

Conservation of Paper Materials: Minor Repairs

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Preservation Division, Acquisitions and Bibliography Department
National Diet Library

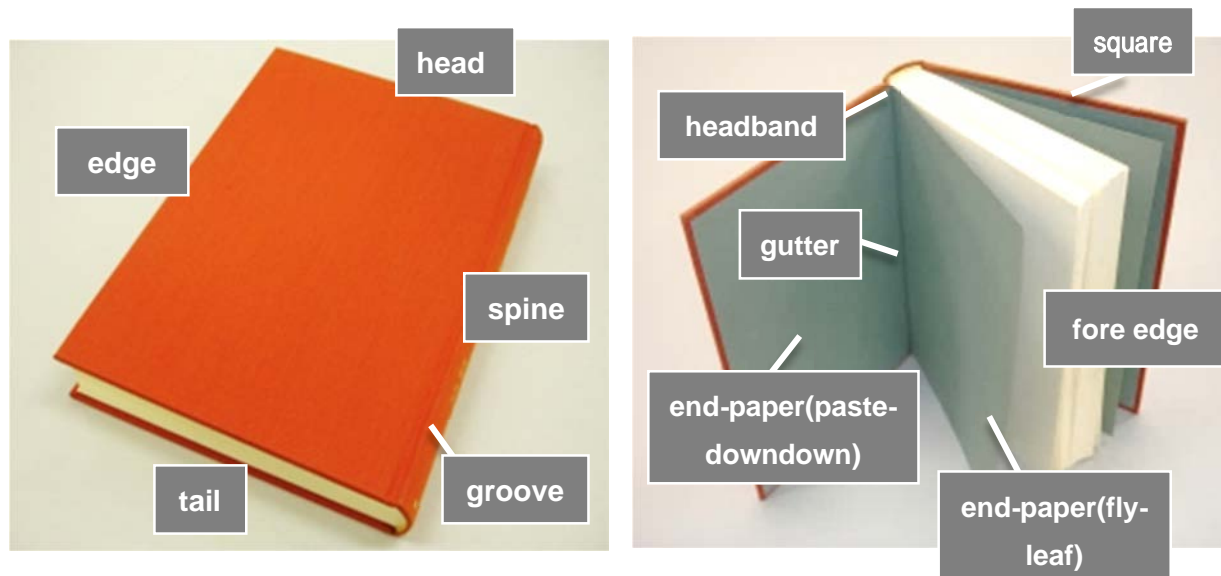
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NOTICE:

The methods described in this booklet are intended for general use by librarians who do not have specialist knowledge or skills in restoration. These methods are not suitable for valuable or severely deteriorated materials. The National Diet Library cannot be held responsible for any inconvenience or damage to materials as a result of work carried out using the methods described here.

The principal parts of a book



Term	Description
head	The top of the book.
tail	The bottom of the book.
spine	The edge of the book that is sewn or pasted.
edge	The three sides other than the spine.
fore edge	The edge of the book opposite the spine.
groove	Hollow where the cover connects to the spine.
square	Where the front and back boards are made several millimeters larger in order to protect the inner part.
endpaper	Paper that serves to connect the cover with the contents.
headband/endband	The headband may be attached to the head and tail of the book's spine, and have an intricate design for decoration.
gutter	Inner margins of the pages near the binding of the book.

Paper grain

The orientation of the fibers, which aligned in a single direction during the manufacturing process.

The orientation of the grain is shown by the double-headed red arrow: 

- Paper tears easily along the grain and less easily against the grain.



- It is easy to bend paper along the grain, but not so easy against the grain.



- Books in which the grain runs from head to tail (as shown on the left) open easily.



Materials

Starch paste









Starch paste is an adhesive made from the powdered starches of various plants, such as wheat, rice, and corn.

It is suitable for use in repairing books for the following reasons.

- It has relatively stable physical properties.
- It has a minimal effect on library materials.
- Repaired materials can be restored to their original, pre-repair state, if necessary.
- Adjusting the consistency provides great versatility.

Starch paste consistency and use

Adjust the consistency by changing the ratio of water to paste.

Consistency	Condition	Use
Thick 	Semi-liquid Mayonnaise-like consistency Hardly moves when tilted	Used to attach paper to cloth  Used to attach paper to paper 
Medium 	Viscous liquid Creamy soup-like consistency Runs slowly when tilted	Used to attach <i>washi</i> to paper 
Thin 	Non-viscous liquid Light syrup-like consistency Runs easily when tilted	Used to attach very thin <i>washi</i>  Used to attach two sheets of <i>washi</i> 

Washi

Washi is Japanese paper made of 100% mulberry (kōzo) and is ideal for repairing books.

