

REPAIRING PAPER

The generally accepted method of repairing torn paper or reinforcing weak areas in a sheet is a wet method which involves patching with strips of strong, almost transparent acid-free paper. The strips are adhered with a sufficiently strong, colorless adhesive which is both acid-free and easily reversed. The following materials are used and recommended by paper conservators for repair of paper objects. They are used for hinging paper objects as well as mending and reinforcing.

Mulberry paper: The preferred acid-free repair paper is handmade in Japan from the inner bark of the mulberry tree. Mulberry papers (often erroneously called rice papers) exist in different weights with names such as Sakishu, Tengujo, Kizukishi and Usumino. The lighter weight papers, especially Tengujo or Tosa, are especially well suited to document repair since they are transparent and unobtrusive and will not obscure the text of the document. These papers are available from conservation suppliers. Some art supply stores also sell Japanese papers, but those tend to be poor quality machine-made types. They resemble the handmade papers but lack permanence and strength. Handmade Japanese papers are ideal for repairs because they are alpha cellulose which does not discolor or become brittle as rapidly as wood-pulp paper. Most conservators use torn strips of this paper because a frayed edge makes a less visible, softer, firmly attached repair.

Adhesives: Use of a proper adhesive is essential. Any adhesive used for mending paper objects must have the following properties:

- Sufficient strength to hold the object for an indefinite length of time -- the adhesive must continue to hold as it ages;
- Permanent colorlessness -- it should not yellow, darken or stain the paper;
- Reversibility -- it must allow the repair paper to be easily removed with a minimal amount of moisture, even after many years.

Few commercially available adhesives meet all these criteria. Rubber cement, animal glues, or gelatin will inevitably darken or stain. Commercial library or wallpaper pastes may lose hold on aging and often contain harmful additives. There are several synthetic adhesives such as white glues which do not stain but which are very difficult if not impossible to remove.

The adhesives found on most "pressure sensitive" (self-adhering) tapes will stain almost immediately and should be avoided at all costs. We know of one transparent self-sticking tape which is not supposed to discolor paper, but conservators do not recommend it because it is difficult for anyone other than a conservator to remove. The adhesives on commercial gummed tapes, which require wetting, are less damaging. But most, including the gummed linen tape favored by many framers for hinging, may stain in time and should be avoided for objects of value. The glassine stamp hinge paper currently available does not cause staining but is neither strong nor aesthetically pleasing.

Commercial products in general should be avoided even if they appear "safe"

because commercial products are subject to alteration by the manufacturer. This year's non-staining tape may have an adhesive with a different formula next year.

Starch-based paste: For many years conservators have favored homemade starch-based pastes. These are made most often from either rice or wheat starch (not flour, but the starch which has been extracted from the flour; available from conservation suppliers). One recipe for wheat starch paste follows:

- Place one cup of wheat starch and five or six cups of water in the top of a very clean double boiler.
- Mix well and let stand at least 20 minutes.
- Fill bottom part of double boiler with a small amount of cold water so that the upper section does not touch the water.
- Place on medium high heat and cook, stirring constantly with a clean wire whisk.
- When the paste begins to thicken (this may happen right away), reduce heat and continue stirring.
- Stir for about half an hour; then remove from stove. The paste should be thick and translucent. As it cooks and thickens, it will become more difficult to stir. To aid in stirring, a wooden spoon may be substituted for a wire whisk, but the spoon should be one which has not been used for the preparation of food.
- When cooked, the paste should be strained through cheesecloth or a Japanese paste strainer (from conservation suppliers) and stored in a clean jar. It should be allowed to cool before use.
- On cooling, the paste may become thick and rubbery. If so, strain again prior to use and slowly mix with water until the paste reaches a workable consistency.

Conservators differ in their preference of how thin paste should be. A consistency similar to heavy cream is adequate for mending. This wheat starch paste should not be refrigerated. Unless a preservative is added, it will keep for a week or less. Some conservators recommend adding thymol as a preservative. Thymol, bought in the form of pungent white crystals from chemical suppliers, is not soluble in water so must be dissolved in methyl alcohol (methanol) before being added to the paste. Take 5cc of methyl alcohol (about one teaspoon) and add thymol crystals to it until the solution is saturated, that is until the crystals no longer dissolve. Add the thymol solution to freshly made paste while the latter is still hot and stir for several minutes. Thymol is toxic, and must be used in a space that provides very good ventilation. In general, we feel it is preferable to make paste in small quantities when it is needed.

With thymol added, paste will last for several weeks. Do not refrigerate, but cover and store in a cool, dry place where there is no danger of mold contamination. If paste discolors, grows mold or develops a sour smell, discard

immediately. Discard if dark flecks appear in the paste since they may indicate mold or bacterial growth.

