



A Comprehensive Analysis of Tools and Technologies for Fine Line Tattooing

Alina Mykhalevych

Lina's Lines Founder, Fine Line Tattoo Artist, Tattoo Industry Educator, Atlanta, Georgia, USA.

Abstract

This study offers a comprehensive analysis of the tools and technologies employed in Fine Line tattooing, encompassing tattoo machines, needles, pigments, and power supply systems. It critically evaluates the performance and technical specifications of both coil and rotary machines, alongside the material properties and configurations of tattoo needles and inks, to determine their impact on the precision and durability of Fine Line designs. The paper integrates global industry trends and practical case studies to present an informed comparison of current methodologies, highlighting innovations that enhance both safety and aesthetic outcomes. Practical guidelines and recommendations for tattoo artists, from novices to experienced practitioners, are discussed, emphasizing the balance between technological capabilities and artisanal skill.

Keywords: Fine Line Tattoo; Tattoo Equipment; Machine Technology; Needle and Pigment Analysis; Global Trends; Digital Power Supply; Practical Guidelines.

INTRODUCTION

Fine Line tattoos are a style characterized by the use of exclusively thin, delicate lines, which has been rapidly gaining popularity worldwide [1, 2]. Unlike traditional “old school” tattoos with bold outlines, Fine Line designs appear light and intricate, are often executed in small sizes, and require the highest level of precision during application [1].

The increasing demand for such refined work is driving technological advancements. The global tattoo industry market was valued at \$13.1 billion in 2022, with projections estimating growth to \$24 billion by 2032 [2]. One of the key drivers of this growth is the emergence of new styles—including geometric and Fine Line tattoos—which require specialized equipment [2].

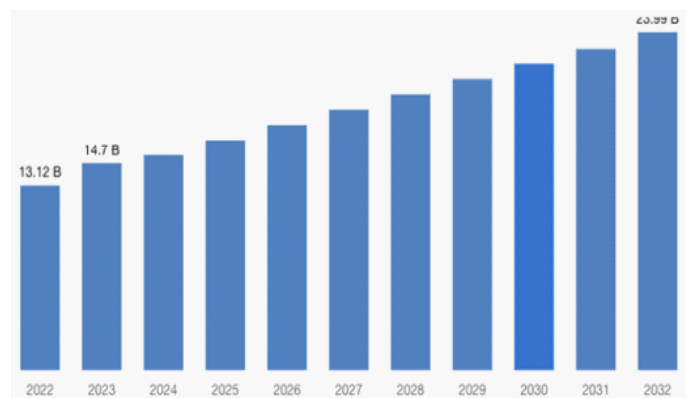


Figure 1. Global tattoo industry market [2]

However, the application of ultra-fine lines presents technical challenges. Thin needles deposit less pigment, which may cause these tattoos to fade more quickly [3]. To achieve crisp and long-lasting lines, tattoo artists must select the most suitable tools, ranging from the type of machine and needles to pigment quality and power supply stability.

The objective of this study is to conduct a comprehensive analysis of modern tools and technologies used for Fine Line tattoos by synthesizing data from leading publications and industry reports. The review examines the primary types of tattoo machines (coil and rotary), the characteristics of needles and cartridges, pigment properties, power supply types, and other technical aspects.

Based on the analysis, practical recommendations are provided for both novice and experienced tattoo artists. This balanced approach—from theory to practice—will help determine which equipment yields the best results for Fine Line tattooing and how global technological trends can enhance the quality and safety of this technique.

Fine Line Tattoo Machines: Coil Vs. Rotary and Power Supply

The type of tattoo machine significantly influences line quality and the artist's comfort. Historically, artists used coil machines, where the needle is driven by electromagnets and a spring. These coil machines deliver a powerful impact, making them suitable for bold outlines; however,

Citation: Alina Mykhalevych, “A Comprehensive Analysis of Tools and Technologies for Fine Line Tattooing”, Universal Library of Arts and Humanities, 2025; 2(1): 29-34. DOI: <https://doi.org/10.70315/uloap.ulahu.2025.0201005>.

they are relatively heavy, vibrate significantly, and produce considerable noise [4].