- It has relatively stable physical properties.
- It has a neutral pH and it does not deteriorate easily, thereby having a minimal effect on library materials.
- Repaired materials can be restored to their original, pre-repair state, if necessary.
- It has long fibers that blend well with the paper in most library materials.

Washi thickness and uses

Three different thicknesses of washi are commonly used.

Thickness	Grammage	Use
Very thin	Roughly 5 g/m ²	Used for repairing pages with text.
Thin	Roughly 15 g/m ²	Used for repairing torn pages with no text. Repair of dislodged pages.
Thick	Roughly 30 g/m ²	Used for repairing pages with missing sections.

Grammage is a unit of weight in grams per square meter (GSM). In general, the higher the grammage, the thicker the paper.

When thicker repair paper is needed, such as for the cover, it should be fashioned by laminating thinner sheets together.

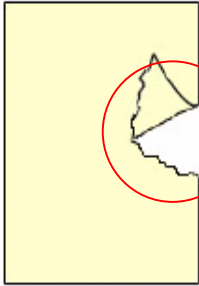
Tools




No.	Item	Notes
	Ruler	Stainless steel is preferred.
	Water brush pen	A brush with water inside. A small brush is also acceptable.
	Small glue brush	Individual glue brushes should be reserved specific purposes, such as for starch paste and for bond glue.
	Tweezers	Used to pick up <i>washi</i> .
	Spatula	Spatulas are used for bookbinding, Japanese sewing, and handling clay.
	Cutting knife (Utility knife)	A box-cutter is fine.
	Scissors	Stainless steel is preferred.
	Cooking paper (Parchment paper (water-repellent paper))	It is used to prevent overflow adhesive from transferring to other areas.
	Dry cloth	Use to wipe off the glue that has come off. Gauze or any type of non-fading cloth may be used.
	Dust cloth	Wet with water and wring tightly.
	Weights	Use when drying materials. Commercial pickling stones are easy to use.
	Press boards (set of 2)	Use hold materials flat while drying.
	Water container	Fill with water for moistening brushes and dissolving glue. Any suitable container is fine.
	Cutting mat	A 30 x 45 cm mat is easy to work with. Thick cardboard or similar materials may be used.

Mending paper tears

1. Repairing hand tears or other damage in which the fibers overlap



Repairing tears with overlapping fibers that appear to have been torn by hand.

- Not necessary to use washi.
- Paste consistency :  Medium

Check the tear and lay a sheet of cooking paper beneath the page.



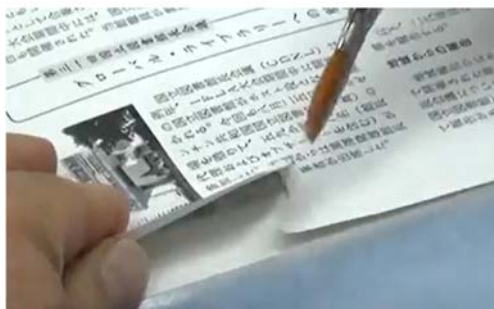
- Check the alignment of the tear, match the top and bottom of the overlap.
- Place a sheet of cooking paper beneath the page.

Prepare the paste.



- Dilute the paste with water until it has a medium consistency similar to cream soup.

Apply the paste

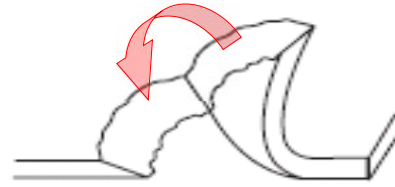


- Use a small brush to apply paste to one side of the tear.
- Load the brushes lightly to avoid applying too much paste.
- Apply the paste in a thin, smooth, and even coat.

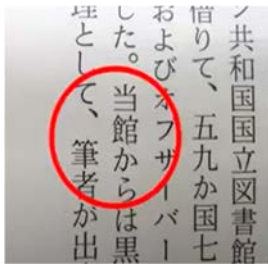
Align the tear so that the page returns to its original state.



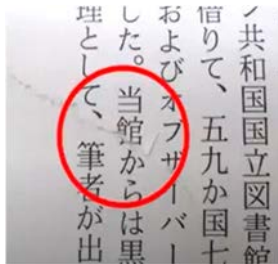
- Align the tear.
- Be careful to align sure the overlap neatly.



The state of being aligned.

