

EXELTOOLS
international

PDR TRAINING

**> TECHNICAL TRAINING
SUPPORT FOR
PAINTLESS DENT REMOVAL**



THE DENT REMOVER--IS YOU !

CONTENTS

CHAPTER 1

GENERAL INFORMATION	3
1.1 Foreword.....	3
1.2 Stress-strain diagram for steel.....	3

CHAPTER 2

ASSESSING THE REPAIRWORK	4
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CHAPTER 3

TOOL USE	4
3.1 Stiff pushing tools	4
3.2 Flexible pushing tools for braces	6
3.3 Tips and extensions	6
3.4 Knock downs	7
3.5 Lighting	7

CHAPTER 4

LIGHT: ITS ROLE AND USE	8
4.1 Using light	8
4.2 Positioning the Board.....	8
4.3 Interpreting the reflection of the black line on the part.....	9

CHAPTER 5

DENT REMOVAL METHODS	10
5.1 Dent removal methods	10
5.2 Dent removal technique.....	11
5.3 Dent removal using a glue pulling system	17

CHAPTER 6

GLUE TABS	18
6.1 Glue pulling for smooth dents	18

CHAPTER 7

CONCLUSION	19
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1. GENERAL INFORMATION

1.1 FOREWORD

1.1.1. INTRODUCTION

Paintless dent removal is not a new technique; it first appeared on assembly lines, where specialists worked in this field with "homemade" tools.

This technique has now expanded to the realm of after-sales service. Most paintless dent removal (PDR) operations are performed by establishments other than classic repair shops. At the same time, numerous suppliers have begun selling a wide variety of tool lines that allow professionals to perform PDR operations themselves if they wish.

1.1.2. FIELD OF USE

QUICK AND INVISIBLE REPAIR.

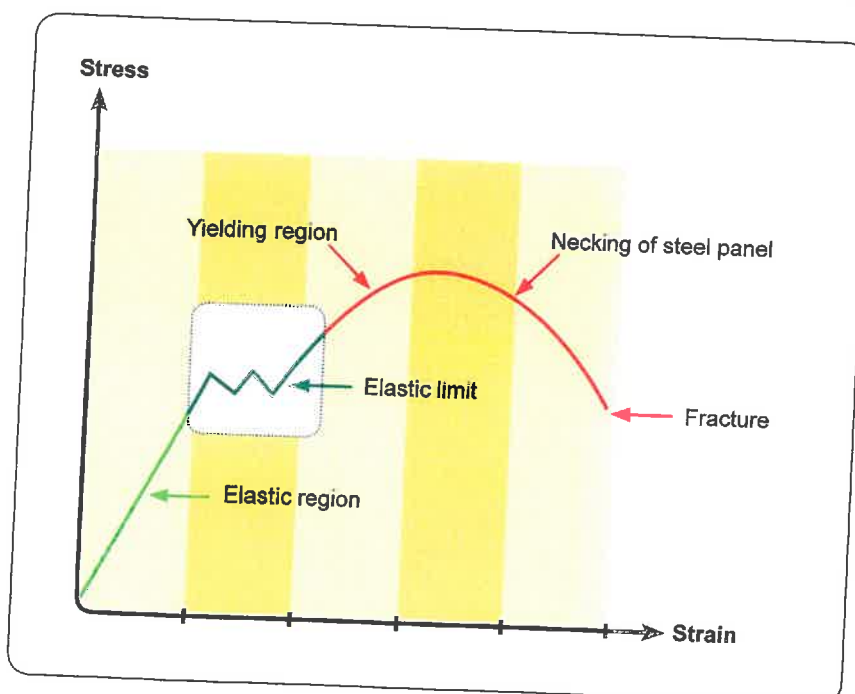
This repair procedure streamlines bodywork and makes the business more profitable:

- > **Quality of work** (corrosion protection, problems with colour, etc)
- > **Time frame** (servicing time, down time, etc)
- > **Costs** (No painting necessary, etc)
- > **Ecological**

PDR offers customers quick, invisible low-cost repair of slight appearance defects on their vehicle and increases their level of satisfaction. The advantage of PDR is that it quickly erases hail damage and small parking dents and dings without keeping the car out of use for too long.

// SUCCESS IN PAINTLESS DENT REMOVAL IS ACHIEVED THROUGH EXTENSIVE PRACTICE AND A HIGH LEVEL OF CONCENTRATION, METICULOUSNESS AND PATIENCE.

1.2 STRESS-STRAIN DIAGRAM FOR STEEL



- > **Elastic region:** The technician can see his tool (indentation of the tool) Steel returns to its original length in this zone.
- > **Elastic limit:** Region allowing the application of proper pushing pressure (push region).
- > **Yielding region:** Pushing too strongly causes outward dents to appear and damages the paint's orange peel (outward dent region).
- > **Necking of the steel panel:** Extremely strong pushing that cracks the paint and stretches the steel panel (blistering).

2. ASSESSING THE REPAIRWORK



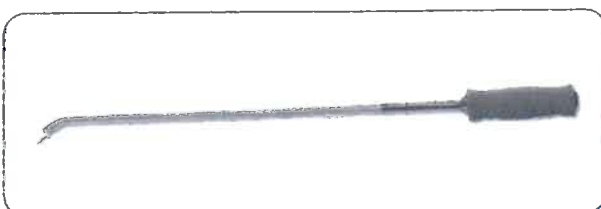
SEVERAL FACTORS NEED TO BE TAKEN INTO ACCOUNT DURING PAINTLESS DENT REMOVAL:

- > Part material: aluminium or steel?
- > Number of dents.
- > Has the paint film been damaged? Does the vehicle need to be repainted?
- > Diameter of the dent.
- > Is the dent on a sharp edge, a flat surface, etc.?
- > Is the repair area accessible or not?
 - Accessible area: no particular difficulty.
 - Inaccessible area: access via a preexisting opening.
 - Inaccessible area: no access (glue pulling system).

3. TOOL USE

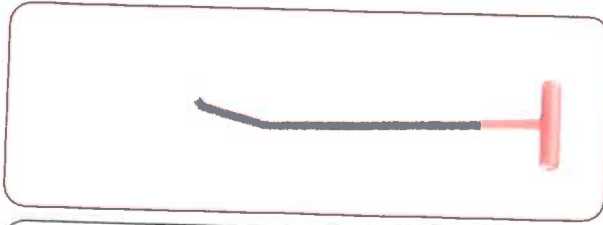
3.1 STIFF PUSHING TOOLS

3.1.1. BONNET ROD

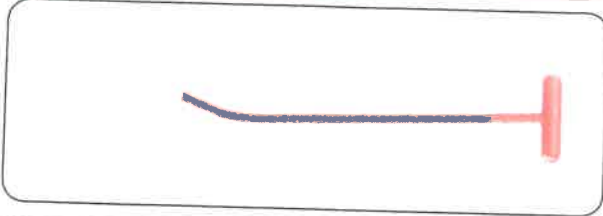


- > **Without brace:** leverage with hooks
- > **Within the brace:** leverage on the inner panel

