CCI SYMPOSIUM ICC – OTTAWA, CANADA
Adhesives and Consolidants for Conservation: Research and Applications
SYMPOSIUM 2011
Adhésifs et consolidants pour la conservation : Recherche et applications
October 17 to 21 – Du 17 au 21 octobre

What's Going on With Guts: Assessing Adhesives Used to Repair Cultural Objects Made of Gut Skin

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Abstract

The use of adhesives for tear repair on artifacts created from gut skin is a largely underexplored topic in the conservation literature, creating the motivation for this preliminary study on the interaction between adhesives and processed intestines. The increased visibility of Alaskan Native collections in Europe, the United States, and Canada through exhibit or loan has necessitated treatments and revealed the gap in information required for making informed treatment decisions. This need prompted the current two-phase study underway at the National Museum of the American Indian (NMAI) in collaboration with the Smithsonian's Museum Conservation Institute (MCI). In the first phase, trends in adhesive use on gut skin were identified by a review of the conservation literature, and through a survey of the condition and past treatment records of the parkas from NMAI and the National Museum of Natural History (NMNH). This information was augmented by a Web-based survey of conservators currently working with adhesive repairs on gut skin. The results from these surveys informed the second phase of the research in which the interface between adhesives and gut skin was examined with scanning electron microscopy to gain a better understanding of the effectiveness and effects of adhesives as a treatment choice.

Titre et Résumé

Ce n'est qu'une baudruche? Évaluation des effets des adhésifs sur les membranes d'organes internes utilisées en restauration des biens culturels

L'utilisation d'adhésifs pour réparer les déchirures d'objets fabriqués de baudruche est un sujet qui est très peu traité dans les publications spécialisées du domaine de la restauration. L'étude préliminaire faisant l'objet du présent article a donc été entreprise afin de déterminer la nature des interactions entre les adhésifs et la baudruche (une membrane d'intestin traitée). Les collections d'objets autochtones d'Alaska font de plus en plus l'objet d'expositions et de prêts entre institutions, que ce soit en Europe, aux États-Unis ou au Canada. Cette situation avantageuse, qui exige toutefois que les objets subissent des traitements adéquats, a mis en lumière les lacunes en matière de renseignements permettant de prendre des décisions de traitement éclairées. C'est ce besoin particulier qui a incité le National Museum of the American Indian (NMAI), en collaboration avec le Smithsonian's Museum Conservation Institute (MCI), à mettre en œuvre un projet d'étude bipartite dont les activités sont toujours en cours. Les travaux de la première phase, qui ont permis d'identifier les tendances associées à l'utilisation d'adhésifs sur la baudruche, ont été réalisés en effectuant une analyse documentaire des publications du domaine de la restauration et en exécutant une enquête sur l'état de parkas des collections du NMAI et du National Museum of Natural History (NMNH) et sur les registres des traitements antérieurs de ces objets. Des renseignements additionnels ont été recueillis au moyen d'une enquête en ligne ciblant les restaurateurs qui utilisent actuellement des adhésifs pour restaurer la baudruche. Les résultats de l'enquête ont servi de base aux travaux de recherche de la seconde phase du projet, laquelle comprend aussi l'examen, par microscopie électronique à balayage, de l'interface située entre l'adhésif et la baudruche. L'ensemble des données permettra de mieux comprendre l'efficacité des adhésifs utilisés comme matériau de traitement à ces fins particulières, mais aussi leurs effets sur la baudruche.

Introduction

Intestines of marine mammals, including seal, sea lion, walrus, and whales, are transformed by Alaskan Native people living in coastal regions into a translucent and waterproof material referred to as gutskin to create parkas and other functional objects (Figure 1). Gut allows for one-way permeability of moisture as part of its biological function inside the body, and as a protective outer-skin when it is worn as a parka (Hickman 1987, p. 6). Gutskin garments were critical to survival as a tear could result in hypothermia for the wearer, and the maintenance of their structural integrity was an important aspect of cultural use (McHugh 2007). In these instances, tears were traditionally repaired by sewing sinew around a patch created from gut (McHugh 2007). As gutskin parkas entered museum collections the material showed a tendency to become brittle and prone to tearing, hence creating the need for repairs. Conservators often are required to mend complex and extensive tears, and they tend to favor adhesive patches over traditional sewing techniques. Within the existing conservation literature, there has been no systematic study of the interaction of gutskin with these adhesives, which leaves conservators to rely on intuition, past experience, and best-educated guess options to carry out treatments. This preliminary research aims to provide evidence of how adhesives interface with gutskin and inform appropriate conservation choices.

Treatment material choices were discussed frequently during preparations for the joint National Museum of the American Indian (NMAI) and National Museum of Natural History (NMNH) Arctic Studies Center exhibit “Living our Cultures: Sharing our Heritage,” which included a variety of gutskin objects. Elaine Kingeekuk, a St. Lawrence Island Yup'ik skin sewer and doll maker, was consulted about the conservation of a torn ceremonial gutskin parka. She believed that adhering a patch with an adhesive would not have the longevity of a traditional sewn repair, and that an adhesive would stiffen the gut (McHugh 2007). This observation resonated with conservators working on the project as stiffening had been observed on mock-ups made in preparation for treatments on other gut objects. This idea that the penetration of an adhesive can induce undesirable stiffening of gutskin artifacts inspired the present research.

Figure 1: Summer gutskin parka in the collection of NMAI (D262568).