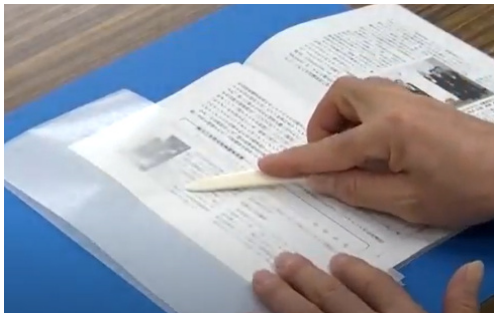


Misaligned state



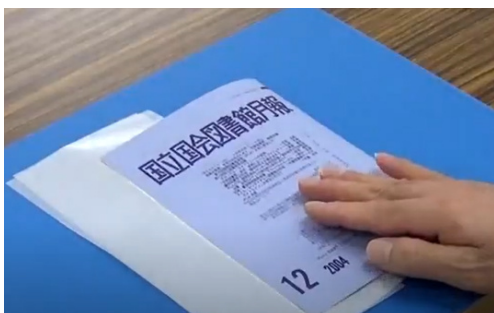
- Take care to align the text properly.

Press the pasted parts together.



- Remove any excess paste by gently wiping the tear with a dry cloth.
- Place a sheet of cooking paper on top of the tear and press lightly with the flat part of a spatula.
- Moist paper tends to tear easily, so be careful not to press too hard.

Cover the tear with cooking paper and close the book.



- Place a sheet of cooking paper on either side of the repaired page.

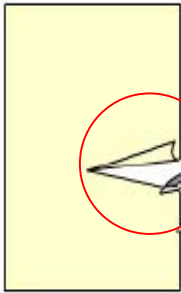
Place boards and weights on the book and allow to dry.




- Place a board on top of the cover and hold it in place with a weight while drying.

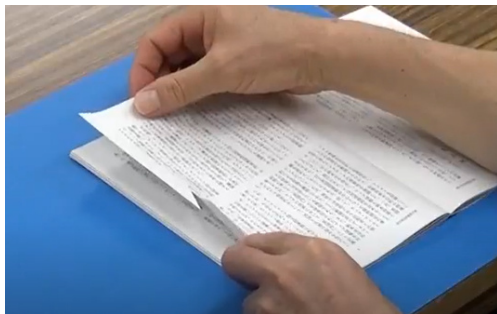
Repair complete.

Mending paper tears 2. Repairing paper cuts made by blades and scissors



- Japanese paper : thin
- Paste consistency :  Medium

Check the tear



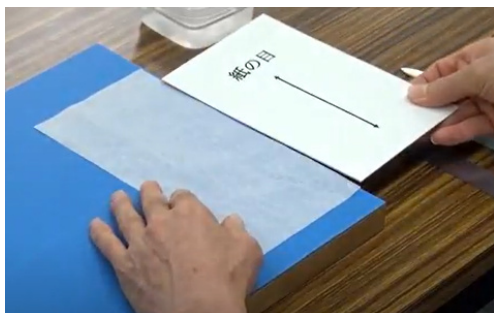
- Since there are no overlapping edges to which paste can be applied, we repair this using strips of washi with feathered edges.

What is a strip of *washi*?



- Feathered edges can be added to a strip of washi by tearing it.
- Feathered edges allow the washi to blend with the page and create a smooth, seamless surface.

Make strips of *washi*.



- Take a sheet of washi and cut it into strips. Be sure that the grain runs vertically from top to bottom.

Moisten the *washi* with water brush pen.



- Place a ruler on the *washi* and hold it down with your fingers.
- Use a water brush pen to moisten the *washi* in a line drawn along the grain.

Crease the *washi* with the edge of a spatula.



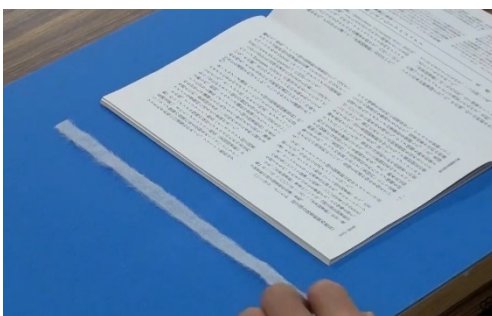
- Use the edge of a spatula to make a crease in the moist part of the *washi*.

Tear to create a strip of *washi*.



- Slide the *washi* and the ruler over so that the moist part aligns with the edge of the board.
- Make sure that the ruler is on moist part.
- Hold the ruler down and gently pull the paper so that it tears along the waterline. Be sure to pull straight out so that you create a feathered edge.
- Repeat this process to make several strips of *washi* that are feathered along both edges.
- The narrower the strips, the less visible the repair will be.

Check the location of the tear and adjust the length of the strips of *washi*.