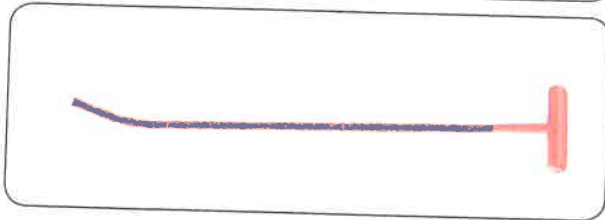
3.1.2. FRONT AND BACK WING RODS



> Leverage on the tyre

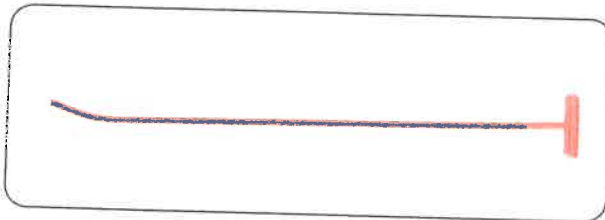


> Leverage on the rear-light wing panel on 5-door vehicles



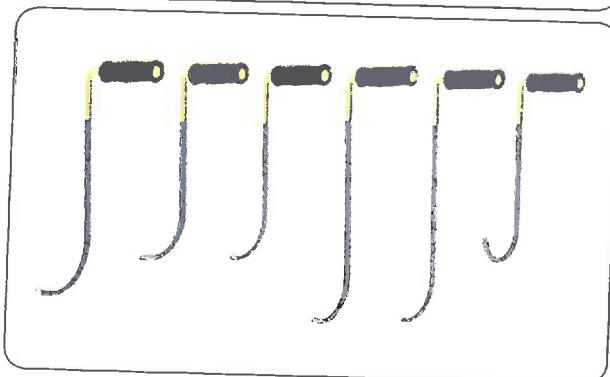
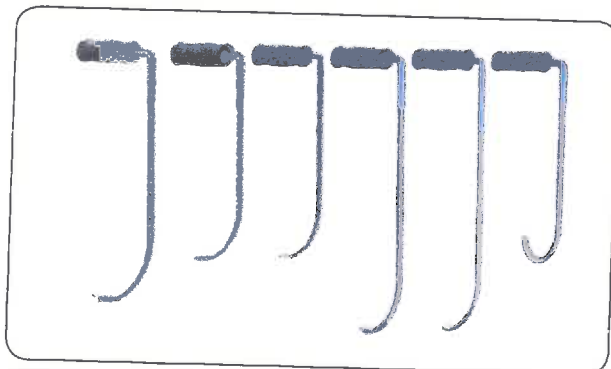
> Leverage on the rear-light wing panel on 3-door vehicles

3.1.3. ROOF ROD



> Rod for roofs pockmarked from hail or other causes, leverage with the roof strap.

3.1.4. HOOKS FOR DOORS



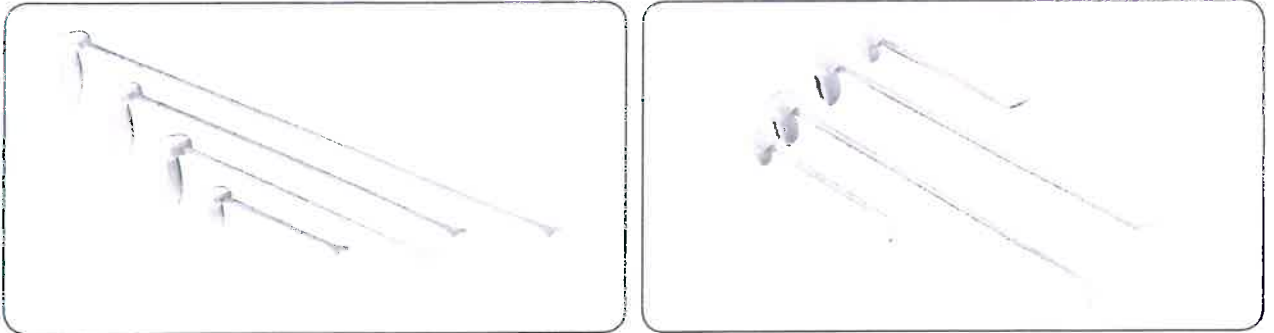
> Hooks for right and left sides of doors, with diverse shapes for reaching different door areas.

3.2 FLEXIBLE PUSHING TOOLS FOR BRACES

3.2.1. FLEXIBLE RODS FOR BRACES



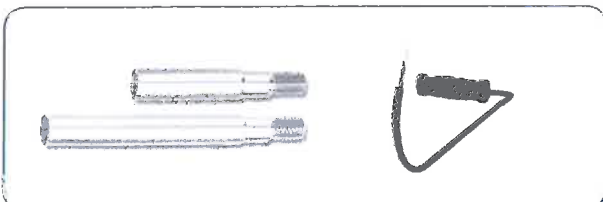
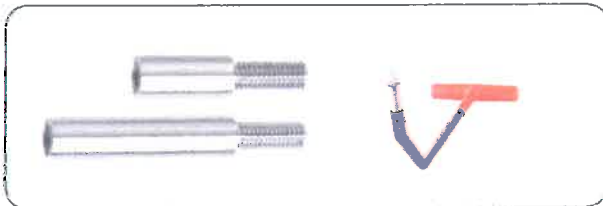
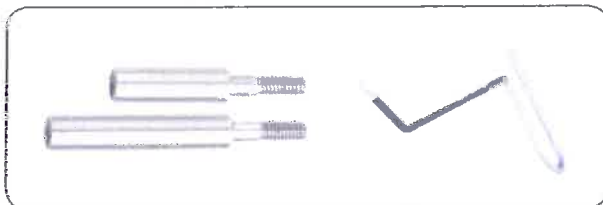
> These tools are used to reach inside of braces. Leverage is achieved using the holes in the inner panel.



> These tools are used for passing between two panels. Leverage is applied on the inside panel.

3.3 TIPS AND EXTENSIONS

3.3.1. EXTENSIONS



> **Extensions are used for two purposes:**

- For lengthening tools that are too short so that they can reach dents more easily.
- For changing the angle of the rod when superior to 45° (which avoids slipping).

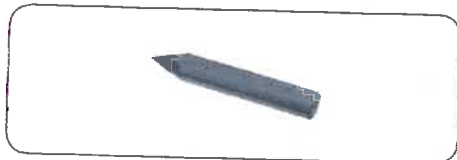
3.3.2. TIPS



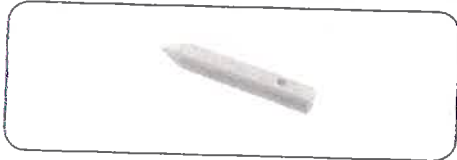
- > Different-sized tips allow varying degrees of pressure to be applied on the panel. Tips are chosen based on how deep the dent is. To accomplish this, the dent must be read using light (Board) in order to analyse the depth.

If we analyse the dent with the board and determine that the dent was made by a pointed object, a fine stainless steel tip must be used to push the bottom of the dent up (reduced elasticity). On the other hand, if we analyse the dent and determine that it was made by a blunt object and is large and smooth, a Teflon tip can be used to exert larger-size pushes (plenty of elasticity).

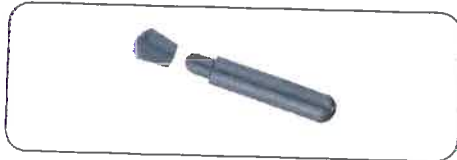
3.4 KNOCK DOWNS



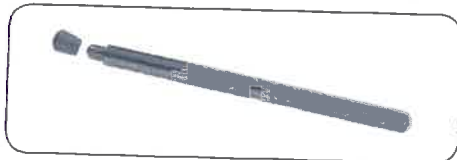
- > The black knock down with a hardness of 7 (Mohs Scale) is used to knock down the whole dent (knock down a large area).



