Journal of Cultural Heritage 16 (2015) 329–337

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Original article

Surface cleaning of intaglio prints with microblasting powdered cellulose and erasing: Treatment effects on inks and support texture

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A R T I C L E I N F O

Article history:
Received 2 April 2014
Accepted 6 August 2014
Available online 30 August 2014

Keywords:
Ink
Intaglio prints
Documents
Dry cleaning
Cellulose
Microblasting
Colour
Spectrophotometry
3D stereomicroscopy
SEM

A B S T R A C T

In this research, microblasting cleaning technique with powdered cellulose has been applied to inked areas of intaglio prints. Taking as starting-point the previous results obtained in cellulosic supports, different cleaning tests were conducted on four prints following the new approach and results were compared to those obtained with dry cleaning with erasers. In order to assess potential changes of surface texture or colour, the documents were examined with optical and 3D stereomicroscopy, SEM and spectrophotometry. The results allow the conclusion that microblasting with powdered cellulose could remove surface dirt or grime on intaglio prints without entailing visible changes to the surface properties of treated supports.

1. Research aims

This research addresses usefulness of microblasting cleaning with powdered cellulose on intaglio prints. The research pursues two main objectives: on the one hand, the proposed treatment must preserve the original texture of inked areas; on the other hand, cleaning results ought to be at least up to the standard of other dry mechanical cleaning methods currently used by conservators. Besides, the study aims to propose a methodology from the standpoint of the restorer systematizing useful procedures for practice that are easily assessable by the restorers with simple techniques.

2. Introduction

The aim of dry cleaning cultural assets is to remove small superficial deposits such as dust, soil or grime. Conservators use different methods, materials and products according to both the characteristics and state of the artefact to be treated and to the nature of the dirt or deposits to be eliminated.

One of the most widespread methods when dry cleaning prints consists of using different types of erasers (vinyl, factice, rubber, starch and silicone-based erasers [1–4]), frequently combined with the use of paint brushes and/or vacuum low pressure. Although this is a very widespread method, conservators are aware of the major drawbacks regarding stability of the media, changes in surface gloss and/or texture [5,6] and the concern about the risk of loss, disruption or abrasion that may be imperceptible *a visu* but may occur. Besides, in most cases erasers leave residues that infiltrate the interstices of the paper fibersand within the picks and valleys of the ink, affecting its absorptive properties [7,8]. These residues may cause potential abrasive and chemical damage in the long-term as erasers usually contain abrasive materials, sulphur, hydrochloric acid, plasticizers, drying oils, etc. [9–13]. For example, it is known that plasticizers can migrate from the residues causing softening of some ink coatings [5]. Moreover, plasticizers are usually soluble to polar solvents that might be used in treatments after surface cleaning [8]. Additionally, synthetic erasers residual particles could dissolve in contact to organic solvents used in a later cleaning, and bond with paper and inks. Erasers pH is another concern when treating printing inks, as these can be sensible to alkalis or acids [12].

In latest years, as an alternative to traditional methods, laser cleaning has been tested on paper documents [14–20] although chemical changes or mechanical alteration that might be caused is

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http://dx.doi.org/10.1016/j.culher.2014.08.001
1296-2074/

still being evaluated. Furthermore, laser equipment is not always available to the restorer and erasing is the most common procedure in an actual dry cleaning treatment.

Recent research has pointed out the possibilities of dry cleaning paper supports with microblasting technique [21]. Microblasting is usually referred to cleaning inorganic substrates, mainly stone materials and metals, by using some natural or artificial silica particles as abrasive. The technique is based on the kinetic energy formula [$E_k = ½\ m \times v^2$], where *m* is mass (abrasive); and *v*, velocity (pressure) [22–24]. As the formula reflects, the most influential parameter is pressure (v^2) and so distance, angle, nozzle and flow of particles because they are related to (flow of particles is not easy to control because most of the available microblasting equipment does not allow this adjustment). Other important parameter is abrasive (½ *m*) and so particle size, shape, density and mass (small size particle normally reduces abrasion in comparison of a large size particle and homogenizes surface cleaning). Evidently, together with technical parameters of the technique, material properties (heterogeneity, texture, cohesion and hardness, among others), dirt properties (especially thickness and adhesion) and equipment characteristics are influential in this procedure.

Controlling technical parameters during a fixed treatment time, mainly pressure and parameters related to, and substituting hard abrasive silica particles by soft powdered cellulose, first experiments using microblasting technique indicated no visual damage on the treated surfaces [21]. Besides, cleaning residues of powered cellulose that may remain in the treated surface seem to be compatible with the artefact because its composition is quite similar. Progressing on this approach, in this research powered cellulose microblasting has been applied on inked areas of intaglio prints.

3. Materials and methodologies

Powdered cellulose microblasting tests were conducted and results were compared to cleaning tests performed with manual eraser. Tests were performed on the inked areas of four prints located at the conservation laboratory of the Fine Arts Faculty, University of Barcelona. The non-inked areas of two of these prints had been successfully cleaned with microblasting cellulose in the previous research.