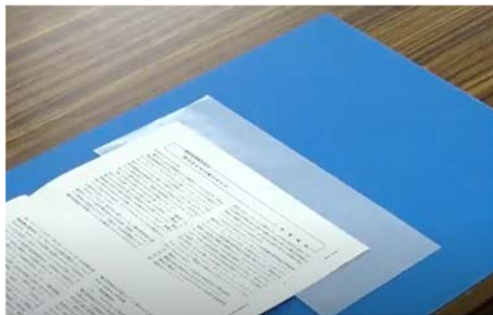
- If possible, apply the strip of *washi* to a page with no text or illustration.
- If the volume of text and illustrations is the same on either side of the page, attach the strip to the verso.
- Tear the *washi* by hand so that it is a little longer than the length of the tear in the page.

Prepare the paste.



- Dilute the paste with water until it has a medium consistency similar to cream soup.

Lay a sheet of cooking paper beneath the page.



- Lay a sheet of cooking paper beneath the torn page.

Place a strip of *washi* on a sheet of scrap paper.



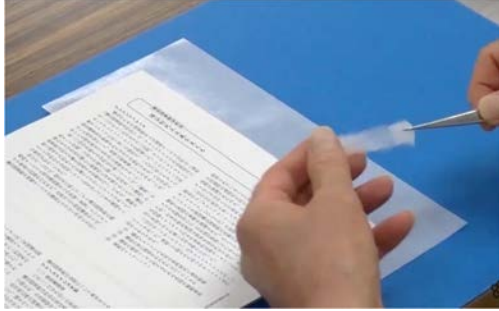
- Place a strip of *washi* up on a sheet of scrap paper with the rough surface (reverse side) up.
- The smooth surface is the obverse side and the rough surface is the reverse side of a strip of *washi*.

Apply paste to the strip of *washi*



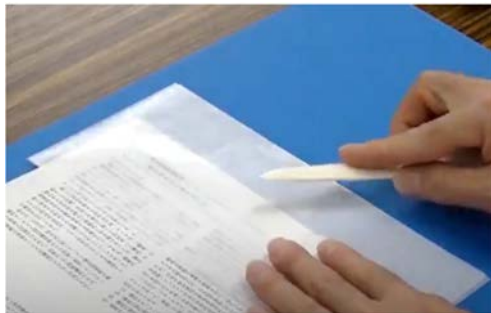
- Load the brush and remove excess paste by wiping against the container edge, then apply a thin, smooth, and even coat.
- Apply paste to the strip by brushing from the center toward the outer edges, letting the feathered fibers extend.

Use tweezers to pick up and apply the strip of *washi* to the tear in the page.



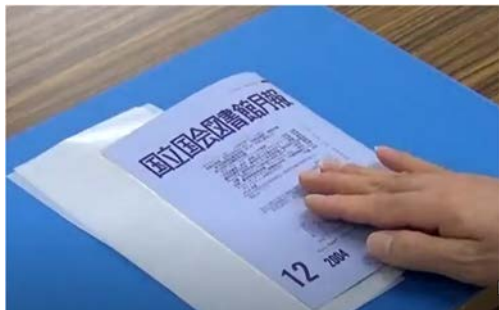
- Use tweezers to pick up the strip of *washi* and apply it so that it overhangs from the edge of the page.
- Remove by wiping.

Make sure that the tear aligns seamlessly.



- Cover the tear in the page with another sheet of cooking paper.
- Press gently on the cooking paper with the flat part of a spatula to align the tear seamlessly.

Close the book.



- Leaving the cooking paper in place, gently close the book.

Place boards and weights on the book and allow to dry.



- Place a board on top of the cover and hold it in place with a weight while drying.

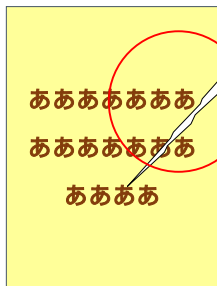
Trim the overhang.




- Open the book and check to be sure that the paste is completely dry.
- Trim the overhang with scissors or a utility knife.
- When using a utility knife, place a cutting mat under the repaired page, lay a ruler over the page, and trim the protruding edge. Take care not to cut the page itself.

Repair complete.

Mending paper tears 3. Repairing tears through text or illustration



Very thin, translucent *washi* is used so that the text or illustrations can be seen through it. *Washi* is applied to both sides of the page for strength.

- *Washi* : very thin
- Paste consistency :  thin

Check the tear



- Check the location of the tear.

Use scissors to cut strips of *washi*.



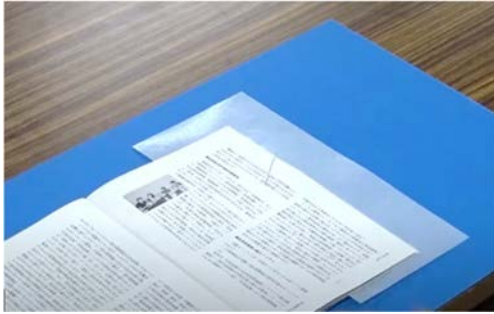
- Using scissors, cut the paper slightly larger than the tear.
- One strip of *washi* is for the recto, the other for the verso.