- > The beige knock down with a hardness of 10 (Mohs Scale) is used for its stiffness to knock down precise points on a dent, inadvertently made outward dents or crimping marks.

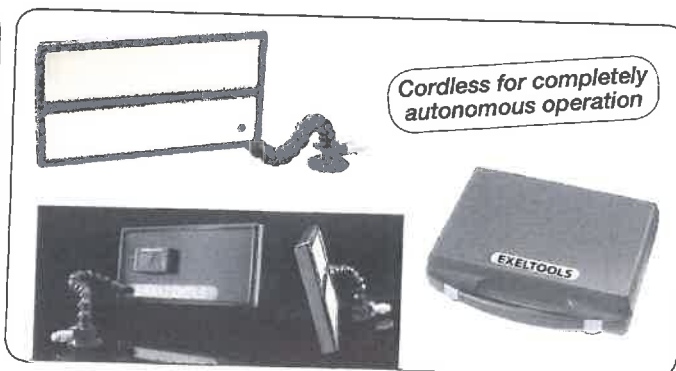
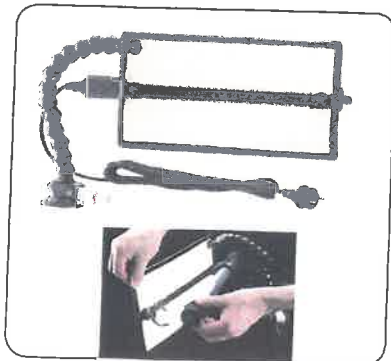


- > Short or long rubber knock downs are used to knock down crowns created by large dents.



3.5 LIGHTING WITH A BOARD

- > Lighting plays a crucial role in PDR since it enables you to locate the deformation. We use boards on tripods or portable boards with suction pads that attach to the vehicle. A black line is also used with the lighting in order to improve the visibility of the deformation.

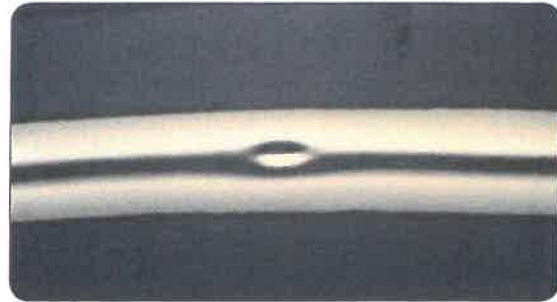
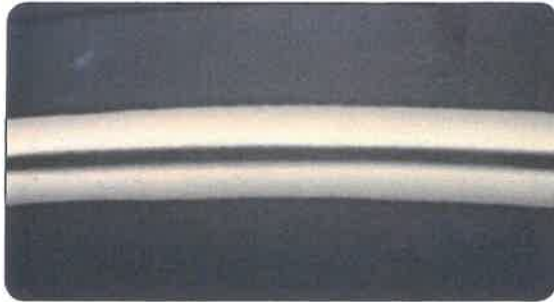


Cordless for completely autonomous operation

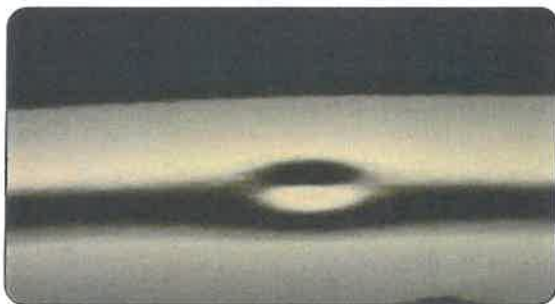
4. LIGHT: ITS ROLE AND USE

4.1 USING LIGHT

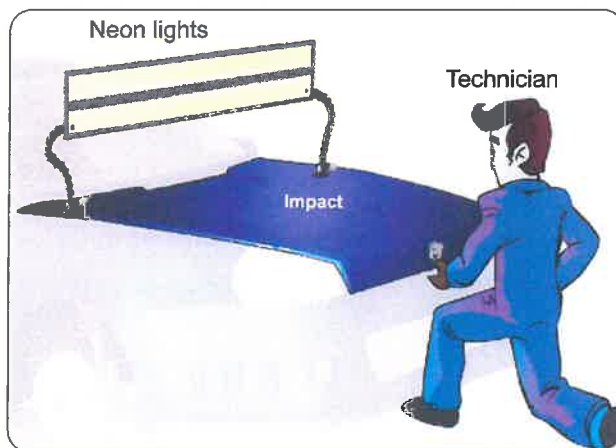
- > Light plays a very important role in dent removal operations. The board reflects a black line that enables you to assess the extent of the deformations, the depth of the dent, and it allows you to better control pushing with different tools.



4.2 POSITIONING THE BLACK LINE

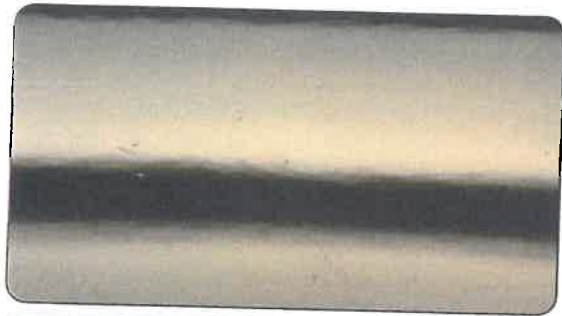


- > In order to position the board's lighting, you must first "read" the dent.
- > To do this, just position the black line under the dent to serve as its edge.
- > The dent will then appear.
- > We position the board based on the depth of the dent.
- > The deeper the dent, the closer the board must be in order to see the bottom of the dent.
- > The black line must always be positioned below the dent.



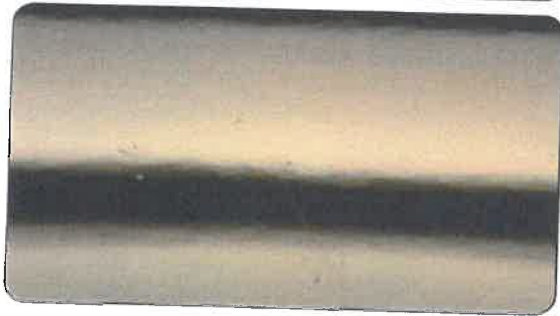
- > For a good view of the dent, the black line must be positioned parallel to the bottom of the dent.
- > The technician must be facing the black line.

4.3 INTERPRETING THE LIGHT'S REFLECTION ON A PART

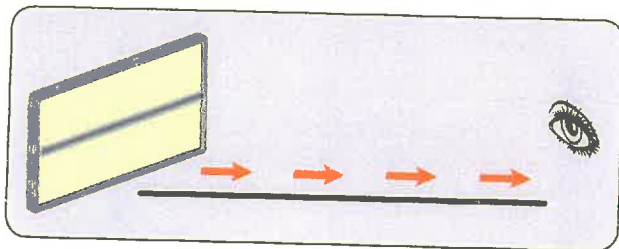


- > Top fog
- > Black line
- > Low fog (not needed)

The fog outlines the orange peel of the paint film.
Orange peel = the relatively coarse grainy texture of the paint finish.