A modern alternative is rotary machines, which utilize an electric motor with an eccentric mechanism to create smooth, reciprocating needle movement [4]. Rotary models, particularly in the “pen-style” form factor, are significantly lighter and quieter than coil machines. They provide a continuous and even needle motion, thereby enhancing precision in creating fine lines [4]. For this reason, many Fine Line tattoo artists today prefer rotary pen machines, as their lightweight design and ergonomic shape offer better hand stability and control when executing delicate contours [1].

Figure 2 presents an example of a typical rotary pen machine prepared for use, wrapped in protective film for sterility. For comparison, Figure 3 shows a classic coil liner machine, which has a more complex construction with two coils and a spring.



Figure 2. Rotary pen-style tattoo machine wrapped for hygiene; its lightweight body and minimal vibration make it a popular choice for fine lines [13]

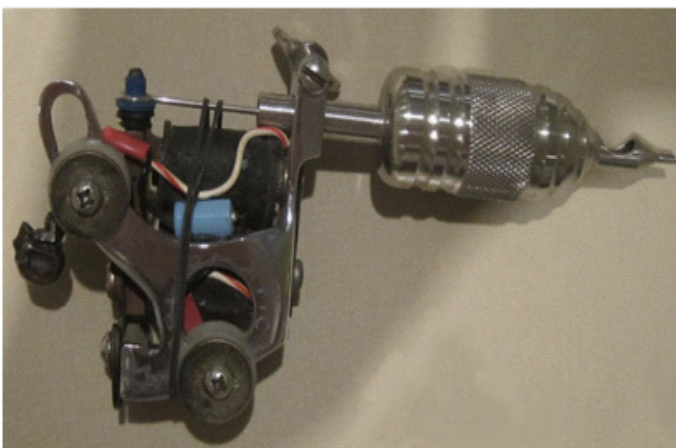


Figure 3. Coil tattoo machine (liner). A heavy frame, coils, and springs provide a powerful impact, requiring skill to control when working on fine details [14]

Coil machines are valued for their power and adjustability. An experienced artist can modify the impact force by adjusting the spring tension or voltage to achieve a precise line in a single pass [4]. For example, the specialized coil liner “Fine Liner” by VladBlad is capable of consistently creating

contours from 3RL to 9RL in a single pass without blurring the outline [4]. However, working with a coil machine requires a high level of skill. Due to the strong impact and vibrations, controlling very fine needles is challenging, increasing the risk of skin trauma and blowouts (ink spreading under the skin) in case of an error.

Rotary machines, in contrast, provide a softer and more stable needle puncture. The motor ensures a constant speed and needle depth, reducing ink splatter and tissue trauma [15]. Studies indicate that the smooth motion of a rotary machine leads to more even pigment deposition, which is particularly important for detailed work [15].

Rotary machines require almost no maintenance, as they contain fewer components—no springs, contact screws, or rapidly wearing parts [15]. Additionally, the low noise level of rotary machines creates a calmer atmosphere for both the client and the artist [15], which is crucial when working on intricate details.

The choice of power supply also affects line quality. Coil machines traditionally operate with foot pedal-controlled power units; maintaining sufficient current strength and proper voltage (typically 6–8V for fine line work) is essential for stable coil performance. Rotary machines are less demanding and often function at lower voltage settings, allowing for slow and precise needle insertion suited for fine line tattooing.

Modern digital power supplies allow for precise voltage adjustment in 0.1V increments, enabling fine-tuning of the machine to match specific needle configurations and skin areas. With the advent of compact lithium-ion batteries, wireless tattoo machines and battery modules that replace traditional cables have gained popularity. This autonomous system eliminates cords that can restrict movement, which is particularly beneficial for artists working on fine details and hard-to-reach areas of the client’s body [5].

Wireless rotary pen machines today can deliver power comparable to wired power units while maintaining a stable needle stroke frequency of hundreds of cycles per second [5]. A single battery charge typically lasts between 2 to 6 hours of continuous operation, and with intermittent use, it can function for up to a week without recharging [5]. Some models now feature quick battery swaps and digital displays on the battery module for real-time voltage monitoring [5].