Prepare the paste.



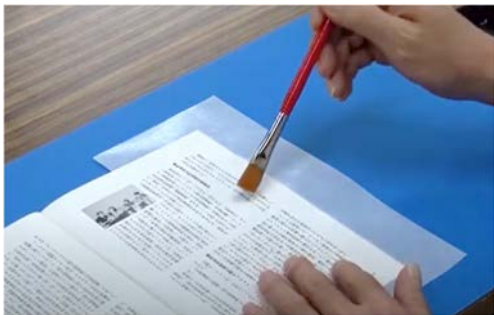
- Dilute the paste with water until it has a thin consistency, similar to syrup.

Lay a sheet of cooking paper beneath the page.



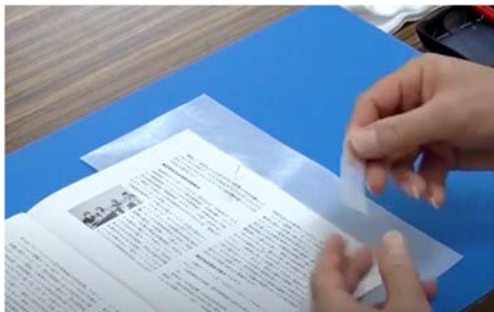
- Lay a sheet of cooking paper beneath the torn page.

Apply paste.



- Since the *washi* used here is so thin, apply paste directly to the tear.
- Remove excess paste from the brush and apply a 4- or 5-mm-wide coat of paste around the edge of the tear.
- Spread the paste in a thin, smooth, and even coat.

Place the *washi*.



- Place the *washi* on the torn area and then gently wipe away any excess paste using a dry cloth.
- Because the *washi* is so thin that it is hardly noticeable, it does not matter which direction the grain runs or whether the rough surface of the *washi* is up or down.

Make sure that the *washi* is applied securely into the page



- Cover the tear in the page with another sheet of cooking paper.
- Press gently on the cooking paper with the flat part of a spatula to secure the *washi* to the page.
- Turn the page and repeat this process to attach another sheet of *washi* to the verso.

Close the book.



- Leaving the cooking paper in place, gently close the book.

Place boards and weights on the book and allow to dry.



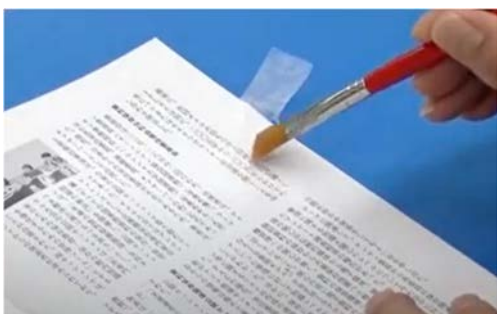
- Place a board on top of the cover and hold it in place with a weight while drying.

Trim any excess *washi*.



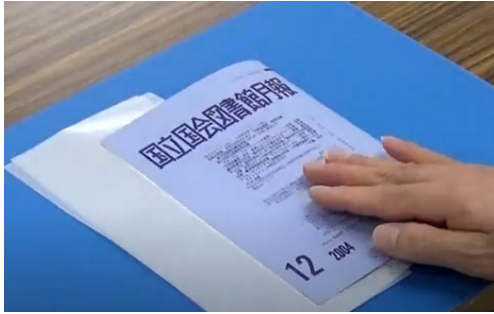
- Open the book and check to be sure that the paste is completely dry.
- Using tweezers, pinch and trim away any unattached area of the *washi* from the edges.
- Turn the page and repeat this process for the verso.

Apply additional paste.



- Apply additional paste to attach any loose edges.
- Remove any excess paste by wiping gently with a dry cloth.
- Turn the page and repeat this process for the verso.

Close the book.



- Leaving the cooking paper in place, gently close the book.

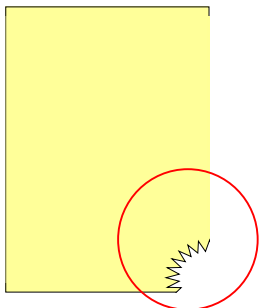
Place boards and weights on the book and allow to dry.



- Place a board on top of the cover and hold it in place with a weight while drying.

Repair complete.


Mending paper tears 4. Repairing missing corners.



Repairing missing corners.

Prepare a sheet of *washi* that is a similar thickness to the page to be repaired.

Laminate two or more sheets of *washi* together to achieve the desired thickness.