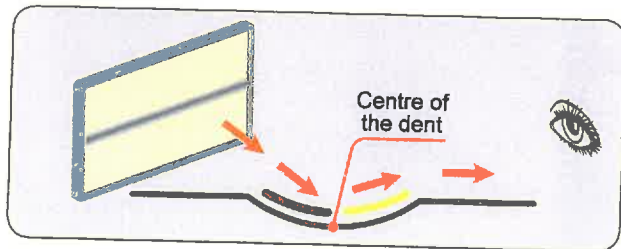
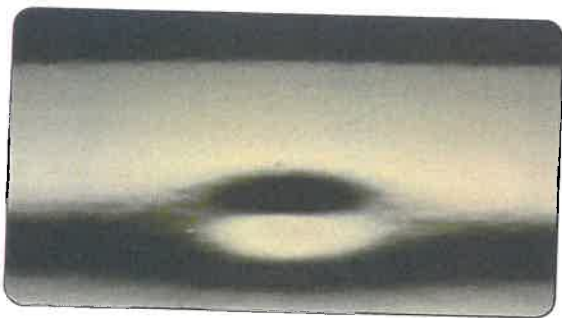


- > Unaltered reflection of the black line = no impact



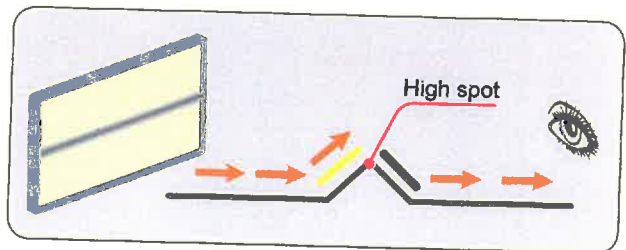
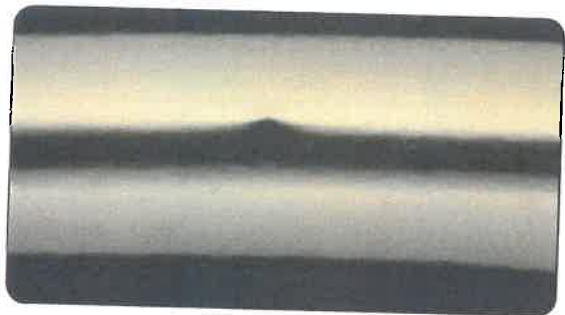
- > The light is diffused, the black line remains straight and the fog is the same from left to right. No impact exists.

INWARD



- > Two half-moons are formed, one yellow and the other black (Dent). The light is diffused, the black line follows the hollow of the dent and the fog does not appear along the edge of the dent. The board must be moved forward or backward until there is an equal amount of black and yellow, as seen in the photo. The centre of the dent is located at the intersection of the 2 colours.

OUTWARD



- > The light is diffused and the black line widens where the push occurs. There is no fog at the top of the push. The apex of the high spot is located between the two colours.

5. DENT REMOVAL METHODS

5.1 WORK ON THE DENT IS CARRIED OUT MAINLY FROM THE INSIDE.



- > Leverage must be found for the tool in order to apply steady and continuous pressure on the panel. To apply this pressure, a leverage point is needed, preferably at the midpoint of the tool.

Various possibilities are available to us depending on the circumstances:



- > Direct access through a hole in the brace. Be careful not to deform the inner panels.



- > Hook used hanging from a hole in the inner panel or brace.



- > Chain with 2 hooks.

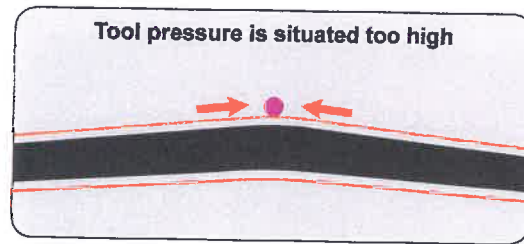
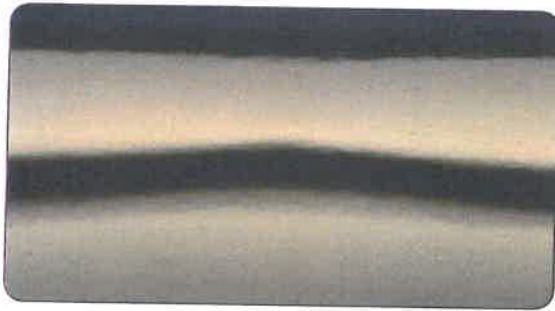


5.2 DENT REMOVAL TECHNIQUE

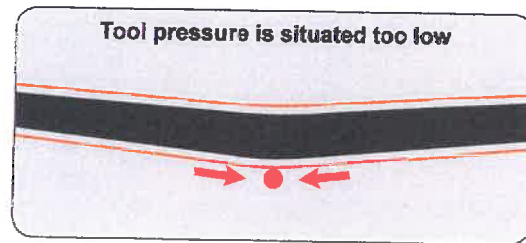
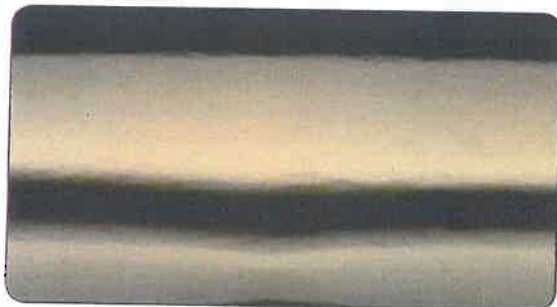
The distance of the board must be adjusted depending on the depth of the dent in order to see the bottom of the dent well. Work is carried out inside the **orange peel** of the dent so that it isn't changed in any way. With each pass, we move the board back little by little until the panel returns to its **original shape**. The dent must be 100% flush, neither hollow nor raised.

TECHNIQUE FOR SEEING YOUR TOOL

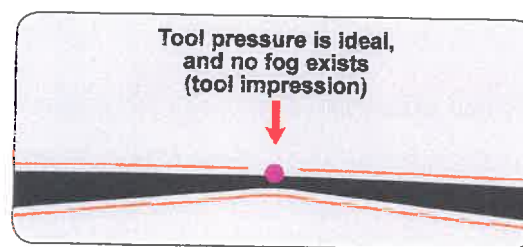
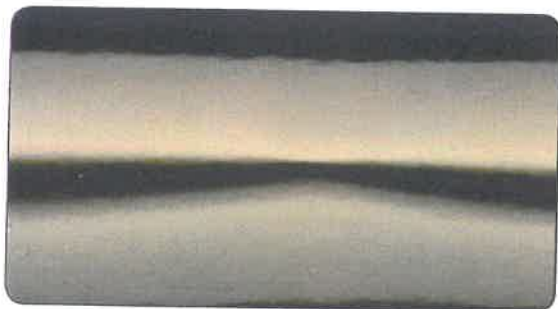
To accomplish this, you must play with the elasticity as described in the table on Page 3. You must locate your tool within the elastic region, which will enable you to see your tool without deforming the panel. Applying light pressure within the elastic zone will cause the black line to bow upwards, and an indentation will appear. The fog will disappear at the indentation's location on the fog line.



> The indentation doesn't appear yet; the line is bowed too high. The tool is too high (the fog remains the same).



> The indentation doesn't appear yet; the line is bowed too low. The tool is too low (the fog remains the same).



> Our tool is located where the fog disappears. The indentation appears.