For beginner artists, rotary pen-style machines and digital power supplies are often the most optimal choice. They are intuitive to use—once powered on, the machine immediately operates consistently without the need to “tune the coil sound” or adjust springs. Low vibration reduces hand fatigue and helps maintain focus on creating precise lines [4].

Experienced professionals working in the Fine Line style often combine different technologies. While most fine lines are executed using a rotary machine, certain tasks may require a well-calibrated coil liner to achieve exceptionally sharp strokes in specific areas, such as dense skin, where stronger impacts are needed [4].

In both cases, voltage stability and the technical condition of the equipment remain critical. High-quality power supplies with smooth current delivery (avoiding voltage drops under load) and the use of functional cables or certified batteries are recommended. This prevents fluctuations in needle speed, which could lead to inconsistencies in linework. Thus, the combination of a properly selected machine (considering the artist's experience) and a reliable power source ensures the necessary consistency of needle penetration for an ideal Fine Line contour.

Needles and Pigments: Materials for Ultra-Fine Contours

Needles are the primary tool determining the thickness and sharpness of a line. The Fine Line style is characterized by the use of the smallest needles and tightly soldered configurations. Standard tattoo needles have a diameter of approximately 0.35 mm (commonly referred to as gauge #12) [6]. For fine line work, artists opt for smaller-diameter needles: Bugpin needles correspond to gauge #10 (Ø0.30 mm), while Super Bugpin needles are gauge #8 (Ø0.25 mm) [6].

A reduced diameter allows the needle to puncture the skin with a smaller opening, leaving a more delicate pigment trace. Additionally, single round liners (1RL) or small groupings of 3–5 needles that are packed as tightly as possible (marked as tight or super tight liner) are commonly used [1]. A tightly grouped configuration of three small-diameter needles can visually mimic the thickness of a 1RL needle while providing more stable pigment deposition due to mutual support among the needles, resulting in a more saturated line. Fine Line artist J. Kim notes that while this style is often associated with the “single needle” technique, in practice, many artists achieve a similar effect using configurations of 3–5 ultra-thin needles [3]. The key is achieving exceptionally fine lines, regardless of the specific needle setup.

When working with fine needles, it is essential to balance trauma and pigment saturation. On the one hand, a smaller needle diameter can cause more skin damage due to deeper and sharper punctures (Bugpin needles are considered to ‘leave a smaller hole’), but on the other hand, thinner needles deposit less ink per pass. As a result, achieving a crisp line often requires slower, more meticulous strokes or multiple passes (typically 2–3), which may increase skin trauma.

An optimal approach involves using long taper needles, which release ink in a more controlled manner. For example, super-tight 0.25 mm liners with a long taper create an extremely fine, precise stroke, although they deliver ink at a slower rate [1]. Manufacturers note that such needles provide a more gradual and stable ink flow, allowing the artist to control every millimeter of the line without excessive bleeding or spreading [1].

Beginners often aim to work with 1RL needles; however, experts caution that a single needle requires flawless technique to avoid inconsistent or unevenly deposited lines

[3]. Therefore, novice Fine Line artists are often advised to start with 3RL (a three-needle configuration) of a larger diameter, as this grouping compensates for slight hand instability and ensures more even pigment distribution. Once proficiency is developed, transitioning to true single-needle work becomes more feasible.

A critical practical recommendation is the regular replacement of needles. Studies indicate that needle tips become dull during the tattooing process, especially during long sessions or when using pigments with solid particles (such as titanium dioxide white ink) [7]. A worn or jagged needle does not penetrate the skin as cleanly and may create irregular or torn lines. For large Fine Line projects, it is advisable to replace the cartridge periodically during the session—for instance, using a fresh needle for each new name or pattern.

Tattoo needles have almost entirely transitioned to a replaceable cartridge format. A cartridge is a “needle-sleeve” module pre-assembled for machine installation and disposed of after use. This is particularly convenient for the Fine Line style, as it allows for quick configuration changes (e.g., switching from 3RL to 1RL for specific details). Most cartridges are now equipped with an internal membrane that prevents the backflow of ink and bodily fluids into the machine's grip [8, 9]. This design significantly enhances hygiene, as the European standard EN 17169 “Safe and Hygienic Practice” now mandates protective membranes in professional equipment [9].

