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SOP – fracture alignment system

MIPO / ORIF

Please read these notes carefully and contact us immediately if you require any further information or have any concerns regarding the printed models or guides supplied.

Pre-operative

- In most cases the following models and guides will be supplied.
  - Pre-operative bone (major fracture fragments) - translucent yellow plastic – for pre-op / intra-op practice of Ellis pin orientation guide fit – these can be autoclaved (see guidelines below).
  - Mirrored contralateral bone - translucent yellow plastic – usually with footprint of reduction guide *in-situ* – for pre-contouring of plate – can be autoclaved.
  - Ellis pin orientation guides and reduction guide – biocompatible and autoclavable translucent orange plastic. Recommend autoclave protocols are below, however all standard protocols are acceptable.
    - 138°C for 3 minutes
    - 134°C for 6 minutes
    - 121°C for 15 minutes
- Four Ellis pins will be required.
  - The diameter varies according to patient size and will be confirmed following guide design and in this SOP when supplied with the models.

Intra-operative

- An appropriate surgical approach to the fractured bone is made.
  - The precise exposure required will depend on the fracture configuration, the surgical plan, and whether ORIF or MIPO is planned; these factors determine optimal guide design and positioning to facilitate internal fixation. These factors are reviewed with the surgeon during the planning stage, and guide design and required exposure determined.
- Elevate soft tissues to the extent required for the Ellis pin orientation guide footprints.
  - Supra-periosteal exposure is appropriate i.e. as for plate application.
  - Note that adherent soft tissues of any significant thickness will adversely affect guide fit and should be removed – in juxta-articular locations these might include retinacular and capsular attachments.
- Identify the positions of Ellis pin orientation guide fit.
  - This is usually obvious as the guides will becomes stable once their footprints match the cortical contours beneath. During MIPO, the relatively small guide footprints and limited exposure can make guide positioning more challenging than during guided ORIF.
  - Comparison to the printed bone helps identify correct positions.
- Apply the Ellis pins through their channels in each Ellis pin orientation guide..
  - Pre-drilling of the *cis*-cortex only with a drill bit of the same or slightly smaller diameter than the Ellis pin is recommended. Carefully align the drill bit with either of the channels such that off-axis pressure on the guide channel (which could move the guide) is avoided. The transparent, cylindrical nature of the channels facilitates alignment.
  - Ideally after the first *cis*-cortex in each orientation guide is drilled the drill bit is left in-situ and a new bit used for the second hole. In this way the position of the guide cannot change.
  - Each drill bit is removed sequentially and replaced with a bicortical Ellis pin.
  - If the drill chuck will contact the end of the previously placed pin –
    - ORIF - that pin can be cut leaving 2-3cm emerging from the guide channel.
    - MIPO – avoid cutting the pin as much as possible due to the longer reduction guide. Usually the pin can be bent to the side, or as short a length removed as possible.
  - Repeat for the second guide.
- Remove both Ellis pin orientation guides.
  - These should slide off the Ellis pins.

- Place the reduction guide.
    - This will align all four Ellis pins in parallel, and, when contacting the cortex proximally and distally, results in optimal re-orientation of the proximal and distal major fracture fragments as pre-planned.
    - It is very helpful to manually align the major fractures such that all four Ellis pins are parallel and distracted approximately correctly before sliding the reduction guide down the Ellis pins. This reduces the risk of the pins binding in the guide channels due to excessive off-axis loading and friction.
    - Sterile lubricating jelly applied to the pins can make it easier to slide on the reduction guide, especially for the longer MIPO guide.
    - Contact between the guide base and the cortex proximally and distally is necessary for planned alignment – if required during guided ORIF non-pointed reduction forceps can be used to push the guide onto the bone.
    - Please note the reduction guide is designed to be as strong as possible within the size limitations imposed by patient size, but is not indestructible. Avoid the use of excessive force or application of point loading (e.g. pointed reduction forceps) – large forces should not be necessary if the above guidelines are followed.
- Apply the precontoured plate.
    - Check that the Ellis pins do not impede planned screw pilot holes. Should this occur pilot holes for cortical screws can usually be slightly angled; for locking screws removal of the Ellis pin once sufficient other screws have been placed is necessary.
    - This system is rarely indicated for simple fractures, however in that case do not attempt to compress the fracture with the reduction guide attached with all four Ellis pins as this will produce stress at the pin / bone interface. If you wish to compress the fracture the plate should be applied securely with at least two screws either proximally or distally. A screw is placed at the other end of the plate in a loaded position, in contact with the plate but not tightened. One pair of Ellis pins is removed (from either end), and the screw tightened. Obviously undesired relative movement of the fracture segments is possible but unusual unless plate contouring is inaccurate. Lightly applied bone-holding forceps between the reduction guide and bone can help maintain alignment but still permit slight compressive movement of the bone segments.
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- Remove the reduction guide and Ellis pins.
    - A second plate can be applied in the vacated space if necessary.

Post-operative

- We actively encourage feedback regarding any aspect of the guide system – please let us know your thoughts.