5.2.1. SMOOTH DENTS

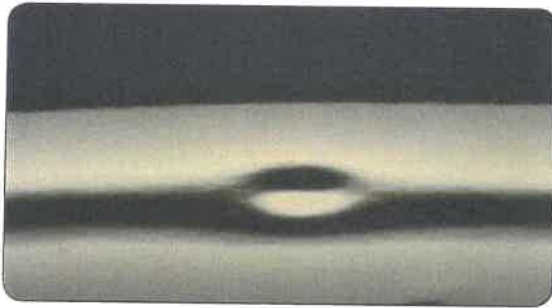
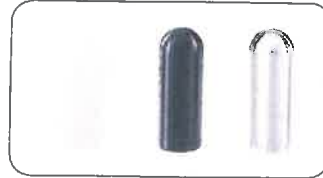
Smooth dents are round with a rounded bottom, plenty of elasticity and little tension (for example, dings from small hailstones).

> The "Snail" Technique

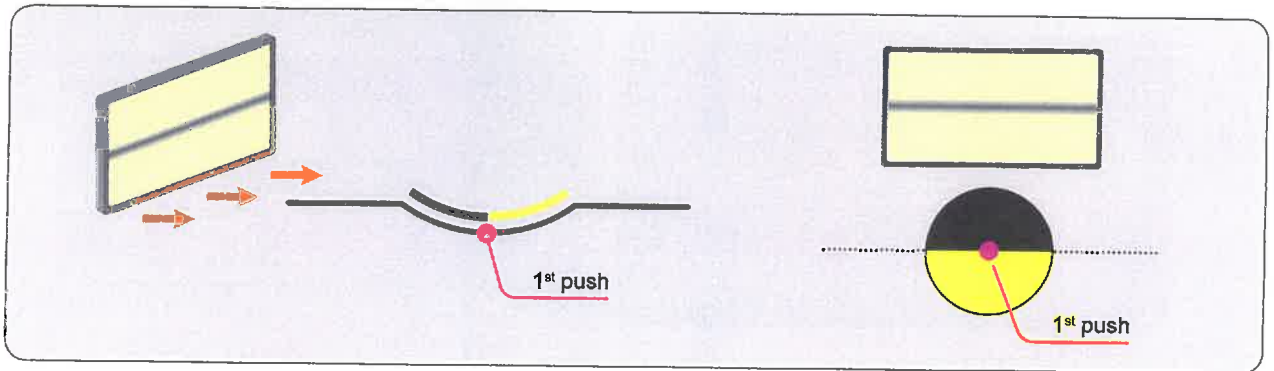
This technique is used over the entire surface area of the dent. The dent removal process begins in the centre of the deformation and moves outwards in a spiral pattern that resembles a snail shell.

The pushes must be performed with the same pressure and be connected together.

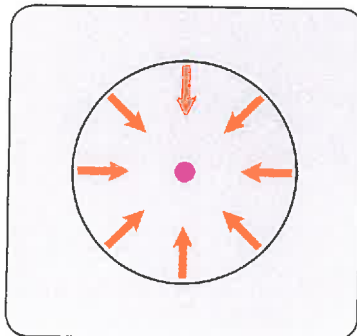
> These are the tips recommended for smooth dents:



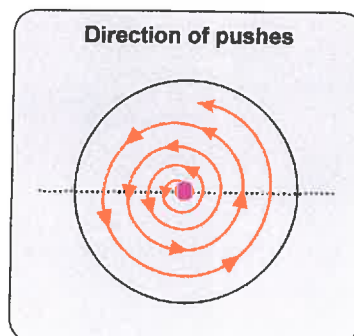
> Smooth dent with plenty of elasticity and a rounded bottom.



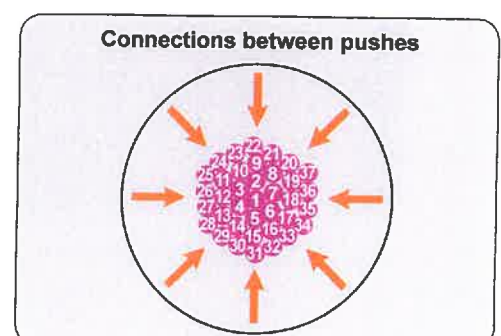
> Position the Board so that you obtain a half yellow/half black line. This will indicate the centre of the dent in a vertical direction; you will then have to centre it yourself in the horizontal direction. Begin to push lightly to see how your dent reacts. You are in the centre of the dent when all the edges of the dent pull towards the centre.



> Do the 1st push, and then proceed in a circle around this point. Continue the spiral pattern in a counterclockwise direction for $\frac{3}{4}$ of the dent.

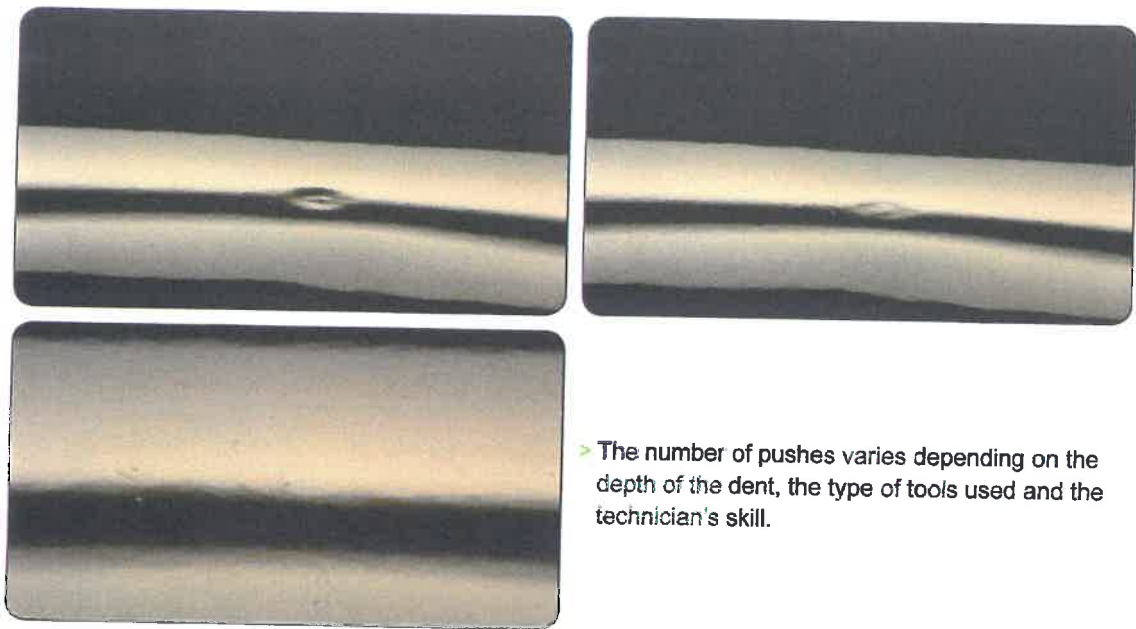


> The same pressure must be applied for each push. The pushes must be connected together so that the orange peel isn't affected. The last quarter of the dent will pop out automatically.



> This step sometimes must be repeated several times depending on the depth of the dent. You must alternate your position with each pass: one from the front, one from side and so forth. Gradually move your board away between passes until the panel returns to its original shape (height of dent).

If you forget to push the dent in some areas, you'll end up with a lack of connections and your orange peel will be altered.



> The number of pushes varies depending on the depth of the dent, the type of tools used and the technician's skill.

5.2.2. CREASES

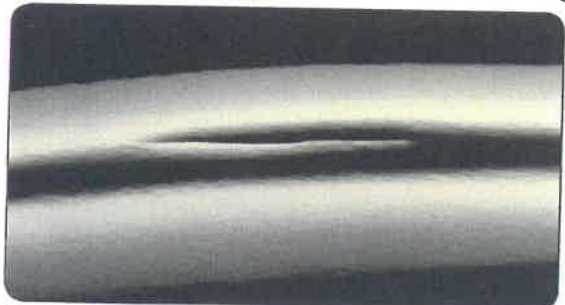
Creases are long narrow dents that can be smooth or sharp (for example, bumper accidents in a parking lot).