Background

The term gutskin, which is used colloquially to describe objects made from processed small intestine, is slightly misleading as no skin is present. As a processed material, gut differs from leather, parfleche, hide – all terms for outer skins - in composition, structure, texture, and mechanical properties, all of which are related to the biological function of the material in the living animal. These material differences make gutskin and outer skin suitable for different applications. For example, gutskin has been chosen for its ability to repel liquid water, while remaining permeable to water vapor (Shaffer 1974, p.72), while hide often is chosen for its insulating properties. Precising the structure of Native processed gutskin is an aim of the current research program, though its structure has been described by Morrison (1986) as a highly ordered specialized tissue that consists of two compact layers, the first of which is called the *submucosa* consisting of large collagen fiber bundles arranged in a double helix at 45-degrees to each other (Figure 2). The next layer is the *muscularis externa* or muscular layer, which exists in two discrete layers of collagen fiber bundles, one oriented in a circular arrangement, and the other in a longitudinal direction parallel to the surface of the gut wall (Morrison 1986).

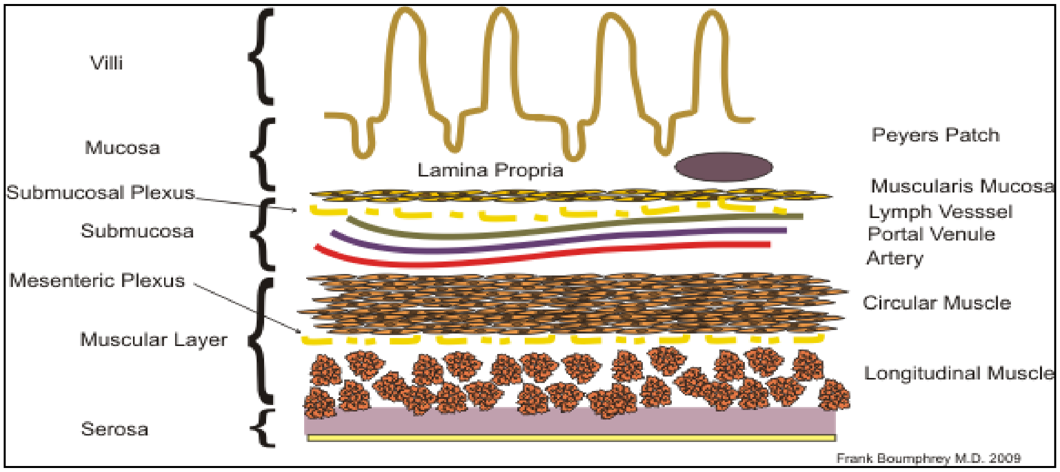

Figure 2: Cross-section of gut. Image source: http://commons.wikimedia.org/wiki/File:Intestinal_layers.png

Native processing of marine mammals' small intestines is described by many authors (Morrison 1986; Florian 2007; Schaffer 1974; Hickman 1987; Fienup-Riordan 2007; Reed 2005) all of whom describe the process as the removal of the intestines from the animal followed by repeated washing. One account indicates that the intestines are placed in a bucket with seawater and urine and given a second rinse followed by removal of the serosa muscle layer which is peeled off with the thumbs (Hickman 1987, p. 29; Florian 2007, p.30). The processing continues by turning the intestines inside out and removing the inner mucosa layer from the central connective tissue using a blunt tool (Florian 2007, p.30). The guts are washed again, one end is tied, and they are inflated into a long tube and stretched to dry (Morrison 1986, p.17). Two different types of gutskin can result from processing depending on the time of year and conditions in which the membranes are dried. A material referred to as "summer gut" is produced by hanging the inflated gut tube in the sun, which produces a translucent, yellowish, slightly stiff, wind and waterproof material (Hickman 1987, p.29). If the inflated gut is hung up in a freezing and windy environment, it becomes opaque white, flexible and supple, and is referred to as "winter gut" (Reed 2005, p. 48). An excellent resource for examples of winter and summer gut parkas is the Smithsonian Institution's "Alaska Native Collections: Sharing Knowledge" website (www.alaska.si.edu). The beginning research presented here focuses exclusively on summer gut, which is compelling for its wind and waterproof qualities.

Adhesives used on gutskin

Summer gut is described in only a handful of articles in the conservation literature that cite similarities in condition, such as brittleness and extensive tears along sharp creases that form in the gut during storage. A brief literature review of materials used to mend tears on summer gut parkas revealed the use of a wide variety of adhesives. Synthetic resins, such as Mowilith 50, Acryloid B-72, and Butvar B-98 prepared in organic solvents, were used successfully to mend tears on gutskin according to several authors (Jackson and Hughes 2009; Cruickshank 1987; Cruickshank and Sáiz Gómez 2009; Hill 1986; Morrison 1986). Equally successful tear repair was reported with water-soluble cellulose ether adhesives, such as methyl cellulose (MC), Ethulose 400, and Klucel G (Fenn 1984; Gottsman 2009; Dumka 1991). Poly(vinyl acetate) (PVAC) emulsions were praised as strong, though less reversible, by Fenn (1984) who found that mock-ups that exhibited “better, less visible bonds” were achieved with PVAC emulsions, such as Elvace 1874 or CM Bond M2. Dumka (1991) also found Archivart (PVAC) thinned with water to be beneficial in instances where long tear edges are brought together slowly after dampening; strictly water soluble adhesives proved to be too reversible in these types of situations. Vinyl acetate emulsions such as Mowilith DMC2 were used for tear repair by Morrison (1986) after extensive empirical testing with a variety of adhesives.

