SUMMARY of SAFETY and CLINICAL PERFORMANCE
SSCP

F20®

Document: SSCP_F20_V1.1
Dated: JAN 2023

Prepared by	**Date**	**Signature**
Name: S. Van de Moortele Function: **Clinical Research Manager** *PRRC for PMS*		

Approved by	**Date**	**Signature**
Name: F. Marcq Function: **R&D Manager**		
Name: S. Salles Function: **Regulatory Affairs Manager** *PRRC for Technical file and EU DoC*		
Name: F. Druilhet Function: **Quality Manager** *PRRC for QMS and Materiovigilance*		

SUMMARY of SAFETY and CLINICAL PERFORMANCE (SSCP) for HEALTH CARE PROFESSIONNALS F20®

Foreword

This Summary of Safety and Clinical Performance (SSCP) is intended to provide public access to an updated summary of main aspects of the safety and clinical performance of the device.

The SSCP is not intended to replace the Instructions For Use as the main document to ensure the safe use of the device, nor intended to provide diagnostic or therapeutic suggestions to intended users or patients

The following information is mainly intended to users (health care professionals such as surgeons). A summary intended for patients can be found at the end.

1. Device Identification and general information

1.1. Device Trade Name(s): **F20®**

The medical device has also the following private labels:
OPTICEM SPINE / SINPLUS S / OSTEOFLEX / VERTOCURE / FRX-CMT / OSTEOFIX / MVX+ / VERTERO / MV CEM / K CEM / META+ / POLYCEM / OSTEO+ / VERTEB24 / Z4+ / STR12 / X CEM / CMV / INVICTUS BONE CEMENT.

1.2. Manufacturer name and address(es):

TEKNIMED S.A.S.		
Headquarters 8, rue du Corps Franc-Pommiès 65500 Vic en Bigorre France	*Production and facilities* 11-12, rue d'Apollo - ZI de Montredon 31240 L'Union France	*Supply Chain site (labelling)* ZI de la Herray 65500 Vic en Bigorre France

1.3. Manufacturer's SRN (Single Registration Number): **FR-MF-000001224**

1.4. Basic UDI-DI: **376017704B03CW**

1.5. Medical device nomenclature description / EMDN nomenclature: **P900403 - Non-resorbable filling and reconstruction devices**

1.6. Class of device: According to EU MDR 2017/745, Annex VIII, Rule 8, F20® is a **class III** device

1.7. Year when the first certificate (CE) was issued covering the device: **2010**

The medical device has been introduced for the first time in the following countries:

Country	Year of introduction
Europe	2010
Russia	2012
Brazil	2015
Israel	2015
Ukraine	2016
Macedonia	2017
Taiwan	2017
Colombia	2017
Morocco	2017
Lebanon	2018
Argentina	2018

Malaysia	2018
Iran	2019
Saudi Arabia	2019
Vietnam	2019
United Arab Emirates	2020
Indonesia	2020
Jordan	2020
Bosnia	2020
Egypt	2021
Montenegro	2022

1.8. Authorised representative if applicable; name and SRN: **NA as the manufacturer is located in the EU**.

1.9. NB's name (the NB that will validate the SSCP) and single identification number: **BSI Netherlands (CE 2797)**

2. Intended use of the device

2.1. Intended purpose

F20® bone cement is intended for use in palliative percutaneous cementoplasty procedures (such as vertebroplasty, kyphoplasty, or osteoplasty).

2.2. Indication(s) and target population(s)

F20® bone cement is indicated for the fixation of painful vertebral compression fractures or metastatic extraspinal lesions.

F20® bone cement is intended to be used in adult patients suffering from:

- painful vertebral compression fractures resulting from osteoporosis, benign or malignant lesions, or of traumatic origin;
- painful secondary extra-spinal bone lesions resulting from primary metastatic cancers;

2.3. Contraindications or restriction for use

- Procedures other than those stated in the INDICATIONS section.
- Coagulation disorders, or severe cardiopulmonary disease;
- Unstable vertebral fractures;
- Compromise of the vertebral body or of the pedicle walls;
- Hypersensitivity or allergy to one of the constituents of the product;
- Patients clearly improving on more conservative treatment;
- Prophylactic use in spinal metastatic or osteoporotic patients with no evidence of vertebral fracture.
- Due to non-sufficient available clinical evidence, the bone cement is contraindicated in paediatric patients and in pregnant or breast-feeding women.