- *Washi* : thick
- Paste consistency:  medium

Check the tear.



- Check the location of the tear.
- Set the material with the recto facing up. Lay a sheet of scrap paper beneath the page.
- Using a piece of colored scrap paper will clearly highlight the missing area.

Prepare *washi*.



- Lay a sheet of *washi* over the missing corner with the rough side up. The edges of the *washi* should extend past the edges of the page.
- Check the grain of the page and match the grain of the *washi* to that of the page for best results.

Outline the edge of the tear on the *washi* with a water brush.



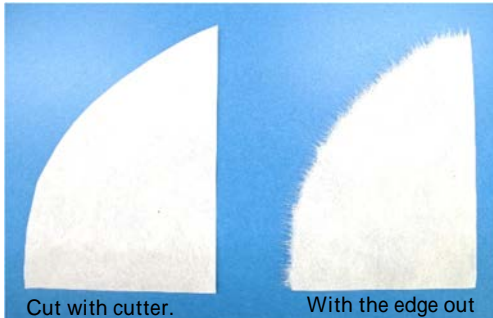
- Wet the brush and outline the tear about 3 mm to the outside of the edges.
- Do not overwet the brush.

Feather the edges of the *washi*.



- Pull sideways to tear the *washi* into a paper patch with the feathered edges.

What are feathered edges of *washi*?



- Tearing a piece of moistened *washi* make feathered edges.
- These feathered edges allow the *washi* to blend into the page to create a smooth, seamless surface.

Prepare wheat starch paste.



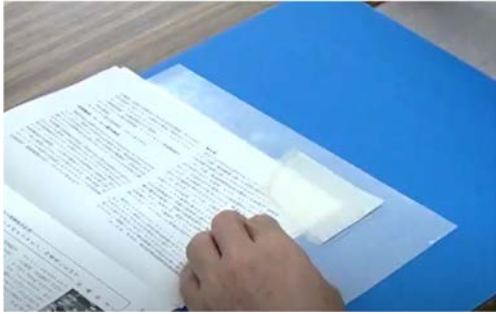
- Dilute the paste with water until it has a medium consistency similar to cream soup.

Apply the paste to the *washi*.



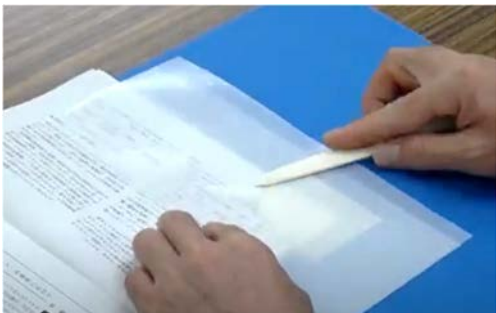
- Place the *washi* on a sheet of scrap paper.
- Load the brush and remove excess paste, then apply paste, along the edges of the smooth side of the *washi* patch.
- Apply the paste in a 3 mm-wide coat along the feathered edges and brush from the inside out to let the fibers extend.
- Spread the paste in a thin, smooth, and even coat.

Attach the *washi* patch.



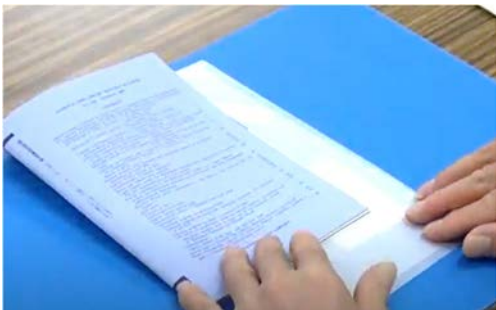
- Lay a sheet of cooking paper beneath the page.
- Position the *washi* patch to cover the missing corner.
- The protruding edges will be trimmed off later.
- Remove any excess paste by wiping gently with a dry cloth.

Make sure the *washi* is applied securely to the page.



- Cover the tear in the page with another sheet of cooking paper.
- Press gently on the cooking paper with the flat part of a spatula to secure the *washi* to the page.

Close the book.



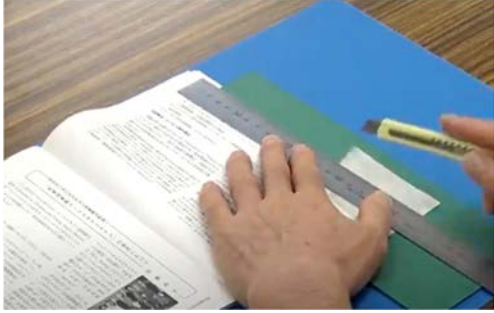
- Leaving the cooking paper in place, gently close the book.

Place boards and weights on the book and allow to dry.