Methyl Cellulose: Starch pastes do require time to make and thus are not practical if they are to be used only occasionally. A simpler paste can be made by buying methyl cellulose from a conservation supplier. Methyl cellulose comes in powdered form and is mixed with water to the desired consistency. Let stand for several hours before use. It may thicken on standing but can be thinned again with water. Methyl cellulose is not as strong as starch paste but should hold adequately if the document is not to be handled extensively or if it is to be encapsulated in polyester film. Methyl cellulose may be strengthened by addition of a small amount of Jade 403, a white polyvinyl acetate (PVA) emulsion adhesive available from conservation suppliers. This material should not be used alone because it is extremely difficult to remove after setting. When mixing it with methyl cellulose, only one part PVA to eight or nine parts methyl cellulose. Methyl cellulose with or without Jade 403 keeps well for several weeks and does not require a preservative.

Applying the Mending Strips: Using a flat piece of glass or plastic as a pasting surface, apply starch or methyl cellulose paste to the strips of Japanese paper with a flat brush (about 1/4 inch wide). Then lift the strip with tweezers and place over the tear. If the document is one sided, place it on the reverse, paste side against the document. The thinner types of mulberry paper tend to pull apart when wet with paste. It is easiest to use strips not more than two inches long. For longer tears, several short strips may be used, placed end to end. It will take practice to manipulate the thin, wet mulberry paper repair strips.

Once in place, tamp the repair lightly with silicone release paper or polyester web (from conservation suppliers) or with waxed paper from a grocery store. If possible, weight the repair while it dries. Weighting insures good adhesion and prevents cockling of the paper. Repairs may be weighted as follows: first place small pieces of Reemay or release paper over and under the area to be dried. A piece of glass is laid on top of the blotter and a weight (about one pound) on top of the glass. The weights may be small bags of lead shot or pieces of lead covered with cloth or cloth tape. One pound fishing weights from sporting good stores make excellent weights provided they have at least one flat side to prevent rolling. Repairs should be weighted for one hour or longer. Use of a small photographer's tacking iron can speed up the drying process greatly. This instrument should not be applied directly to the document. Place a piece of Reemay or release paper between the iron and the document. Iron until apparently dry, then weight for a few minutes to encourage flatness.

Repairing with heat set tissue: Heat-set tissue was developed by the Library of Congress for convenient, rapid paper repairs. This prepared mending material consists of thin pure cellulose lens tissue that has been coated superficially on one side with a combination of heat-activated acrylic resins. It is available commercially from August Velletri Bookmakers, 2025 Eye Street, N.W., Washington D.C. 20006, (202) 296-6613.

The material is applied with a small tacking iron (available from photographers' or conservation suppliers), and does not require weighting to prevent cockling after it is applied. The tissue is weaker than Japanese tissue, and mends may not adhere as well. It is reversible with ethanol.

The following instructions are from a Library of Congress working draft:

"[The] temperature of the tacking iron should be controlled at 190 - 200`F. Warning: It is unwise to rub the bare face of the hot tacking iron directly onto the tissue when attaching it to the mending area because heat and friction attract particles of acrylic resin onto the iron. This in turn leads to a redeposit of acrylic onto the face of a fresh tissue mend...To avoid this effect a thin piece of Japanese paper, silicone release paper or white polyester fabric [Tyvek, Reemay] can be used between the face of the iron and the heat-set tissue.

For best results large mended areas should be pressed in a heated platen press for at least 8 seconds, using a temperature of 180`F at the surface of the mend.

For small mends, hand pressure with the hot iron is usually sufficient to achieve consolidation.

The shape of a heat-set tissue patch must be carefully considered, consistent with the nature and position of the tear and general condition of the paper. For mending lacunae, two patches slightly larger than, but conforming to the shape of the missing area should be shaped in the following manner: place a sheet of polyester film over the lacuna and place the tissue over the film. With a dissecting needle outline in the tissue the desired shape of the patch, and tear along the line made by the needle.

A tear which leads in from an edge is best mended by shaping the heat-set tissue so that it tapers from the inner area of the tear to the outer edges of the paper.

Ordinarily heat-set tissue should be applied to the reverse side of a document. If it is necessary to support a tear from both sides of the paper...one patch should be larger than the other."

It is possible to tone heat-set tissue if it contrasts too starkly with the mended paper. Before use, the uncoated side can be brushed with a water-color solution slightly lighter than the paper to be mended, and allowed to dry. The tinted tissue tends to darken when heat is applied. Alternatively, the tissue can be brushed with ethanol after it has been applied as a mend.