Supplementary Material

	Plate positioning	Plate deformation	Fit criteria	Plate set	Surgery ready	Anatomic constraints
2007 Goyal	x	x	x	x	x	x
2008 Schmutz	x	NA	o	x	x	x
2010 Kozic	o	x	o	x	x	x
2011 Schmutz	x	x	o	o	x	x
2011 Bou-Sleiman	NA	o	x	x	x	x
2012 Schulz	NA	x	o	x	x	x
2016 Harith	o	x	o	o	x	x
2018 Petersik	o	x	x	x	x	x
2019 Schmutz	x	x	o	x	x	x
2019 Wu	x	NA	o	x	x	x
2019 Tkany	o	x	o	x	x	x
2022 Zenker	NA	x	x	x	x	x
Ours	o	o	o	o	o	o

Table 1: Comparative table of plate designs and evaluation methods. Legend: (o: yes); (x: no), (NA: non-available or non-applicable). "Plate positioning" and "Plate deformation": is it done automatically? Fit criteria: is there a binary fit criterion? Plate set: does the method provide several plates? Surgery ready: given a bone, does the method provide a surgery-ready plate shape? Anatomic constraints: does the plate positioning optimization consider anatomic constraints?

Algorithm 1 Plate set creation algorithm.

```
procedure BuildPlateSet(plate_list plate_list, bone_list bone_list)
    plate_set ← ∅
    while |bone_list| ≥ 0 do
        plate_sorted ← sort_by_bone_fit_nb(plate_list, bone_list)
        plate ← plate_sorted.pop(0)
        plate_set.append(plate)
        for bone ∈ fit_bone_list(plate, bone_list) do
            bone_list.remove(bone)
        end for
    end while
    return plate_set
end procedure
```

Plate positioning

Definitions:

B: the input bone mesh.
$\mathcal{B}_h$**:** the vertices on the head fixation region of the bone.
$\mathcal{B}_s$**:** the vertices on the side fixation region of the bone.
P: the input plate mesh.
N_p**:** number of vertices of the plate mesh.
$\mathbf{r} \in \mathbb{R}^{3\times3}$**:** a 3D rotation.
$\mathbf{t} \in \mathbb{R}^{3}$**:** a 3D translation.
$\mathbf{P}^{\mathbf{r},\mathbf{t}} = \mathbf{r} \cdot \mathbf{P} + \mathbf{t}$**:** the positioned plate.
$\mathcal{P}_h^{r,t}$**:** the vertices on the head fixation region of the positioned plate.
$\mathcal{P}_s^{r,t}$**:** the vertices on the side fixation region of the positioned plate.

$d(.,.) \to \mathbb{R}$**:** the Chamfer distance between two point sets.
$col(A, B) \to \mathbb{N}$**:** counts the number of vertices of A which are inside B.

w_i**:** optimization weights: $w_1 = 5, w_2 = 0.01$.
$d_c = 0.01$ **mm:** collision threshold.
$d_s = 2$ **mm:** snap threshold.
$\alpha = 16$**:** constant.

$\mathbf{r}_0, \mathbf{t}_0$ Initial position of the plate.
$\mathbf{r}_f, \mathbf{t}_f$ Final position of the plate.

Equations:

$$\arg\min_{\mathbf{r}_0,\mathbf{t}_0} E_1(\mathbf{r}, \mathbf{t}; \mathbf{P}, \mathbf{B}) = w_1 d(\mathcal{P}_h^{r,t}, \mathcal{B}_h) + d(\mathcal{P}_s^{r,t}, \mathcal{B}_s). \tag{1}$$

$$\begin{aligned} \arg\min_{\mathbf{r}_f,\mathbf{t}_f} E_2(\mathbf{r}, \mathbf{t}; \mathbf{P}, \mathbf{B}) = w_2\ & col(\mathbf{P}^{\mathbf{r},\mathbf{t}}, \mathbf{B})\ E_{col}(\mathbf{P}^{\mathbf{r},\mathbf{t}}, \mathbf{B}) \\ &+ E_{snap}(\mathcal{P}_h^{r,t}, \mathcal{B}_h) \\ &+ E_{snap}(\mathcal{P}_s^{r,t}, \mathcal{B}_s) \end{aligned} \tag{2}$$

where

$$E_{col}(\mathbf{P}, \mathbf{B}) = \sum_{i\in[1,N_p]} \begin{cases} (E_{p2m}(\mathbf{p}_i, \mathbf{B}) - d_c)^2 + \sigma(d_c), & \text{if } E_{p2m}(\mathbf{p}_i, \mathbf{B}) \le d_c \\ \sigma(E_{p2m}(\mathbf{p}_i, \mathbf{B})), & \text{if } E_{p2m}(\mathbf{p}_i, \mathbf{B}) > d_c \end{cases} \tag{3}$$

with

$$\sigma(x) = \frac{1}{1 + e^{-\alpha(x-d_c)}} \tag{4}$$

and

$$E_{snap}(\mathbf{P}, \mathbf{B}) = \sum_{i\in[1,N_p]} \begin{cases} 0, & \text{if } E_{p2m}(\mathbf{p}_i, \mathbf{B}) \le d_s \\ (E_{p2m}(\mathbf{p}_i, b_i) - d_s)^2, & \text{if } E_{p2m}(\mathbf{p}_i, \mathbf{B}) > d_s. \end{cases} \tag{5}$$