexion/extension (or &lt;15 + deviation)</td>
<td>32</td>
<td>30</td>
<td>38</td>
<td>100 (59%)</td>
</tr>
<tr>
<td>&gt;15 flexion/extension + deviation</td>
<td>8</td>
<td>0</td>
<td>8</td>
<td>16 (9%)</td>
</tr>
</tbody>
</table>
An exploratory study of occupational health risks for beauty therapists who carry out massage and spray tanning treatments

This study explored the possible risks of musculo-skeletal and respiratory ill-health for beauty therapists who deliver massage and spray tanning treatments. The delivery of these treatments was observed in three salons who also offered facials, waxing, manicures and pedicures.

The postural analysis of both massage and spray tanning treatments for this study indicated an overall medium risk level of developing MSDs. However, as the reported activity (treatment) durations were short and frequencies low, the risk may be lower than these assessments suggested. If these or other treatments involving similar postures or repetitive movements were carried out for more than two hours a day then further assessment and risk reducing action may be needed.

When delivering spray tanning treatments, the workers' personal exposures to specific volatile and semi-volatile organic compounds were all low and the active ingredient in spray tan solution (dihydroxyacetate) was not detected. The bacterial/fungal contamination of the samples was very low and not considered to pose a risk to health.

It is acknowledged that the findings of this exploratory study may not be representative of the wider beauty therapy sector. Further study is recommended in order to gain a better understanding of the potential impact of the health issues identified.

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