Future Prospects of Conservation Treatments with a Micro-Aspirator Tool

Great Aspirations

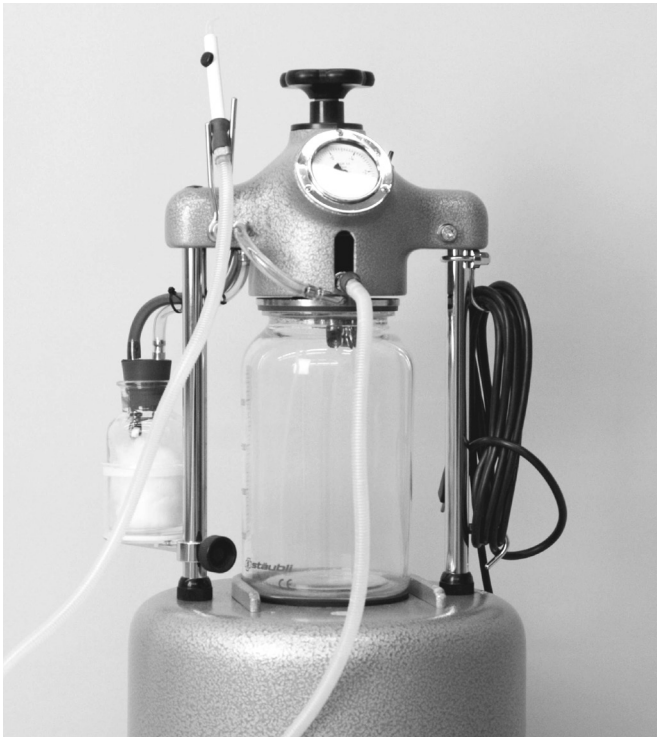
A conservator's dream would be to treat surfaces contact-free, with as little mechanical impact as possible. The technique of micro-aspiration has shown some promising results in this direction and has recently been experimented with by the conservators at the Fondation Beyeler.

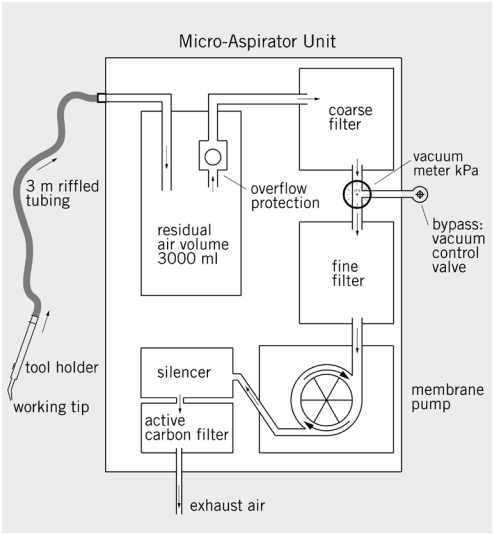
The innovative Swiss conservator Benno Wili has been working with micro-aspiration since 1997 and has continuously been modifying the equipment to the needs of conservators for the past 20 years. Currently about 25 of his prototypes are in use in conservation studios throughout Europe. Similar techniques have been used by other conservators, however modestly and with other application approaches (Heiber, Nikolaus, 1998 ; Hausamann et al. 2010, Pfister 1999 , Cremonesi 2017).

The micro-aspiration method described here is a "micro-cleaning," where small surface areas are treated locally under magnification with regulated suction from a vacuum pump. The generated vacuum is so strong that liquids and gels can be completely and immediately removed, leaving the surface dry again.

The Micro-Aspirator

The device is a mobile vacuum membrane pump from the medical field modified for use in conservation. Liquids and solvents are sucked in through a glass nozzle tip with a diameter of less than 1mm, together with the ambient air. As the solvents travel through the three meter riffed tubing and a three liter residual air volume vessel, they are evaporated, so liquid solvents do not accumulate within the vessel. The use of additional fume extraction is still recommended.