- > **The "Line" technique** Place the board so that the half yellow/half black line indicates the centre of the crease. This technique is used over the entire surface length of the dent. Dent removal is performed beginning at one side of the deformation and working towards the other side.

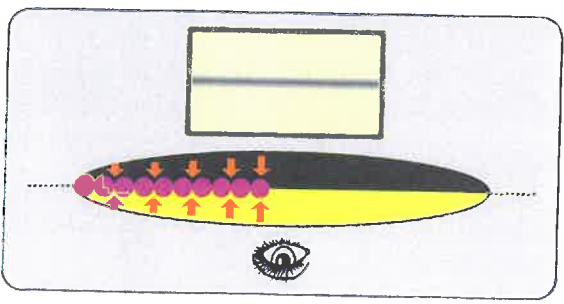
The pushes must always be performed with the same pressure and be connected together.

// IMPORTANT: THE BOARD MUST BE PLACED PARALLEL TO THE CREASE.

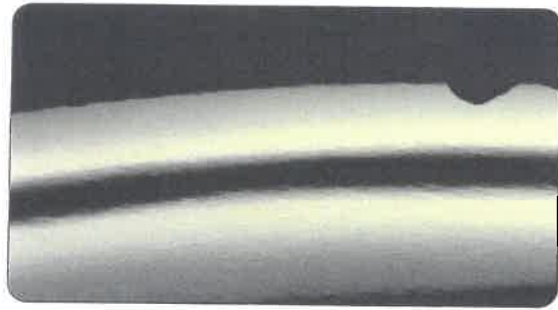
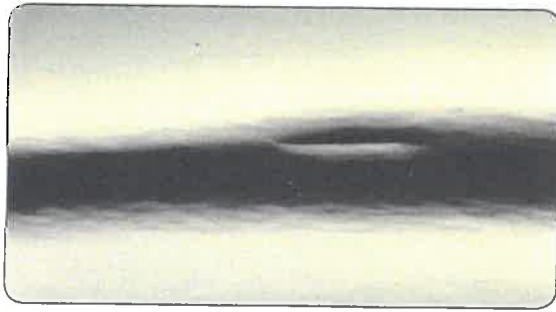
> These are the tips recommended for creases:



> Small 10 cm crease with a slightly creased bottom. To fix this, we'll use a round stainless steel tip.



- > Begin to push lightly to see how your dent reacts.
- > You are in the centre of the dent when the edges of the crease all pull towards the centre.



> All pushes must be done with the same pressure between the half yellow/half black line, and they must be connected all the way to the end of the crease.

> When the crease is repaired, the black line and the fog must be identical whether in the area of deformation or not.

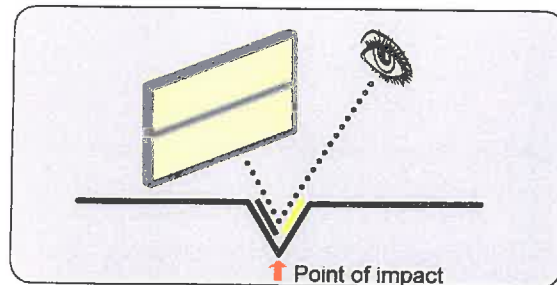
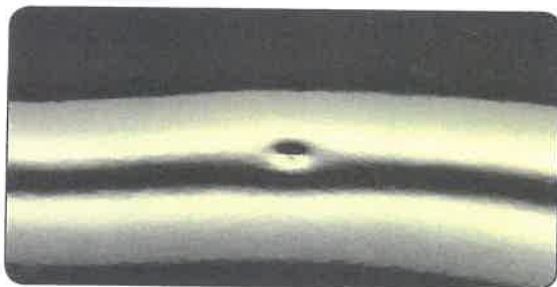
5.2.3. SHARP DENTS

As indicated by their name, sharp dents are small and very deep, which makes them difficult to repair (for example, impact from small rocks and pebbles).

> The "Point" technique

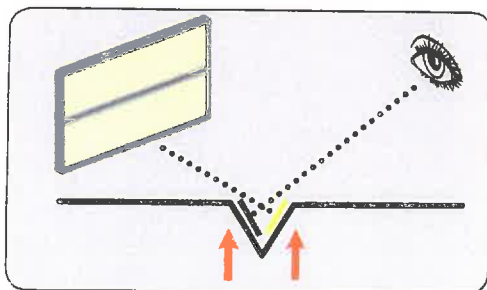
Place the board so that the half yellow/half black line indicates the centre of the dent. With this type of deep dent, the board must be placed very close in order to see the bottom of the dent. The technique here is to reveal the point of impact that made the dent. Once the point of impact is found, you must play with the elasticity within the elastic limit (see stress-strain diagram on page 3) by pushing many times directly on the point of impact.

> These are the tips recommended for sharp dents:

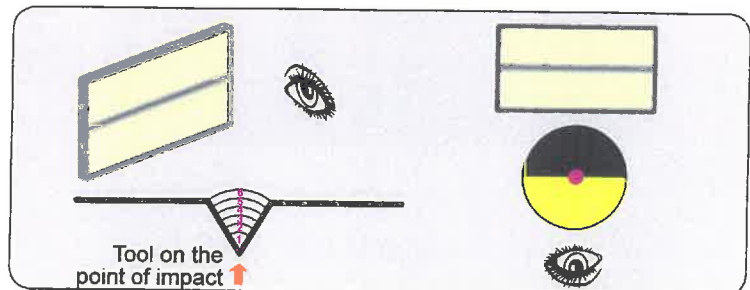


> Small and deep sharp dent. To fix this, we'll use a pointed stainless steel tip.

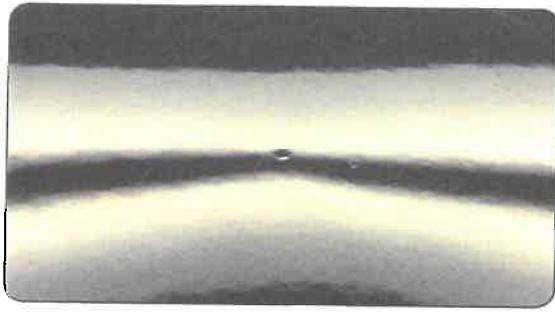
> **Proper Board position.** Board close in order to see the bottom of the dent.



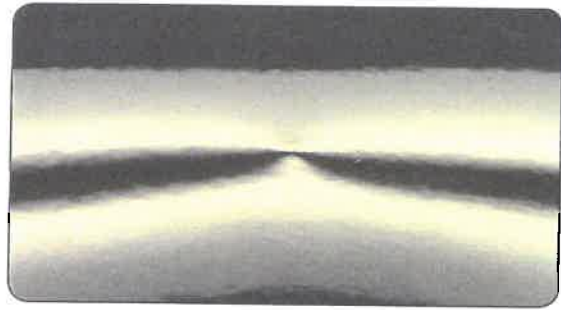
> **Poor board position.** Board is too far away, bottom of dent not visible, light lines overlap. This will cause you to push off-centre of the bottom and narrow the dent further.