The literature review of adhesives that conservators have used to repair summer gutskin was augmented by reviewing past conservation records at the NMAI and NMNH, and by asking conservators directly via an online survey posted on the Conservation Online DistList (CooL) and the American Institute for Conservation Object Specialty Group List Serv (OSG) in February of 2011, which remains available on-line for further data collecting. In 2011 the authors conducted an initial examination of ten summer gut parkas in the NMAI collection. Only one of these parkas had an existing treatment record dating to 1998 when a tear was repaired with a patch of goldbeater’s skin adhered with heat-set Acryloid F-10, which appeared stable. Eight summer gut parkas at NMNH also were surveyed to examine the performance of PVAC resins, emulsions, and cellulose ethers applied between 1976 and 1991. Most of the adhesive patches were peeling away at the perimeter, but were stable overall. Additional information about adhesives used on gutskin was gathered by creating an online survey, which collected information from conservators experienced in mending both summer and winter gutskin. The survey yielded thirteen in-depth responses that are summarized in Figure 3. The data from the online survey, literature review, and list of materials known to have been used at NMAI and NMNH was used to inform the second phase of the study in which a selection of the cited adhesives were experimentally prepared on a piece of summer seal gut for observation with SEM.

Methods

Pre-cut strips (approximately 4 cm length x 0.5 cm width) of goldbeater’s skin were dredged through a selection of aqueous and solvent-borne adhesives (listed in Tables 1-3), which were spread with a wooden tongue depressor into a thin layer on silicone release Mylar with the relative thickness gauged empirically. The adhesive-coated goldbeater’s skin was applied onto a sample of summer seal gut. To ensure good contact between the adhesive layer and the gutskin, a clean piece of silicone release Mylar was placed over the sample and pressure was applied by rolling a handheld bamboo skewer over the surface. For comparative purposes samples of Lascaux 498/360 HV (3:1 proportion) mixture, and wheat starch paste (WSP) and Jade 403 (3:1) mixture were applied onto pieces of gutskin that had been dampened prior to adhesive application. This application method was mentioned by Dumka (1991) and several survey respondents. Heat-set adhesives were applied onto the summer gut sample with an ERSA 30 heated spatula set at 70°C. In this preliminary study one sample of each adhesive and adhesive mixture was created. In all samples the protruding ends of the goldbeater’s skin were labeled with the name of the adhesive for record keeping. The samples were allowed to sit for five days in ambient conditions (21 °C, 56% relative humidity) after which time small rectangles (approximately 0.5 x 0.2 cm) were cut from the center of each sample with a sharp scalpel. In few instances this mechanical action appeared to disrupt the adhesive bond. Samples were cut from the center to avoid pooled adhesive around the perimeter and thus favor consistent sample thickness. The cut-out samples, placed on edge to reveal the cross-section, were mounted on a SEM stub prepared with a layer of carbon tape. The stub was sputter coated at the Smithsonian Museum Conservation Institute (MCI) with approximately 30 nanometers of 99.99% pure gold with an Anatech Hummer sputter coater, and placed in a Hitachi S-3700N Variable Pressure scanning electron microscope (SEM). The samples were observed under vacuum in secondary electron mode. Several SEM images were taken along each sample, with the most representative locations presented in this preliminary report.

Results

Survey results

The results from the online survey of adhesives that have been used by practicing conservators for gutskin tear repair are organized in Figure 3. Many respondents listed more than one adhesive, though the most common mention was BEVA 371 Original Formula and BEVA film followed by various mixed proportions of Lascaux 360 and 498 HV acrylic emulsions, unspecified PVAC resins, and polysaccharides. Mixtures of cellulose ethers, such as MC, with other polysaccharides were popular but less common.