High-quality cartridges, such as the Cheyenne Safety series, are not only sealed but also made from durable, wear-resistant steel. The manufacturer claims that their needles do not release abrasive metal particles into the skin during use [10]. This is a crucial advancement, as recent scientific studies have found that the wear of metal needles can lead to the deposition of nickel and chromium nanoparticles in clients' skin and lymph nodes [7].

Engineering solutions, including needle alloys, coatings, and machine smoothness, have minimized these risks. A key takeaway for artists is to use branded cartridges with membranes and avoid low-quality needles from unknown manufacturers. This is not only a matter of sterility but also of line precision, as a sharp and intact needle will produce better results than a cheap one that may have burrs or dull quickly.

Pigments for fine detail work must be selected with special care. Fine Line tattoos typically feature monochromatic designs—black or dark gray outlines without shading [1]. Classic black tattoo pigment contains ultra-fine carbon soot or blends of organic dyes, providing high contrast and durability. Fine Lines fade faster because they contain less pigment, and the immune system removes the ink more actively than it does in thicker layers of color [3].

Dermatologists explain that when ink particles are sparsely and superficially placed in the skin, macrophages can break

them down more easily, which is why Fine Line tattoos may lose sharpness sooner than denser designs [3]. This cannot be entirely prevented but can be slowed by selecting high-quality ink and following proper technique. The pigment must be sufficiently concentrated to ensure longevity even when applied in minimal amounts.

Leading brands such as World Famous, Eternal, and Intenze have developed specialized lines of black and gray pigments for linework, featuring high concentration and fine particle size to improve color retention. It is also important to avoid excessive dilution of the ink. Pre-diluted Greywash is commonly used for fine lines, but overly thin pigment may result in a faded appearance.

The chemical composition of tattoo inks has been under increased regulatory scrutiny in recent years. Analytical studies indicate that the content of tattoo pigments varies across manufacturers and colors, with samples containing aluminum, copper, iron, zinc, and other impurities in concentrations ranging from tens to thousands of mg/kg [11]. In some cases, the levels of certain elements, such as copper, exceed recommended safety limits [11].

Tattoo pigments are primarily composed of inorganic metal compounds (iron oxide for brown, titanium dioxide for white, chromium salts for green, cadmium salts for yellow, etc.) and organic dyes [11]. Black pigments typically use carbon-based soot, while diluted shades are achieved by mixing with titanium dioxide (TiO₂) white pigment. Titanium dioxide is particularly known for its hardness, with its particles acting as an abrasive on needles.

In an experiment where pigskin was tattooed with white ink, electron microscope analysis revealed significant wear on steel needles, whereas black carbon-based pigments caused considerably less abrasion [7]. Detached metallic particles, such as nickel and chromium from the needle's steel composition, remain in the skin and lymph nodes, potentially triggering allergic reactions [7]. In the context of Fine Line tattooing, this means that if a design includes white elements or highly pigmented colors containing titanium dioxide, frequent needle changes may be necessary, and lines may require touch-ups after healing.

From a safety and quality perspective, the tattoo industry is shifting toward cleaner pigments. In the European Union, regulations restricting the use of certain traditional dyes, such as Blue 15 and Green 7 pigments, came into effect in 2022 due to concerns over their potential toxicity. Manufacturers have been forced to develop new ink formulations. Many brands now label their products as "EU REACH-compliant," indicating adherence to strict regulations on hazardous substances. This is a positive trend for Fine Line artists, as modern inks contain fewer heavy metals (Ni, Cr, Co, Hg, etc.), reducing the risk of allergic reactions in clients [7, 11].

Additionally, "vegan" inks, which do not contain animal-derived ingredients or undergo animal testing, typically exclude outdated components such as bone-black soot,

replacing them with high-purity synthetic pigments. In practice, this has led to more predictable healing and greater ink longevity. With fewer impurities, pigments retain stability, are less susceptible to UV degradation, and cause fewer complications.