3. Device description

3.1. Description of the device

F20® is an implant intended to be used in human beings, for the palliative stabilisation of pathological fractures of the vertebral body, using percutaneous cementoplasty procedures such as vertebroplasty and kyphoplasty, or of extraspinal metastatic lesions using percutaneous osteoplasty procedures.



This medium viscosity bone cement is made of two sterile components: Poly-methyl-methacrylate polymers (powder) and monomers (liquid) which must be mixed at the time of use.

Composition	% (w/w)
POWDER – 25.8g	
PMMA (Polymethylmethacrylate)	19.2
Methylmethacrylate/styrene copolymer	35.3
Benzoyl peroxide (BPO)	0.5
Zirconium oxide (ZrO_2)	45
LIQUID – 9.2g	
MMA (Methylmethacrylate)	99.3
N, N dimethyl-p-toluidine (DMPT)	0.7
Hydroquinone	20ppm

The powder component is mainly composed of a polymethylmethacrylate polymer and a MMA-styrene copolymer. It also additionally contains benzoyl peroxide (BPO) as an initiator to start polymerisation. Zirconium dioxide is added as radiopaque medium.
The liquid component is mainly composed of methylmethacrylate monomer. N, N dimethyl-p-toluidine (DMPT) is the activator necessary to promote acceleration of polymerisation reaction when powder and liquid are mixed and the obtention of an acceptable setting time and maximum polymerisation temperature in the operating theatre. In order to prevent a premature polymerisation of the monomer during storage due to heat or excessive exposure to light, a stabiliser or inhibitor, hydroquinone, is added to the liquid in small quantities

When the powder and the liquid are mixed in the operating room, a medium viscosity mixture is first obtained. The BPO (benzoyl peroxide) from the powder and N, N-dimethyl-p-toluidine DMPT from the liquid react to generate free radicals by means of a redox reaction. The free radicals react with the monomeric liquid, causing an increase of viscosity and the hardening of the cement into a solid matrix.
Injection must be performed during the viscous phase, before the final hardening of the cement which must take place inside the treated bone or cavity.

F20® bone cement expected lifetime is 10 years. At the end of this expected lifetime, the cement is not intended to be removed and does not need any maintenance, unless a medical complication would require a surgery.

The product (powder and liquid) is supplied sterile.
It is a single use product.

3.2. Reference to previous generation(s) or variants if such exist, and a description of the differences

F20® is not issued from any previous generation and has no variant.

3.3. Description of any accessories which are intended to be used in combination with the device

F20® bone cement is intended to be used with the following accessories (sold separately by Teknimed):

- S5M mixing and injection system – Reference: T060407– Classification: I sterile
- MedV+ Spinal cement system – Reference T060417 – Classification: I sterile
- PureKIT mixing and injection system – Reference T060425 – Classification: I sterile

3.4. Description of any other device or products which are intended to be used in combination with the device

No other devices or products are intended to be used in combination with F20®.

4. Risks and warnings

4.1. Residual risks and undesirable side effects

- Leakage of spinal bone cement beyond the intended site of implantation. They are frequent: rates up to 56% have been reported in the literature[1], and up to 33% in a clinical study with F20® (Cf. section 5.3 below). These leakages are almost always asymptomatic[2]. Yet, in some cases, when the cement penetrates into the vascular system, leakages can result in embolism of the lung and/or heart or other clinical sequelae (rates up to 1.5% have been reported in the literature[3], none concerning F20®).
- Adverse reactions affecting the cardiovascular system (also known as Bone Cement Implantation Syndrome), including chest pain, tachycardia, signs of severe respiratory distress, and death have also been reported in the literature[4]. They are supposedly due to MMA monomer release during polymerisation, and/or to excessive exothermic reaction, and/or to too much pressure applied during cement injection. For this reason, patients should be monitored carefully for any change in blood pressure during and immediately following the application of bone cement. The anaesthetist should be told during the operation when the bone cement is implanted.
- Some isolated cases of perioperative fractures have also been reported, such as: Fracture of ribs, of posterior element or of pedicle in patients suffering from diffuse osteopenia or osteoporosis, in particular during thoracic vertebroplasty procedures, due to the high pressure exerted downwards while the needle is being inserted[4]; Fracture or collapse of a vertebra adjacent to the one injected due to an osteoporotic disease (up to 23% in the literature[5], none in clinical studies with F20®);