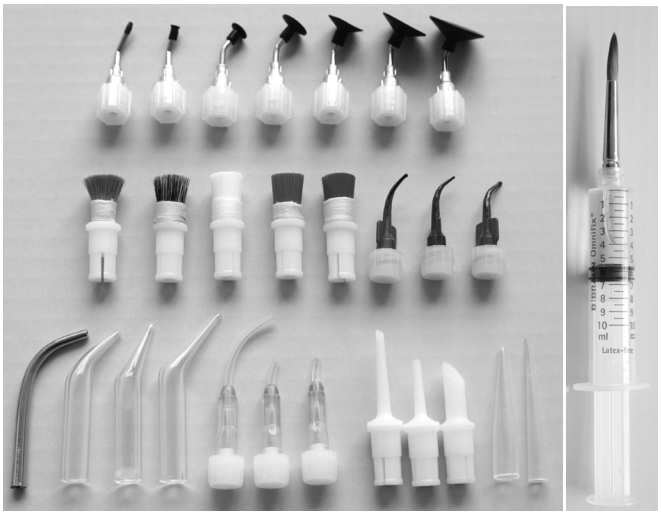


throughput 20 ltr./min. vacuum range 0 to – 0,80 bar
vacuum max. - 0,80 bar noise level < 70 dBA

The device has a particularly high throughput, almost three times as high as other vacuum pumps, which results in considerably faster solvent/liquid removal from treated surfaces . The vacuum can be regulated with a bypass gauge.

The finger control on the hand-tool allows for an immediate and easy start / stop of the suction.

A large variety of tips, nozzles, and brushes attached to the vacuum tubing allow for diverse and precise treatment options, especially when combined with a syringe fitted with a brush tip which allows controlled dispensing of liquids.

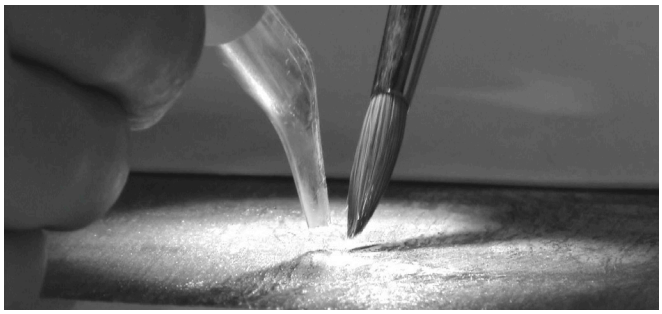


The technique has shown to be convincing for both wet and dry surface cleaning.

Solvent Cleaning

A painting by Claude Monet was tested for removal of a poly(butyl acrylate) varnish which distorted the matte, pastel-like surface and color harmony. Highly concentrated xylene was found to best remove it, however, a removal with cotton swabs was not possible. Mechanical swabbing affected the original paint layer, and the varnish could not easily be reached within the impastoed paint layer.

Micro-aspiration was found to solve both problems. The solvent was applied with brush syringes by gently moving the tip of the brush over the surface in an area of several millimeters. Almost simultaneously, the solvent and dissolved varnish were extracted with the micro-aspirator.

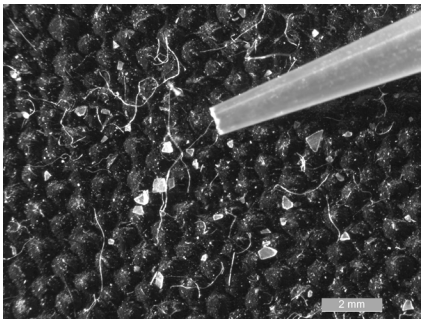


The cleaning could be controlled by the ability to finely regulate the solvent dosage with the hand-held brush syringe and the positioning of the vacuum nozzle closer or further away from the brush syringe, thus decreasing or increasing the solvent action time. Working with both tools simultaneously, a flushing effect was produced, streaming solvent and air turbulences over the surface.

Dry Surface Cleaning

An Andy Warhol silkscreen painting in which the artist covered the wet silkscreen paint with diamond dust (actually crushed glass), suffered from extreme, almost disfiguring soiling from "house" dust. The affected black paint in the background is an unusually soft acrylic emulsion. Conventional dusting methods were not possible without affecting the soft original paint surface and disturbing the only lightly adhering diamond dust particles.

Microaspiration gave an ideal alternative method to treat this sensitive surface. Individual dust fibers were easily removed with the right amount of suction strength without having to rub the surface. Most importantly, precision control with the glass nozzle made it possible to accurately work around the tiny diamond dust particles in which the fibers were entangled, without dislodging them.