- Place a board on top of the cover and hold it in place with a weight while drying.

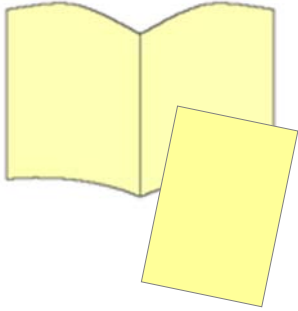
Trim any excess *washi*.



- Open the book and check to be sure that the paste is completely dry and edges have adhered securely.
- Trim any excess *washi* with scissors or a utility knife. When using a utility knife, place a cutting mat under the repaired page, lay a ruler over the page, and trim the protruding edges. Take care not to cut the page itself.

Repair complete.

Reattaching a detached page



Reattaching a detached page using a strip of *washi* with feathered edges.

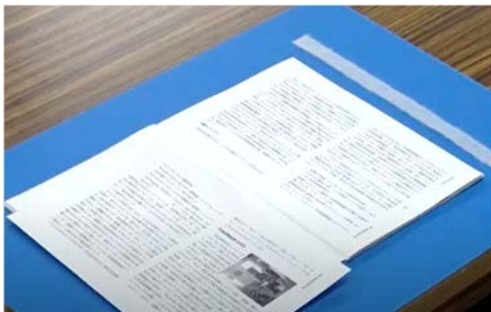
- *Washi* : thin
- Paste consistency: ●●● Medium

Check the detached page.



- Check the detached page.

Prepare a strip of *washi* with feathered edges.



- Prepare a strip of *washi* with feathered edges.

Prepare wheat starch paste.



- Dilute the paste with water until it has a medium consistency similar to cream soup.

Lay the detached page on a sheet of scrap paper.



- Lay the detached page on a sheet of scrap paper with the verso facing up.

Apply the paste.



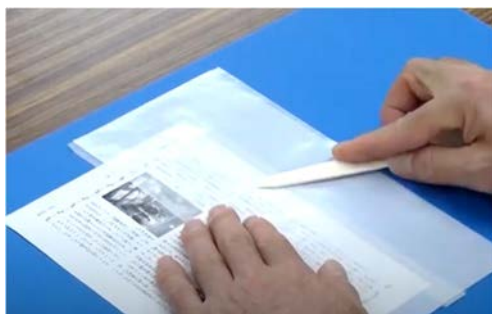
- Mask the page with another sheet of scrap paper, leaving about a 5-mm-wide strip along the inner joint.
- Apply paste along the edge of the inner joint.

Attach a strip of *washi* with feathered edges.



- Remove the sheets of scrap paper.
- Attach a strip of *washi* to the pasted area, letting it extend by on half the width.
- Remove any excess paste by wiping gently with a dry cloth.

Make sure the *washi* is applied securely to the page.



- Sandwich the page between two sheets of cooking paper and press gently on the cooking paper with a flat part of a spatula.
- Place a board on top of the page and hold it in place with a weight while drying.

Trim the ends of the *washi*.



- Once the paste is completely dry, trim the protruding ends of the *washi* to match the edge of the page.



- Trim the ends at a slight diagonal to prevent the *washi* from sticking out and to ensure a clean finish.

Lay the detached page on a sheet of scrap paper.



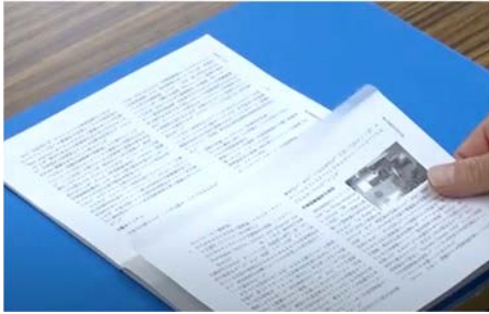
- Lay the detached page on a sheet of scrap paper with the recto facing up.

Apply paste to the *washi*.



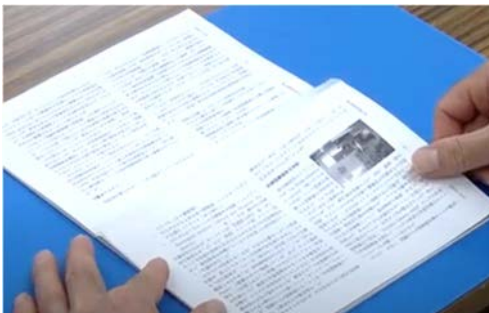
- Cover the page with scrap paper, leaving only the *washi* exposed.
- Load the brush and remove excess paste before applying.
- Spread the paste in a thin, smooth, and even coat.

Check the position of the detached page.