To preserve fine lines, artists are advised to use trusted ink brands and educate clients on proper aftercare. Fine Line tattoos require meticulous maintenance; sun protection, moisturization, and timely touch-ups in case of fading will help maintain line sharpness for years [3, 12].

Recommendations for Tattoo Artists

Based on the conducted analysis, practical recommendations can be formulated for selecting tools and technologies suited to different experience levels of tattoo artists.

For beginner artists working in the Fine Line style, the priority should be simplicity and control. It is advisable to start with a high-quality mid-range rotary pen-style machine, as it provides stable needle movement without complex adjustments. Models such as the Cheyenne Hawk Pen or Axys Valhalla offer ergonomic designs and are well-suited for practicing fine line techniques.

A digital power supply should be purchased immediately (if the machine is not wireless), as the ability to precisely set low voltage (around 7–9V for 3RL) helps prevent excessive needle penetration.

For needles, beginners are recommended to use 3RL Bugpin (#10) cartridges with a long taper. This configuration compensates for minor hand instability while ensuring the required line thinness. Single 1RL needles should be introduced only after gaining experience, as they are more difficult to control [3].

An important recommendation is to practice on synthetic skin or fruits (such as oranges or lemons) to develop hand stability before transitioning to actual Fine Line tattoo work. This helps in understanding the appropriate needle penetration depth and stroke speed, as precision is critical, and any mistakes in fine line work are highly visible.

Hygiene should be a primary focus for beginner Fine Line artists. Only sterile disposable cartridges with membranes should be used, gloves must be worn during procedures (Fig. 2), and the work area should be thoroughly disinfected [1].

Small details often require close inspection, so proper lighting and magnification (such as working with a magnifying loupe) can be advantageous. Investing in expensive pigments at the start is not necessary; a high-quality basic black pigment set from a reputable brand is sufficient to ensure ink does not spread or change color over time.

For experienced professionals who have already developed their skills, expanding their technical arsenal for Fine Line tattooing is advisable. Many advanced artists use two machines: a rotary machine for the majority of their work and a finely tuned coil liner for specialized tasks.

Case studies of leading geometric and linework tattoo artists demonstrate that a properly calibrated coil machine can produce exceptionally sharp lines, even with small needle groupings [4]. Therefore, professionals interested in expanding their skills should consider mastering coil machines, at least to understand their mechanics and be able to switch when necessary. Regardless of the machine type, top Fine Line artists focus on precise adjustments, selecting the optimal stroke length for their specific linework style and experimenting with different cartridge models. For instance, they compare needles from Cheyenne, Kwadron, and Envy to determine which provide the most consistent and refined lines.

Professionals also frequently transition to wireless operation. Using a battery module on the machine eliminates the cable, which can snag and disrupt hand stability when creating long lines or intricate lace-like patterns. According to reviews, the absence of a cord allows for greater freedom of movement and facilitates smoother, uninterrupted lines [5]. The downside is the additional weight of the battery in hand, but modern modules weigh between 50 and 80 grams, which is not a significant issue for an experienced artist.

Another essential tool for professionals is thin disposable grips and tips. While many pen-style machines have integrated grips, when working with a coil or modular system, selecting a lightweight grip with a smaller diameter can provide a pencil-like feel for better control. Some artists wrap their grips with tape to adjust the thickness to their preference (see Fig. 2, where a soft wrap is applied to the handle for a more comfortable grip). These refinements aim to enhance stability and precision, as even the slightest hand tremor can impact the quality of fine line work.

Regardless of skill level, certain general recommendations apply to the Fine Line style. First, careful planning and pre-production are crucial. Fine details require a flawless stencil on the skin—it must be clear enough to prevent the artist from second-guessing the line placement during the tattooing process. Using high-quality transfer paper or freehand markers for outlining helps minimize errors.

Secondly, placement on the body affects longevity. Fine lines tend to fade more quickly in areas subject to frequent friction and skin tension, such as fingers, palms, and soles [3]. If a client insists on a Fine Line tattoo in such a challenging location, it is important to inform them about the higher likelihood of blurring and the need for frequent touch-ups.