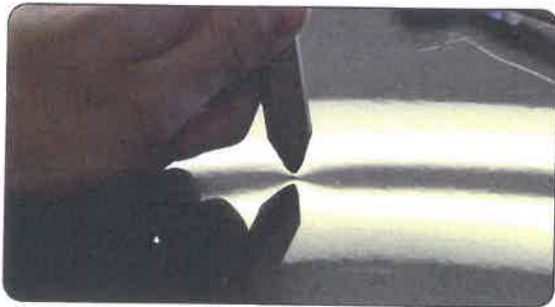
> Position the tool precisely under the point of impact and begin pushing around lightly and playing with the elasticity, relieving the pressure when an outward dent is about to form (up to the elastic limit).



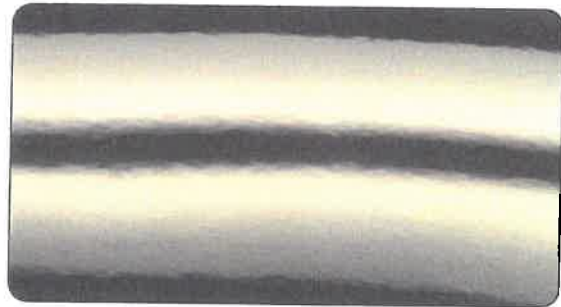
> The dent is deep and very sharp, with reduced elasticity.



> The dent must be pushed up to create a high spot in order to eliminate the point of impact.



> The dent has been pushed up at the centre and now has a high spot. Next, check the height of each dent closely during the final stage of its repair (until original shape is reached). The high spot must be tapped down to make it level.



> Once the high spot is tapped down, the panel should be in its original shape. The black line and fog are now identical to an unaffected area of the panel. The dent is repaired.

5.2.4. JAGGED DENTS

Jagged dents can be small or large dents with a jagged, uneven bottom. They are generally very deep and at the panel's stretching limit; these dents are thus very difficult to work on since they are very narrow. You must therefore push very strongly in order to approach the panel's necking point (see stress-strain diagram on Page 3).

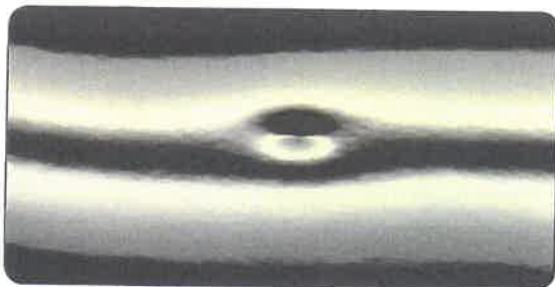
> The "Jagged" technique

Place the board so that the half yellow/half black line indicates the centre of the dent.

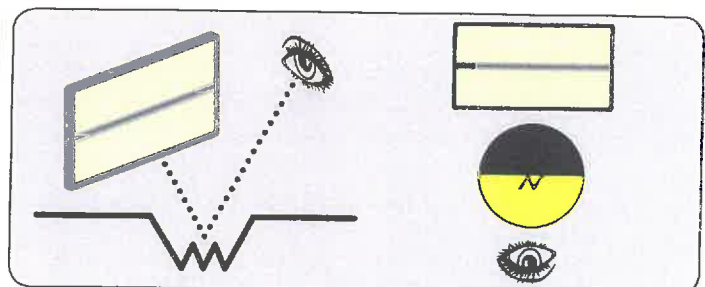
With this type of deep dent, the board must be placed very close in order to see the bottom of the dent.

The technique here is to reveal the point of impact that made the dent. Once the centre is found, you must play with the elasticity (elastic limit) by pushing many times directly on the point of impact.

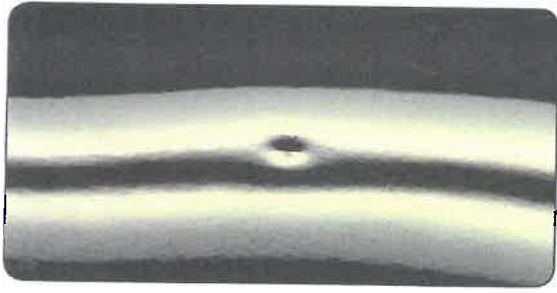
> These are the tips recommended for deep jagged dents:



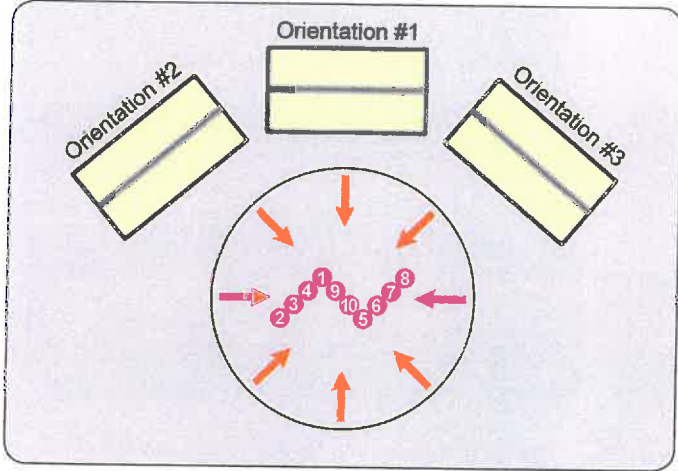
> Deep jagged dent. To fix this, we'll use a pointed stainless steel tip.



> As with all deep dents, the board must be very close to the dent in order to see its bottom. Start pushing and lifting the centre of the dent so that the jagged bottom surface of the dent appears.

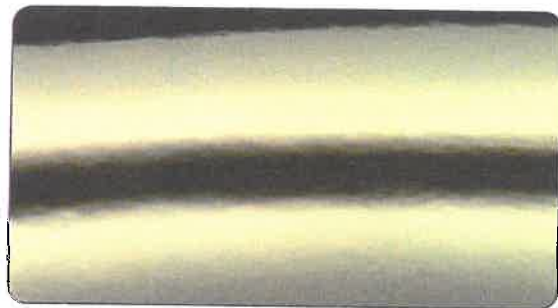
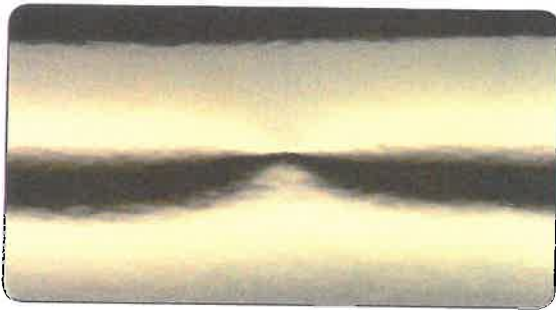


> The jagged impression appears in the form of a star, so each line that forms the star must be pushed. The board must be placed parallel to each line.



- > **Push 1** (centre of the dent so that its impression appears): Board orientation #1.
- > **Pushes 2, 3, 4, 5, 6, 7 and 8:** Board orientation #2.
- > **Pushes 9 and 10:** Board orientation #3.

// THE BOARD ABSOLUTELY MUST BE PARALLEL TO THE DEFECTS



> An outward dent will appear once the lines of the star have been pushed out. Use the knock down on the outward dent, moving the board farther away until the panel returns to its original shape.

> The dent is fully repaired once the outward dent is knocked down.

5.2.5. DOOR PANEL DENTS

These are dents that occur on the edge or bodyline of the door. We can consider these as vertical creases, so the technique used will be practically the same.