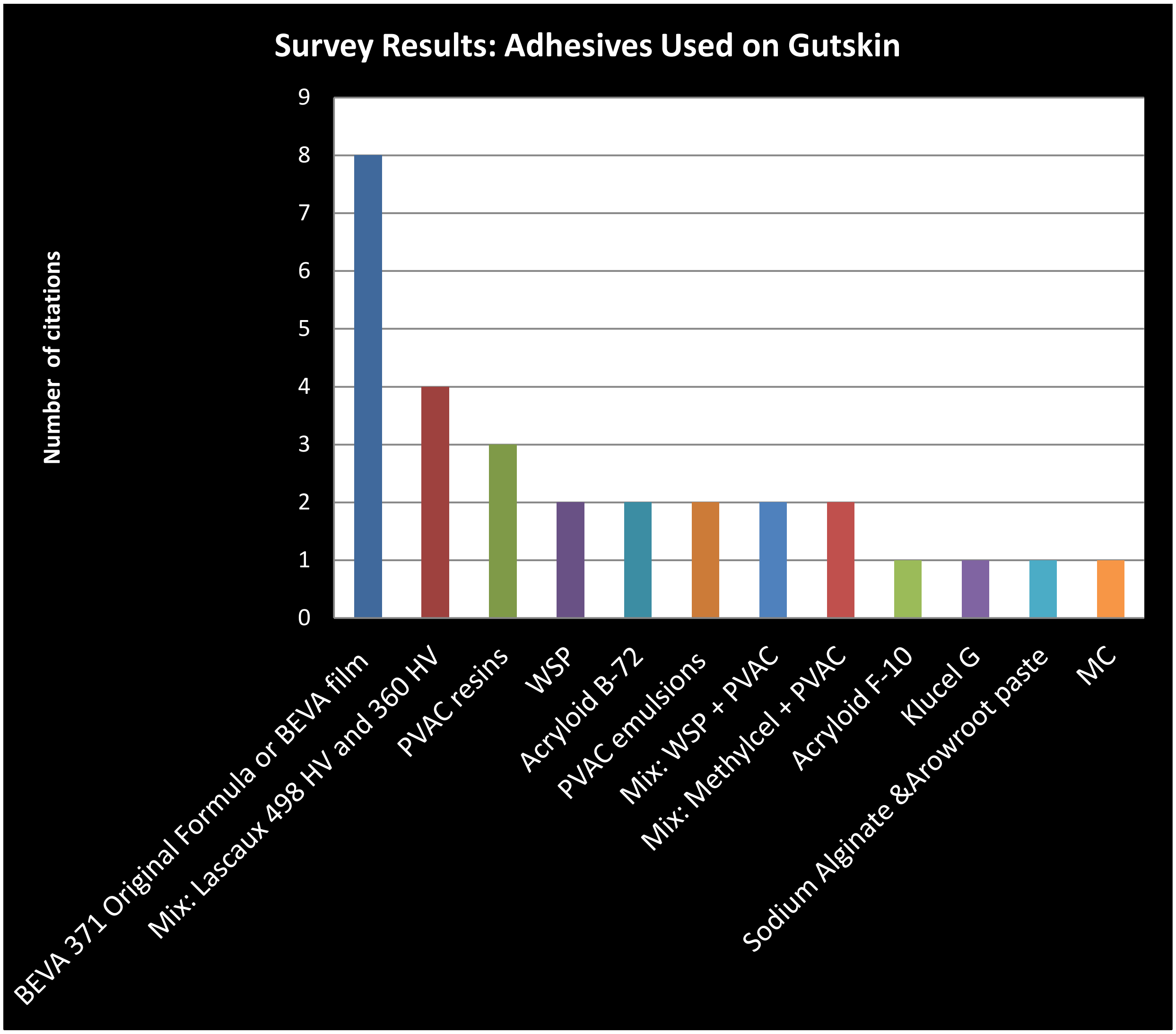

Figure 3: Survey results of adhesives used by respondents to repair gutskin, organized by number of citations.

SEM results

The SEM images of eighteen, experimentally prepared samples mounted in cross-section appear to indicate that the adhesives tend not to penetrate into the summer gutskin. While depth of penetration was an initial focus of the research, additional qualitative information was obtained about the adhesive bonds between the gutskin-adhesive-goldbeater's skin interfaces. Future work will aim to provide quantitative data about the nature of the adhesive bonds.

Three major trends in contact were observed among the adhesives tested and are described here qualitatively with supporting annotated SEM images. The first trend showed intimate contact, defined here as possessing closely aligned bonding sites over extended areas of the gutskin-adhesive-goldbeater's skin interfaces. Eight of the eighteen samples exhibited this type of adhesion. The second trend revealed intermittent contact defined here as discontinuities in adhesion between the adhesive-gut interface. This trend was observed on eight of the samples examined, though much variation exists within this category due to the samples exhibiting segments of intimate contact interspersed with lengths of intermittent contact. The third trend is a lack of intimate contact, which in practical terms would constitute adhesive failure, and is characterized in this study by few bonding cites throughout. Six samples exhibited a lack of intimate contact, and some samples that exhibited intermittent contact also showed segments with no contact. Trends in adhesive contact along with the original question of whether there is penetration into the gutskin are organized in Tables 1-3 by category of adhesive.

Table 1: Acrylic and vinyl acetate ethylene (VAE) emulsions.

Adhesive	Dampened gut?	Intimate contact	Intermittent bonding	No intimate contact	Penetrates gutskin
Lascaux 498/Lascaux 360 HV mixture (3:1)	No	X	X		
Lascaux 498/Lascaux 360 HV mixture (3:1)	Yes	X			
Lascaux 498/Lascaux 360 HV mixture (1:1)	No	X			
Elvace 45675 CX	No		X		
Jade 403	No			X	

Table 2: Polysaccharides, cellulose ethers and combinations.

Adhesive	Dampened gut?	Intimate contact	Intermittent bonding	No intimate contact	Penetrates gutskin
MC	No			X	
WSP	No		X		
12% Sodium Alginate/ Arrowroot paste mixture	No		X		
MC/Jade 403 mixture (3:1)	No			X	
WSP/Jade 403 mixture (3:1)	Yes	X	X		
WSP/Jade 403 mixture (3:1)	No	X	X		
WSP/MC mixture (3:1)	No	X			

Table 3: Solvent-borne and heat-set synthetic resins.

Adhesive	Dampened gut?	Intimate contact	Intermittent bonding	No intimate contact	Penetrates gutskin
Acryloid F-10 stock solution in mineral spirits (40% solids)	No	X			
Acryloid F-10 cast film Heat set	No		X	X	
5% BEVA 371 Original Formula in xylene	No		X		
BEVA 0.25 mm cast film. Heat set	No	X			
15% PVAC-AYAA in acetone	No			X	
20% Acryloid B-72 in acetone	No			X	

Amongst the emulsions presented in Table 1 the three different Lascaux 498/360 HV mixtures produced bonds characterized as intimate, which is particularly evident when seen in comparison to the intermittent and non-intimate contact bonds evident in the Jade 403 sample (Figure 4 a-d).

Within the polysaccharides and experimental mixtures with emulsions organized in Table 2, the WSP created the most intimate contact between surfaces, but only in combination with Jade 403 or MC (Figure 5 a, b). WSP alone created an intermittent bond. The reason for the less successful bonding is not clear but could be due to one or more competing factors including viscosity of the WSP, application method, and rigidity of the dry film upon sample preparation.

A range of contact was observed amongst the solvent-borne and heat-set synthetic resins organized in Table 3. In the sample of BEVA 0.25 mm film intimate bonding between the layers is evident in the SEM images. However, this is not the case in the example of the heat-set Acryloid F-10 film where intermittent bonding between the gutskin and the adhesive occurs at irregular, tiny intervals across the sample (Figure 6 a, b). Overall a lack of intimate contact was observed with adhesives in applied in acetone possibly due to solvent volatility causing bubbling that is visible in the SEM images where the GB skin is pushed away from the gutskin (Figure 7a,b). The PVAC-AYAA example shows no intimate contact with an undulating adhesive skin barely touching the surface of the gutskin and large bubbles within the film, which is also observed on the Acryloid B-72 example. Intimate and intermittent bonding is present on samples prepared in other solvents. For example, the Acryloid F-10 in mineral spirits produced an intimate bond, and the BEVA 371 Original Formula in xylene resulted in an intermittent bond (Figure 6 b, c). This may be due to the lower volatility of these solvents and therefore less of a tendency to bubble.