Thirdly, speed and pressure during application should be carefully controlled. The optimal approach is a slow and steady motion. Rushing compromises quality, leading to broken or inconsistent lines. On the other hand, excessively slow execution may oversaturate the area, causing ink layering and spreading. Achieving the right balance requires practice, such as drawing fine, even lines on latex while adjusting voltage and hand speed until a consistent result is obtained without gaps.

Finally, client communication is an integral part of a tattoo artist's professionalism. Fine Line tattoos are highly aesthetic, but clients should be aware of their characteristics. It is advisable to inform them in advance that fine lines may slightly thicken and fade over time, with possible touch-ups needed after one to two years, especially for very small tattoos. Many artists include one complimentary touch-up a few months after the initial session, which helps build trust and ensures the final quality of the work.

Providing detailed aftercare instructions is also essential. Proper care in the first two weeks is crucial, as a thin outline can be easily damaged by scabbing. Avoiding sun exposure and tanning beds, along with regular moisturizing, directly influences how long the tattoo retains its original sharpness.

CONCLUSION

The development of the Fine Line style has driven advancements in tattooing equipment and materials, providing artists with tools that enable the creation of intricate and long-lasting tattoos.

The analysis has shown that the transition from bulky coil machines to lightweight rotary pen-style machines has become a key technological trend. Modern rotary machines offer smooth operation, low vibration, and high precision, all of which are essential for fine lines [1, 4]. However, coil machines have not lost their relevance—they remain capable of producing flawless outlines in skilled hands, and new specialized liner models combine the power of coils with the control needed for Fine Line work [5].

Another critical component is needles. The use of small-diameter needles (#10–#04) and tightly grouped configurations (1-3RL) has become the standard for this style [1]. The introduction of disposable cartridges with membranes has made the process safer, reducing contamination risks and needle wear [9, 10].

The chemical composition of pigments highlights the importance of selecting high-quality inks. Highly concentrated pigments with minimal heavy metal content provide longer-lasting fine lines and reduce the likelihood of allergic reactions [7, 11].

Fine Line tattoos still tend to fade slightly faster than other styles due to the characteristics of the healing process [3]. However, by applying advanced techniques—such as using durable pigments, ensuring proper needle depth, and following meticulous aftercare—these tattoos can retain their delicate aesthetic for decades.

The practical significance of this review lies in its comprehensive overview of modern Fine Line tattooing technologies and the specific recommendations provided for different skill levels. Beginners will benefit from guidance on which equipment is easiest to learn with, such as starting with a rotary pen and Bugpin needles, while experienced artists can explore techniques for fine-tuning their tools, from specialized coil liners to wireless modules.

The tattoo industry is globally moving toward increased precision and safety. The growing popularity of minimalist styles is pushing manufacturers to develop more advanced machines, needles, and pigments [2].