The printing trial (referred to as Document 1) is an etching trial proof carried out within the framework of teaching intaglio techniques at the Faculty in 2012. The print measures 20 cm × 29 cm size, 80 μm thick. It is a Vélin paper, 300 g/m^2 grammage. The support is a mould-made rag paper of cotton linters with random fiber orientation and uniform distribution of the pulp. Starch has been detected as the main component of the sizing. No optical brighteners have been identified in this support. Most of the fibers maintain the cotton morphology intact and a high length as the pulp has been barely refined. Thus, this paper shows a high strength and resistance to tearing but low surface levelness and smoothness, density, hardness, ink holdout and smoothness. Besides, it has an increased compressibility and porosity. The impression was performed on the rough side of the paper with high pressure, leaving the surface of the plate mark area very smooth in the obverse and transferring the blanket texture to the reverse. The image is mainly created by line drawing although darker areas were produced with crosshatching and by using the etching needle in a pointillist manner. The plate was deeply bitten in at least three different stages as three profound tonal layers can be easily distinguished. So, sustained elements in the print have a notable texture. However, non-bitten areas of the plate show a very delicate dark layer of ink in the print achieved by deliberately not wiping the surface of the plate entirely clean and thus leaving a noticeable surface tone that appears as a greyish haze. This trial print was in excellent condition and thus some areas were intentionally stained with powdered sanguine in order to evaluate the cleaning efficiency of powdered cellulose microblasting.

Document 2 is a line photogravure reproduction of the *Victoria Dacica [Arch of Constantine]*, one of the 48 etchings included in G. P. Bellori and P. Bartoli's book 'Veteres arcus augustorum triumphis insignes ex reliquis quae Romae supersunt cum imaginibus triumphalibus antiques nummis notisque', published in Rome by J. J. de Rubeis in 1690. This work depicts famous Roman arches and their reliefs and architectural details. The original etching *Victoria Dacica [Arch of Constantine]*, reproduces a high relief located at the attic on the east facade of the Constantine Arch in Rome representing a scene of the Trajan's Dacian Wars. The photogravure reproduction treated in this research measures 24 cm × 41.8 cm size, 31 μm thick, 130 g/m^2 grammage, and shows a very fine laid finishing. The support is a machine-made paper with transverse fibre direction, uniform distribution of the chemical pulping and without watermark. Fibres show rather good condition although they are short in length, probably due to a strong beating during pulp production. Both gelatine and starch have been identified as sizing agents in this paper that has a low porosity and compressibility degree. There are no references about the date, title and author of this reproduction, but taking into account the characteristics of its constitutive materials and production methods, the artwork was in all probability printed in the 20th century. In this print, line photogravure was used to reproduce the original image based exclusively on lines, and thus, the ground, the typical gelatine grain usually used in photogravure to reproduce tonal gradations, cannot be distinguished. However, the use of a photomechanical process in this print can be identified due to the lack of difference in depth between darker and lighter lines. Besides, this print is a perfect mirror image of the original engraving. In photomechanical processes, the plate is made light sensitive, exposed to a negative, and then etched in acid. In this case, the negative might have been erroneously located turned over, transferring a positive image to the printing plate that leads to a mirror image of the original print. The condition of this work is poor and it presents damp stains, residues of paint and some degree of acidity.

Document 3 is a photomechanical reproduction of an engraving executed by Johann Simon Negges (1726–1792) after the Göz Gottfried Bernharhd print entitled *Salutantem resalutat Deipara*, published in Augsburg in 1764 as the 18th image of the series *Historia Vitae S. Bernardi.* Based on the printing characteristics of this reproduction, it probably dates from the first half of the 20th century. It measures 21.5 cm × 16.5 cm size, 24–31 μm thick, 140 g/m^2 grammage and it also consists of a laid paper. The support is a handmade rag paper with irregular distribution of the pulp, and without watermark. Rosin has been identified as the main sizing agent of this paper that shows a very low porosity, especially in areas with high density of pulp. Some of the lines in the image reproduce the pointed end created by the burin but as the reproduction has been carried out with etching technique from a light sensitised plate, the carved appearance typical of engravings has been lost. Also, while the height of the ink lines in an engraving will vary depending on the depth on the plate, in this print all the lines show the same height, thus being created in one acid bite. The condition of this print is poor; it shows damp stains and structural deformations.

Document 4 is a reproduction of a 17th century print engraved in Rome by Hyeronymus Frezza, as stated at the right bottom inscription. The image portrays a saint holding Christ Child, both inserted in a classical style oval fringe. The legend at the left corner specifies that the character is St. Stanislaus Kostka. According to the characteristics of its constitutive materials and printing technique, the artwork was probably made in the 20th century. As in Document 3, line photogravure was used to reproduce an original etching performed only with lines, and thus, no gelatine ground was employed