All SEM images are annotated with the following designations to identify the different layers: Summer seal gut is represented with a "G", the adhesive layer is "AD" and the goldbeater's skin is "GB".

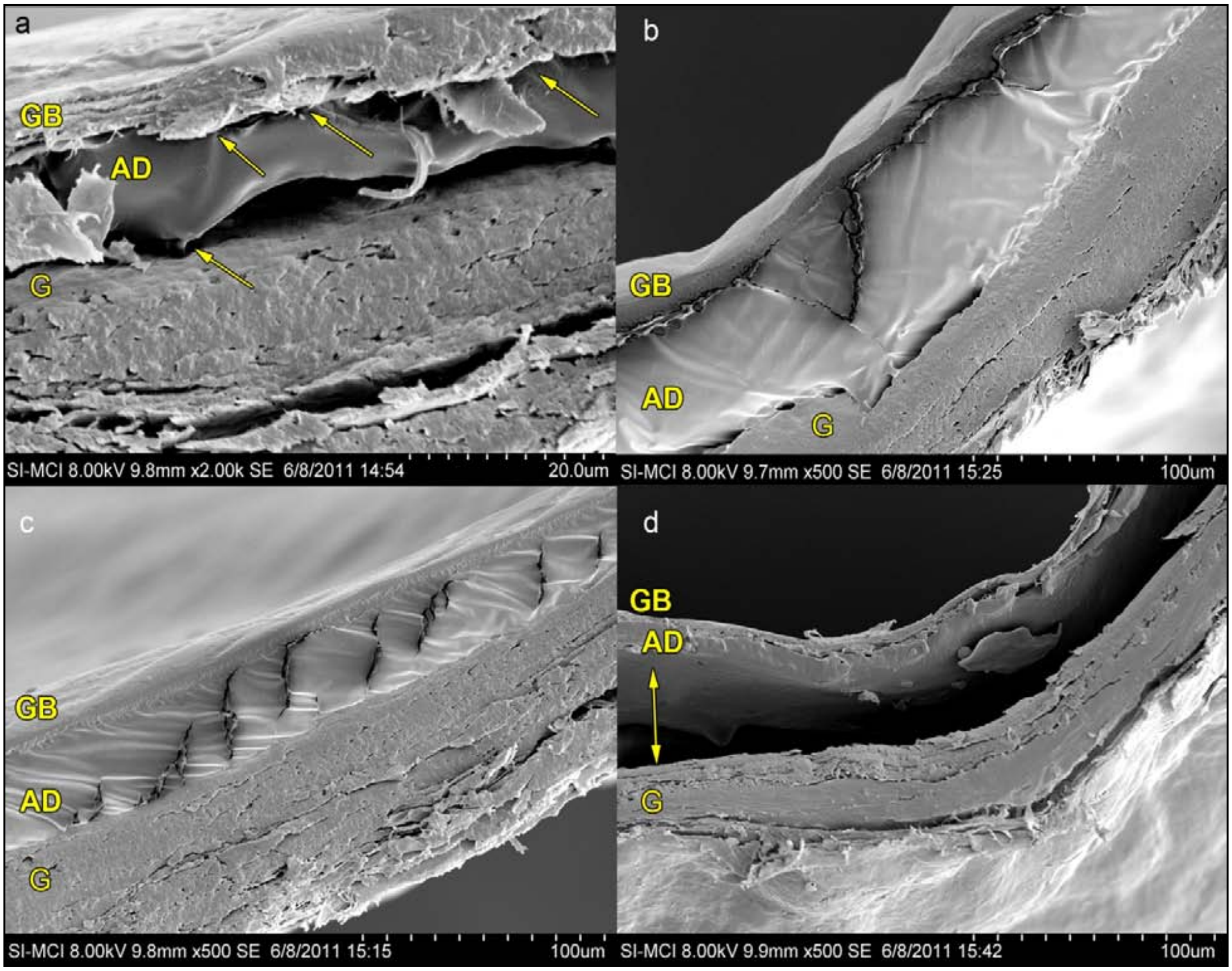

Figure 4: Emulsions. a) Lascaux 498:360HV (3:1). Arrows point to locations of intermittent contact between the layers. b) Lascaux 498:360 (3:1) applied to damp gut. The sample largely shows an adhesive layer exhibiting intimate contact, though there are a few small gaps between the adhesive and gutskin. c) Lascaux 498:360HV (1:1). Sample shows intimate contact and the boundary between the layers is difficult to distinguish due to close adhesion. d) Jade 403. Arrows illustrates the gap between the gutskin and adhesive layers, characterized here as adhesive failure, or lack of intimate contact.