REFERENCES

1. Steri-Studio. (2022, October 18). *The Trend and the Tools: Fine Line Tattoos*. <https://www.steristudio.com/blogs/steri-studio-tattoo-supply/the-trend-and-the-tools-fine-line-tattoos#:~:>
2. Custom Market Insights. (2023, December 6). *Latest Global Tattoo Market Size/Share Worth USD 23.99 Billion by 2032 at a 9.5% CAGR - Analysis & Forecast* <https://www.globenewswire.com/news-release/2023/12/06/2791440/0/en/Latest-Global-Tattoo-Market-Size-Share-Worth-USD-23-99-Billion-by-2032-at-a-9-5-CAGR-Custom-Market-Insights-Analysis-Outlook-Leaders-Report-Trends-Forecast-Segmentation-Growth-Grow.html#:~:>. GlobeNewswire Press Release.
3. Rekstis, E. (2022, August 9). *The Truth About How Fine-Line Tattoos Heal* <https://www.allure.com/story/do-fine-line-tattoos-last#:~:text=match%20at%20L152%20With%20that,it%20out%20of%20your%20system>. Allure Magazine.
4. Vlad Blad. (2023). *Fine Liner Air - Precision Tattoo Liner (product description)* <https://vladblad.shop/tproduct/524306892-437453824071-fine-liner-air#:~:text=We%27ve%20taken%2015%20years%20of,powerful%2C%20yet%20totally%20under%20control>. Vlad Blad Iron Machines.
5. Tatvida. (2023). *Wireless Tattoo Machine: An In-Depth Guide* <https://tatvida.com/blogs/news/wireless-tattoo-machine-comprehensive-guide?srsId=AfmBOoo-EbK6WW0yGvlOHRVzRdnbMZGxIFTjccBqH30Wbxpupc rf0Dv#:~:text=Wireless%20tattoo%20machines%20have%20evolved,tightly%20to%20a%20single%20location>. Tatvida.com.
6. Element Tattoo Supply. (2022, November 13). *What is a bugpin tattoo needle?* <https://www.elementtattoosupply.com/en-nl/blogs/most-frequently-asked-questions-about-tattoo-cartridge-needles/what-is-a-bugpin-tattoo-needle?srsId=AfmBOoqoyhJboBV20Ef0i5umGZLca-J6opkt7MDmYba-R28nHfQ-mrqf>. Element Tattoo Blog.
7. Schreiber, I., Hesse, B., Seim, C., et al. (2019). *Distribution of nickel and chromium containing particles from tattoo needle wear in humans and its possible impact on allergic reactions* <https://pmc.ncbi.nlm.nih.gov/articles/PMC6710876/#:~:text=Here%2C%20we%20report%20the%20deposition,IV%20allergy%20toward%20a%20tattoo>. Particle and Fibre Toxicology, 16(1), 33. DOI:10.1186/s12989-019-0317-1
8. Dynasty Membrane Tattoo Needle Cartridges. Retrieved from https://needlejig.com/collections/dynasty-membrane-cartridges?srsId=AfmBOoruT1Fk7xqpt8XZsODl6SPlwzIPA_upxVrU5ckKHy4tEJgIkg1p#:~:text=Membrane%20Tattoo%20Needle%20Cartridges%20,are%20preferred%20by%20many%20artists
9. Cheyenne (2021). *Safety Cartridges - Product Info*. Retrieved from https://www.eternaltattoosupply.com/products/cheyenne-round-shader-needle-cartridges?srsId=AfmBOorZYYVmdJg-_ZDGa5_DmPCqJgk7Chs6Avq9AxQfJlAxAwB9_Ry&variant=39794937790562. CheyenneTattoo.com.
10. Cheyenne Tattoo Cartridges: The Safest Tatoo Needles. Retrieved from <https://cheyennetattoo.com/en/tattoo-needles#:~:text=Cheyenne%20Tattoo%20Cartridges%20,The>
11. Karadagli, S. S., Cansever, I., Armagan, G., & Sogut, O. (2023). *Are Some Metals in Tattoo Inks Harmful to Health? An Analytical Approach* <https://pmc.ncbi.nlm.nih.gov/articles/PMC9846827/#:~:text=hydrochloric%20acid%2C%20and%20hydrofluoric%20acid,necessary%20to%20understand%20the%20effects>. Chemical Research in Toxicology, 36(1), 104-111. DOI:10.1021/acs.chemrestox.2c00323
12. Dr. Thomas Barrows (2023). *Discover How an Aged Fine Line Tattoo Looks After 10 Years*. Retrieved from <https://removery.com/blog/aged-fine-line-tattoo/#:~:text=Discover%20How%20an%20Aged%20Fine,your%20body%20art%20for%20decades>
13. File:00A-Axys Valhalia pen rotary style tattoo machine, wrapped for sanitary practice.jpg. Retrieved from https://commons.wikimedia.org/wiki/File:00A-Axys_Valhalia_pen_rotary_style_tattoo_machine,_wrapped_for_sanitary_practice.jpg
14. File:'Rollomatic' liner.JPG. Retrieved from https://commons.wikimedia.org/wiki/File:%27Rollomatic%27_liner.JPG
15. The Rotary Tattoo Machine: A Modern Marvel in Tattooing. Retrieved from <https://inkcredibleartistic.com/rotary-tattoo-machine/#:~:text=1,Lightweight%20and%20Easy%20to%20Handle>