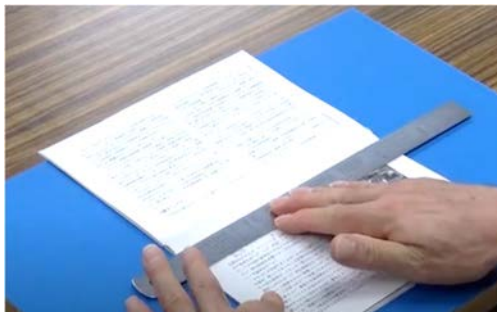
- Position the detached page with the paste facing down. Confirm the page numbers and edges of the page.
- Adjust the position of the detached page as needed.

Align the detached page with foredge, head, and tail of the book.



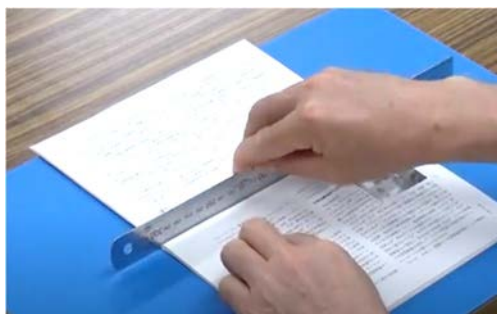
- Align the edges of the detached page with the foredge, head, and tail of the book.

Position a ruler near the inner joint.



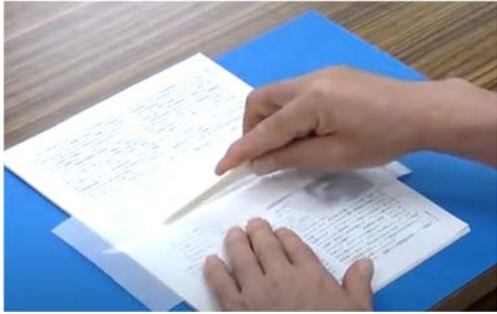
- Lay a ruler flat on the page, then press gently and move the ruler slowly toward the inner joint.

Press down on the inner joint.



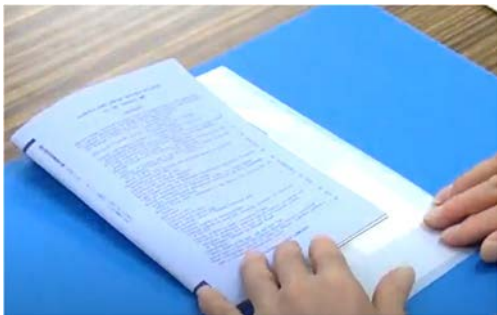
- Stand the ruler on edge at the inner joint and force the paper edge into the inner joint.
- Tilt the ruler to the opposite side, then press and remove the ruler.

Make sure that the *washi* is applied securely to the page.



- Cover the page with a sheet of cooking paper.
- Press gently on the cooking paper with the flat part of a spatula to secure the *washi* to the page.
- Place a sheet of cooking paper along the inner joint and gently close the book.

Close the book.



- Leaving the cooking paper in place, gently close the book.

Place boards and weights on the book and allow to dry.



- Place a board on top of the cover and hold it in place with a weight while drying.

Repair complete.

Drying paste

- Always use paste of an appropriate consistency and quantity.
- Always allow the paste to dry thoroughly before proceeding to the next step.
- Placing weights on the repaired page helps prevent the page from rippling while drying.

Insert the cooking paper.



- Place a sheet of cooking paper on both sides of the repaired page.

Close the book.



- Gently close the book.

Place a board on top of the book.



- Place the book on top of a board and then place another board on top of the book.

Place a weight on the board.



- Place a weight on the board.

Dry the paste



- Let the paste dry thoroughly for three or four hours.

Drying completed.

Useful Links

National Diet Library website “Preservation and Conservation” (English)

<https://www.ndl.go.jp/en/preservation/index.html>

- Manuals

- Dry Cleaning with Brushes
- Dry Cleaning with Powder Eraser
- Cleaning Mold-Damaged Materials
- How to reattach a cover to a text block
- Simple Folding Case
- Drying Wet Materials

- E-Learning

- ”Conservation of Paper Materials: Minor Repair”

Northeast Document Conservation Center (USA)

- NEDCC Preservation Leaflets

<https://www.nedcc.org/free-resources/preservation-leaflets/overview>

Foundation for Advancement in Conservation (USA)

- Conservation Online (CoOL)

<https://cool.culturalheritage.org/>

The British Library (UK)

- Collection Care

<https://www.bl.uk/conservation>

The Library of Congress (USA)

- Preservation Directorate

<https://www.loc.gov/preservation/>

Harvard University Library (USA)

- Preservation Services

<https://preservation.library.harvard.edu/>