> **The "Line" technique**

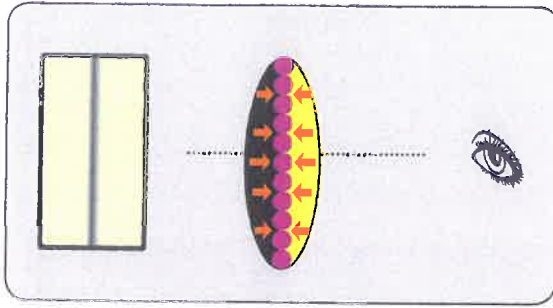
Place the board so that the half yellow/half black line indicates the centre of the crease. This technique is used over the entire surface length of the dent. Dent removal is performed from the top of the door dent to the bottom.

For door panel dents, we use the Hook without tips.

// IMPORTANT: THE BOARD MUST BE PLACED PARALLEL TO THE DOOR PANEL DENT



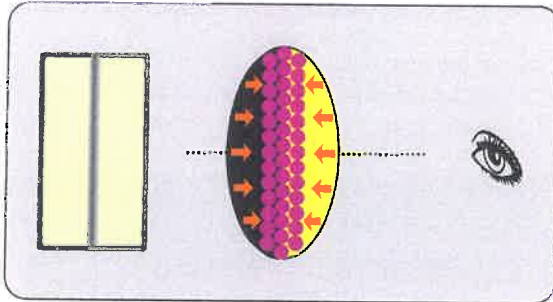
> The typical door panel dent occurs on the bodyline of the door.



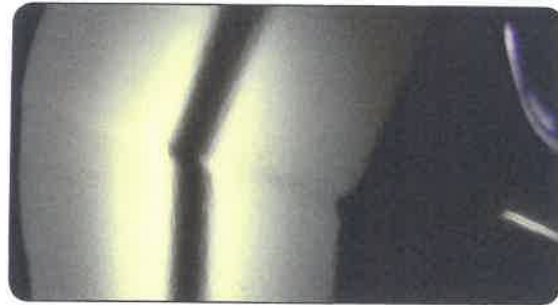
> Begin to push lightly to see how your dent reacts. You are in the centre of the dent when the edges of the crease all pull towards the centre.



> All the pushes must be done between the half yellow/half black line with the same pressure, and they must be connected together.



> If one pass is not enough, repeat the operation on the right and on the left of the first pass until the panel returns to its original shape.

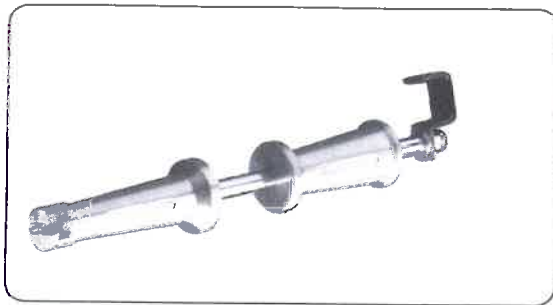


> The black line and the fog are now identical to the original. The dent is repaired.

5.3 DENT REMOVAL USING A GLUE PULLING SYSTEM

Dent removal by glue pulling is performed on small- to medium-size dents that are generally shallow since this system needs plenty of elasticity to work (smooth dents, shallow creases and dings from hail).

Several pulling tools are available. The most widely used are:



> The slide hammer, which adapts to all dents and accesses.



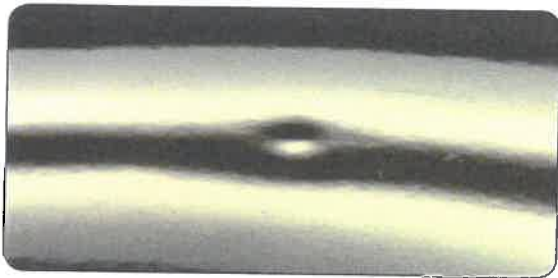
> Glue puller, recommended for small smooth dents and hail damage on flat surfaces (roof, bonnet). The glue puller is larger and can't access every location, but it can pull very hard.



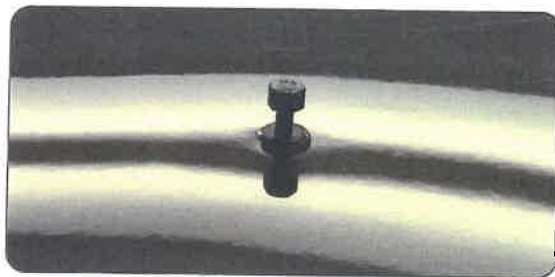
> The pulling tools use hard plastic glue tabs with diameters between 12 mm and 32 mm. These glue tabs are shaped to provide maximum hold with the hot glue used for pulling out the dent. This glue is specifically designed to be used for dent removal. Different hot glues exist with varying degrees of adherence depending on the working temperature.

6. GLUE TABS

6.1 GLUE PULLING FOR SMOOTH DENTS



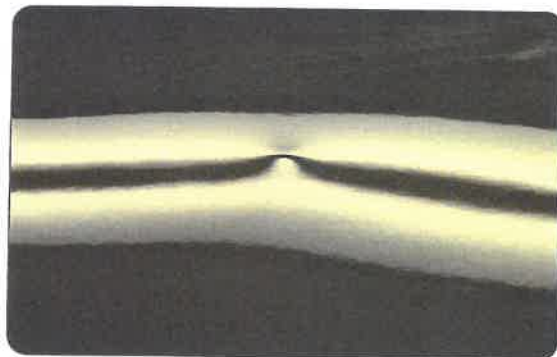
> Small smooth dent.



> Position the glue tab on the centre of the dent. The glue tab must be smaller than the dent since it needs to lift up the bottom of the dent.



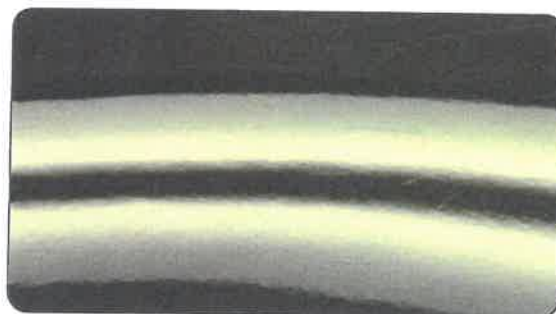
> We can use either the slide hammer or the glue puller to do this.
> Insert the glue tab into the glue puller's tab holder and squeeze.
> Remove the excess glue remaining on the panel with an adhesive remover spray.



> We obtain an outward dent.



> We must knock down the outward dent to make it flat.



> When the fog is identical everywhere, the dent is repaired.

7. CONCLUSION

As you have undoubtedly understood by now, removing dents requires that you be calm, meticulous, possess good hand-eye coordination and above all, have a passion for dents. And let's not forget the secret of **practice, an enormous amount of practice. One becomes a dent remover by removing dents.**

Some tips from professionals:

- > Analyse the dent well before beginning, check the position of the board and the access available and carefully evaluate what techniques and tools to use. All these steps are very important.
- > If you have a very large dent, you can rough out the dent with glue pads; this will save you time and keep you from damaging your orange peel.
- > Keep in mind that it takes 20% of the time to remove 80% of the dent and the remaining 80% of the time to remove the last 20% of the dent. Finishing a dent takes much longer.
- > Finishing a dent properly depends on whether you took your time at the beginning and did your first pushes in the correct place.
- > The place where you perform dent removal is very important. A covered area with low lighting is preferable, especially for light colours (such as white or grey).
- > Consider removing a part from the vehicle if you are in an uncomfortable position for removing the dent. You will thus be able to perform higher quality work (door bottom, bonnet frame).



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