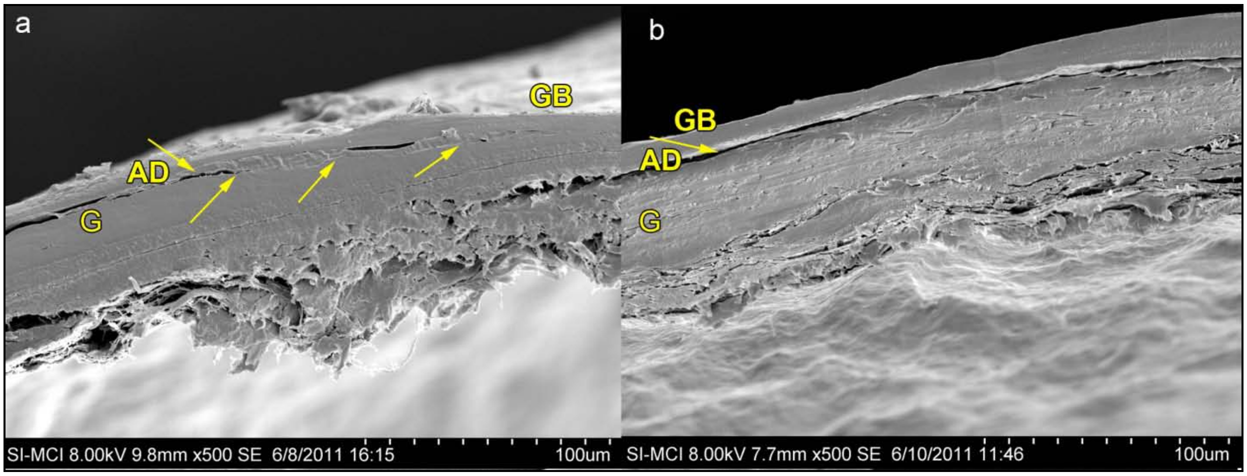

Figure 5: Polysaccharides and mixtures with emulsions. a) WSP and Jade 403 (3:1). The arrows point to the irregular adhesive layer where there are intermittent and intimate areas of contact. b) WSP. The adhesive layer is very thin, occurring as the bright white line indicated by the location of the arrow. In the SEM image it is possible to see gapped areas of no contact and those of close adhesion.

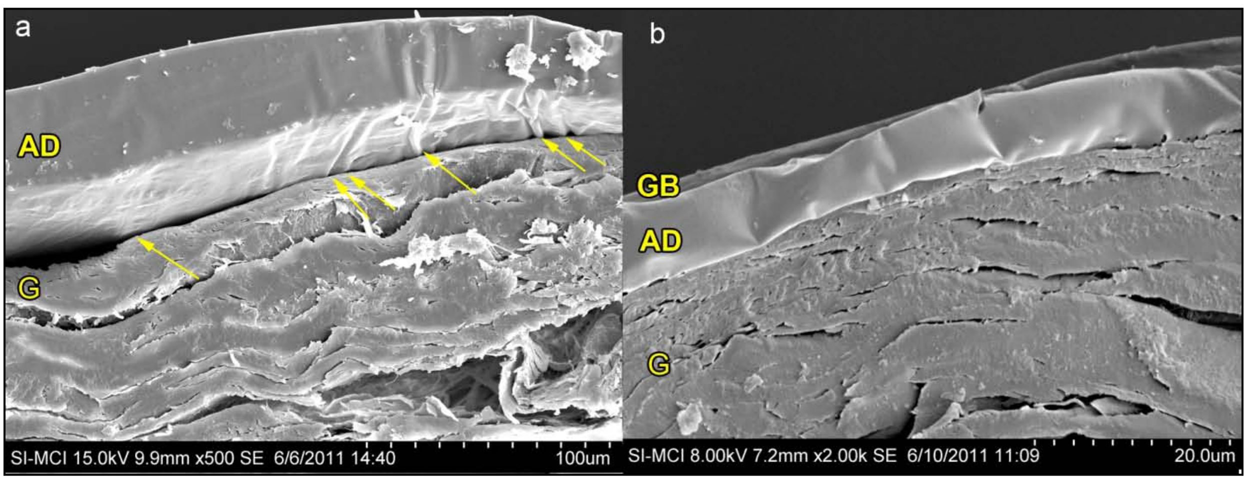

Figure 6: Heat-set adhesives. a) Acryloid F-10 film. In this SEM image the goldbeater's skin is absent, and the arrows point to the locations of the intermittent contact between the gutskin and the film layer. b) BEVA 0.25 mm film. The heat-set film shows intimate contact with both surfaces.