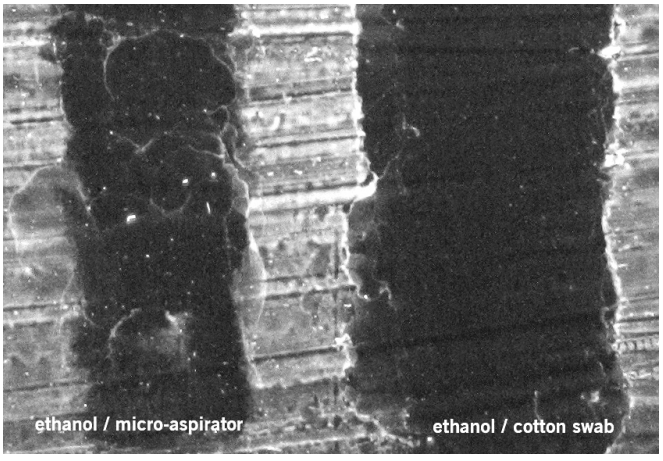


The accurate and lightweight tools as well as the quiet motor, made the laborious and time-consuming treatment easily manageable.

under ultraviolet light

Up Close

The possibilities of micro-aspiration are promising, however, there is no research on how this method affects paint surfaces on a micro-level. To get a preliminary idea, test panels were treated for a varnish removal (aged dammar) with traditional cotton swabs and micro-aspiration. Both methods showed similar results optically while working. The cleaned surfaces were then compared under UV and high magnification, and differences were apparent.

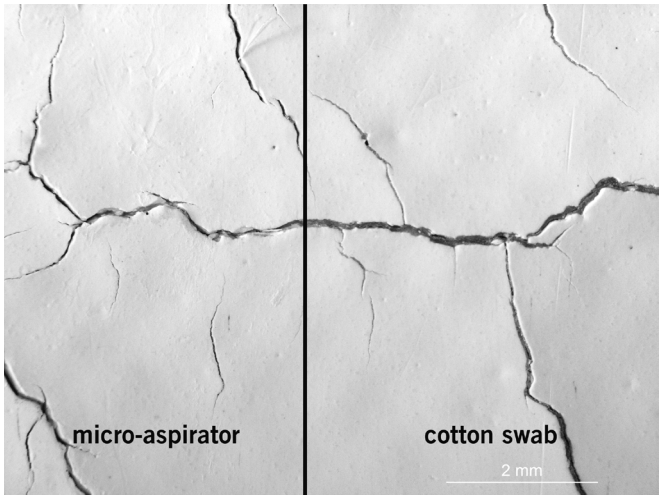


Micro-aspiration can leave "smears" and pooling of dissolved varnish residues, while the areas cleaned with cotton swabs are evenly clean.

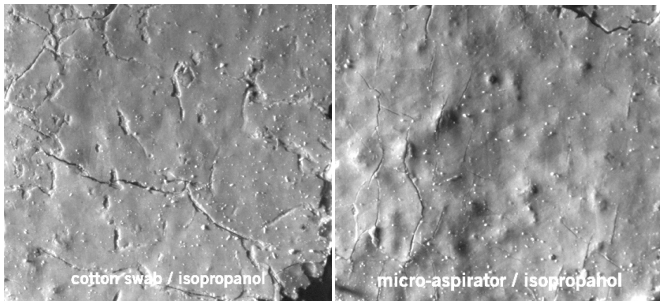
Although the varnish was solubilized, working on a micro-scale with fluids and air pressure can form tide lines, strongly depending on individual working style and hand skill experience. Cleaned areas should be checked in UV and treatment repeated several times when using micro-aspiration, since the surface dries almost immediately after each application.

SEM images of porous test surfaces also show fine residues of varnish partially still present within the deeper micro structure of the paint compared to the more thoroughly swab cleaned areas. One reason might be cotton's adsorption ability. Possibly a better adjusted solvent choice when working with micro-aspiration could counter this affect.

On a macro level, micro-aspiration is clearly more effcient and precise when cleaning heavy impasto or cracks . The strong and accurately positioned vacuum pulls unwanted material out of interstices, while swabs can hardly reach into deep impasto cavities and even tend to push material further into cracks while cleaning.



On fragile paint layers, micro-aspiration shows positive results. The unavoidable mechanical friction of cotton swabs (left) can quickly attack sensitive surfaces, while micro-aspiration allows gentler working (right).



These initial tests suggest that not all surfaces and cleaning problems are suitable for micro-aspiration treatment. Testing needs to be continued and supported by further analyses in order to fully understand the role of micro-aspiration within the complex issue of surface cleaning.

In Summary:

Benefits

- minimal to no mechanical surface impact
- easy access to all surface structures (impasto, cracks)
- precise control over working time of solvents; quick dry time
- precise working on a small-scale
- no pushing of materials into paint structure
- quiet machinery and large variety of tools

Challenges

- even and thorough cleaning needs practice and experience
- potential of varnish residues, depending on manual dexteriety
- larger amounts of solvents necessary, as no mechanial action is involved
- testing/analysis and structured comparison of swab and micro-aspiration cleaned surfaces not yet available to establish clear conclusions

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