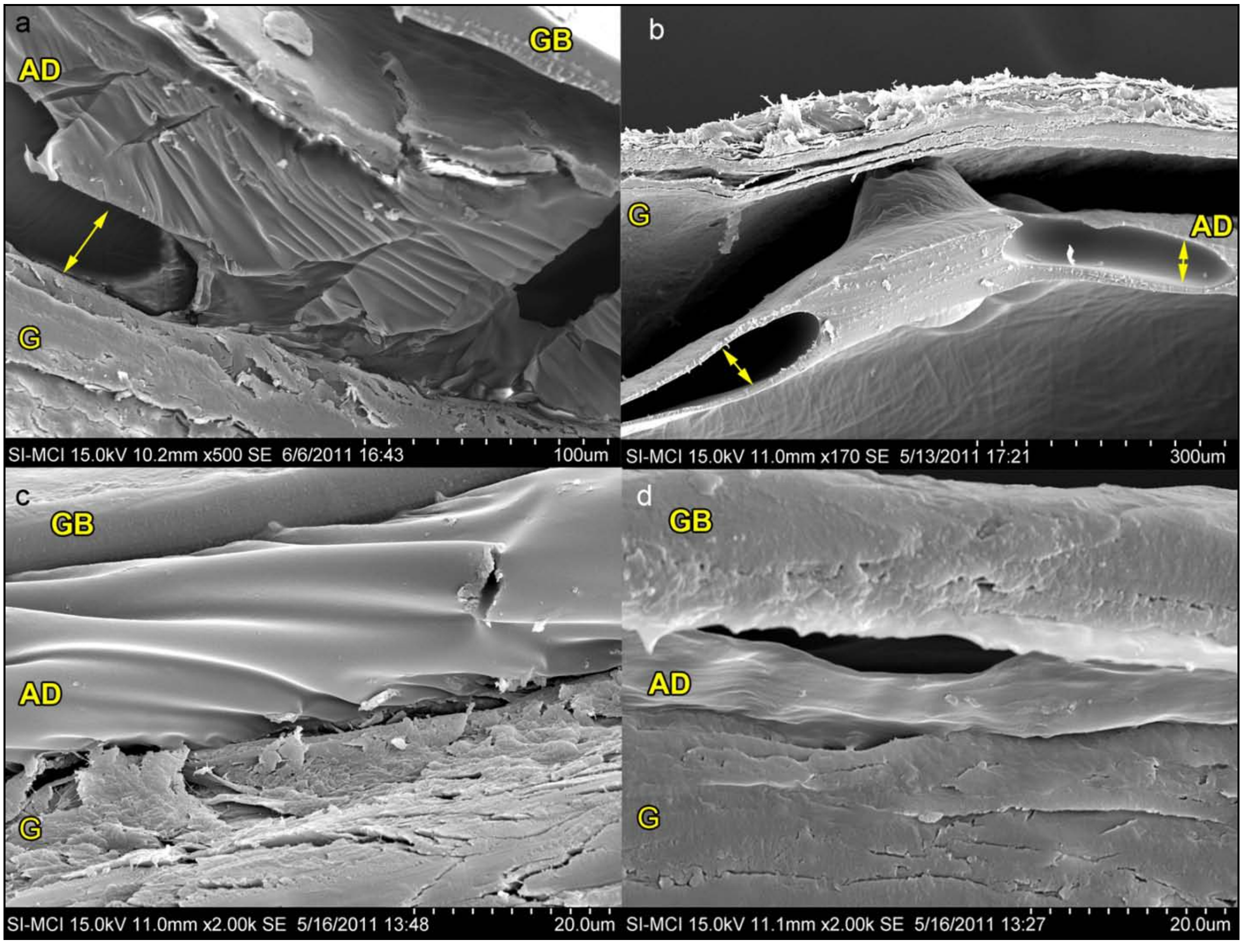

Figure 7: Solvent-borne adhesives. a) 20% Acryloid B-72 in acetone. The arrow shows the location of an air bubble pushing away the adhesive and goldbeater's skin layer from the surface of the gutskin. b) 15% PVAC-AYAA in acetone. Arrows indicate the locations of air bubbles that may have contributed to complete adhesive failure in this sample. The layer of goldbeater's skin was not captured within the image frame, but it was loosely attached at random points. c) Acryloid F-10 from concentrate in mineral spirits (40% solids). Intimate contact is exhibited between the layers visible in this SEM image, which is representative of the whole sample. d) 5% BEVA 371 in xylene. The central gap seen in the image, which is surrounded by areas of adhesive contact, provides evidence of intermittent contact.

Discussion

The wide variety of adhesives cited in the literature and survey results reflect the experimental and non-formulaic approach that conservators have adopted when mending gutskin objects. This trend also may reflect the differing treatment requirements for individual artifacts, which are rarely uniform. For example, gutskin can be flexible, stiffened, oiled, painted or heavily decorated, or may have received prior treatments such as lubricants or polyethylene glycol, all of which would influence a conservator's choice of adhesive.

SEM has proven to be a useful tool for visualizing at cross-sections and indicating where there is contact between the adhesive and gut. However, SEM cannot tell the strength or weakness of a repair/interface. Future research is planned to gather quantifiable data of tensile properties of select adhesives from this study to compliment SEM images to give a fuller picture of what's going on with these guts.

SEM images suggest that adhesion can differ when the adhesive is applied to damp gut. In the case of the 3:1 mixture of Lascaux 498/360 HV, the dampened gut resulted in more intimate contact. We hypothesize that the added moisture both relaxes the gut and can increase interaction with water-borne adhesives such as this emulsion. On the other hand, we might expect, but have not tested, that adhesion of a polymer dissolved in less polar solvents may be inhibited by humidified gut.

SEM images also revealed that bubbles formed during volatilization of acetone from solvent-borne resins and may undermine the success of gutskin repairs. The synthetic resins applied in mineral spirits and xylene, both less volatile solvents, did not show a problem with bubbling. This could be an important distinction not only for an intimate and continuous adhesive bond but also for very fragile gutskin that could be damaged by the force of bubble formation. The potential influence of dampened gut and solvent choice underscore the importance of application method in any repair. Many conservators experience great success with adhesives that did not perform well under the conditions imposed in this study, and this indicates that myriad possible variations in application method can be key factors when repairing gutskin.

Conclusion

This study of gutskin is just beginning, and the results reported here are very preliminary. Furthermore, the tests presented here could benefit from repeat experiments to determine reproducibility. Nevertheless, the initial results with SEM of cross-sections of eighteen adhesives applied onto summer seal gutskin demonstrate the potential of SEM to characterize adhesives bonds. This initial set of experimental samples, selected because they are adhesive formulations that have been used by conservators to repair summer gutskin artifacts, points to some interesting factors that may influence adhesion and a successful repair. For example, the mixture of Lascaux 498/360 HV acrylic emulsions in 3:1 proportion adhered more intimately to gutskin that had been dampened prior to application. On the other hand the acrylic resin Acryloid B-72 did not adhere well to the gutskin or goldbeater's skin perhaps because of bubbles formed during volatilization of the acetone solvent. Synthetic resins applied in mineral spirits and xylene and as a heat-set film without solvent did not show this bubbling phenomenon. Though the adhesives used in this study were prepared with different solvents and cannot be compared definitively, the use of less volatile solvents could be important not only for an intimate and continuous adhesive bond but also to protect fragile gutskin from forces imposed during solvent volatilization. These are just a few potential avenues for future research. Our initial results also seem to disfavor the idea of adhesive penetration for most formulations tested, and this certainly warrants further study. With the Intimate-Intermittent-Not Intimate classification, we have proposed a straightforward system for visually assessing adhesive success with the SEM.

Acknowledgements

The authors would like to thank the Mellon Foundation, Michele Austin-Dennehy and Greta Hansen (NMNH), Ellen Carrlee (ASM), Elaine Kingekuuk, Marion Mecklenburg and Kim Cullen Cobb (MCI), and the conservators who graciously responded to our survey.

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Materials and Suppliers

All materials supplied by talas: http://www.talasonline.com

Arrowroot paste: A starch obtained from the tubers of the *Maranta arundinacea* plant.

Acryloid B-72: (U.K: Paraloid) Ethyl methacrylate, and methyl acrylate copolymer.

Acryloid F-10 : N-butyl methacrylate homopolymer in 40% solids solution in mineral spirits.

BEVA 371 Original Formula: Ethylene vinyl acetate [EVA] copolymer), Ketone Resin N (polycyclohexanone), A-C copolymer (EVA), Cellolyn 21 (phthalate ester of hydroabietyl alcohol) and paraffin.

BEVA film (0.25 mm): Elvax, Ketone Resin N A-C copolymer (EVA), Cellolyn 21 and paraffin dissolved in 1000 g of toluene.

Elvace 45675 CX (U.K:Vinamul): Vinyl ethylene acetate copolymer aqueous emulsions.

Seal gutskin: Prepared by Susanna Chanar of Tooksok Bay, Alaska in 2001 and purchased at the Native Hospital.

Goldbeater’s Skin: Membrane prepared from the thin sack that surrounds the whole intestine of calves or other cattle.

Jade 403: Vinyl ethylene acetate copolymer emulsion.

Lascaux 498HV: Emulsion of butyl acrylate thickened with methacrylic acid.

Lascaux 360 HV: Emulsion of butyl acrylate and methyl methacrylate thickened with acrylic butyl ester.

Methyl cellulose (Talas Brand): Cellulose ether with a methyl functional group substitution. 2000 cPs.

PVA-AYAF (U.K: Mowilith 50): Vinyl acetate.

PVA-AYAA : Vinyl acetate.

Sodium Alginate : Sodium salt of alginic acid.

Wheatstarch paste: Polysaccharide granules.

Author Biographies and Contact Information

Lauren Anne Horelick has a BFA in Sculpture from the San Francisco Art Institute, a BA in Art Conservation from the University of Delaware, and an MA in Archaeological and Ethnographic Conservation from the University of California at Los Angeles (UCLA)/Getty Conservation Master's program. She is currently an Andrew W. Mellon Fellow in Objects Conservation at the National Museum of the American Indian where she is carrying out research on ethnographic gut skin. Her recent work on Alaskan and Northwest Coast Native objects at the American Museum of Natural History in New York and at the Alaska State Museum provided the background for her current research focus on adhesive use on inner skins.

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Kelly McHugh has an MA in Art History and a Certificate in Conservation (2000) from New York University (NYU) Institute of Fine Arts, as well as a BA in Art History/Peace and Global Policy Studies (1990) from NYU. She has been an objects conservator in the Conservation Unit of the National Museum of the American Indian (NMAI) since 2010, and worked as a conservator at NMAI on numerous projects dating back to 1996. Most recently, she completed a project with the Smithsonian's Arctic Studies Center (National Museum of Natural History) and the Anchorage Museum at Rasmuson Center where she developed a research interest in Alaskan Native objects made from the inner organs of marine mammals.

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Biographies et coordonnées des auteurs

Lauren Anne Horelick a obtenu un baccalauréat en beaux-arts (B.B.A.), plus précisément en sculpture, du San Francisco Art Institute, un baccalauréat ès arts (B.A.) en conservation-restauration des œuvres d'art de l'Université du Delaware ainsi qu'une maîtrise ès arts (M.A.) en conservation-restauration des objets archéologiques et ethnographiques, décrochée au programme de maîtrise de l'Université de Californie à Los Angeles (UCLA)/Getty Conservation Institute. Elle est actuellement boursière de la fondation Andrew W. Mellon en restauration d'objets au National Museum of the American Indian, où elle mène des recherches sur les objets ethnographiques en boyau. Ses travaux récents sur les artéfacts des peuples autochtones de l'Alaska et de la côte du Nord-Ouest à l'American Museum of Natural History de New York et au musée d'État de l'Alaska ont servi d'assise aux recherches qu'elle mène actuellement sur l'utilisation des adhésifs sur les membranes intérieures.

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Kelly McHugh détient une M.A. en histoire de l'art et un certificat en conservation-restauration (2000) de l'Institut des beaux-arts de l'Université de New York (NYU), et elle a obtenu un B.A. en histoire de l'art/sciences politiques mondiales et paix (1990) à la NYU. Depuis 2010, elle est restauratrice d'objets à l'unité de restauration du National Museum of the American Indian (NMAI); elle avait déjà travaillé au NMAI comme restauratrice dans le cadre de nombreux projets, et ce, depuis 1996. Elle a par ailleurs récemment mené à bien un projet avec l'Arctic Studies Center de la Smithsonian Institution (National Museum of Natural History) et l'Anchorage Museum au Rasmuson Center, où elle a orienté ses recherches sur les artéfacts autochtones de l'Alaska fabriqués avec des organes internes de mammifère marin.

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Odile Madden has a PhD in Materials Science & Engineering from the University of Arizona, an MA in the History of Art and Archaeology and an Advanced Certificate in Conservation from New York University, and a BA in Italian and Art History from the University of California at Los Angeles (UCLA). She is currently a Research Scientist at the Smithsonian's Museum Conservation Institute, and heads their growing modern materials research program. Her research focuses on the technology, materials science, preservation, and environmental impacts of synthetic and natural polymer composite materials, as well as Raman spectroscopy and the challenge of pesticide residues on museum artifacts.

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