- After extraspinal cementoplasty: Asymptomatic leakages (up to 39%) have been reported, with 1 case (1.5%) of subsequent limitation of movement[6]; Some cases of postoperative infection (4%) and of secondary fractures in case of huge metastatic extra spinal lesions (2%) have been reported in the literature[7]; Transient nerve injury (0.6%) due to leakage in soft tissues have also been reported in the literature[8].

Other side effects include:
- Allergy to one of the bone cement constituents (rate up to 1.4% reported in the literature[9]);
- Exposure of the health care operators to monomer fumes[10].

Any serious incident occurring in relation to the F20® bone cement must be reported without delay to the manufacturer and the competent local authority where the user and/or the patient is established.

---

[1] Alhashash M, Shousha M, Barakat AS, Boehm H. *Effects of Polymethylmethacrylate Cement Viscosity and Bone Porosity on Cement Leakage and New Vertebral Fractures After Percutaneous Vertebroplasty: A Prospective Study*. Glob Spine J. 2019;9(7):754–60.

[2] Tsoumakidou G. et al. *CIRSE Guidelines on Percutaneous Vertebral Augmentation*. Cardiovasc Intervent Radiol. 2017;40(3):331–42.

[3] Hinde K. et al. *Mortality Outcomes of Vertebral Augmentation (Vertebroplasty and/or Balloon Kyphoplasty) for Osteoporotic Vertebral Compression Fractures: A Systematic Review and Meta-Analysis*. Radiology. 2020;295(1):96–103.

[4] Krueger A. et al. *Management of pulmonary cement embolism after percutaneous vertebroplasty and kyphoplasty: a systematic review of the literature*. Eur Spine J. 2009;18(9):1257–65

[5] Luo K, Jiang G, Zhu J, Lu B, Lu J, Zhang K. *Poly(methyl methacrylate) bone cement composited with mineralized collagen for osteoporotic vertebral compression fractures in extremely old patients*. Regen Biomater. 2019;7(1):29–34.

[6] Cazzato RL, Buy X, Eker O, Fabre T, Palussiere J. *Percutaneous long bone cementoplasty of the limbs: experience with fifty-one non-surgical patients*. Eur Radiol. 2014 Dec;24(12):3059-68.

[7] Qiu Y-Y, Zhang K-X, Ye X, Zhang X-S, Xing C, Wu Q-S. *Combination of Microwave Ablation and Percutaneous Osteoplasty for Treatment of Painful Extraspinal Bone Metastasis*. J Vasc Interv Radiol JVIR. Dec. 2019;30(12):1934–40.

[8] Garnon J. et al. *Percutaneous extra-spinal cementoplasty in patients with cancer: A systematic review of procedural details and clinical outcomes*. Diagn Interv Imaging. 2019;100(12):743–52

[9] Goon A., Bruze M., Zimerson E., Goh C.H., Soo-Quee Koh D., Isaksson M. *Screening for acrylate/methacrylate allergy in the baseline series: our experience in Sweden and Singapore*. Contact Dermatitis 2008: 59: 307–313.

[10] Ungers L., Vendrely T., Barnes C. *Control of Methyl Methacrylate During the Preparation of Orthopedic Bone Cements*. 2007. Journal of Occupational and Environmental Hygiene, 4(4), 272–280.

4.2. Warnings and Precautions

Read instructions for use carefully prior use and follow preparation and handling instructions of the cement and its injection system carefully.
Ignoring the instructions for use may lead to potential undesirable effects.
For an optimum use of the cement, it is essential to perform a thorough pre-operative review of the patient before the intervention in order to confirm the indication and plan the surgical technique. The healthcare professional must be familiar with cement properties and handling characteristics, and experienced in cement injection procedures. It is advisable to respect the recommended preparation and application times.

Conservation

- It is strictly forbidden to re-sterilise the product. This product is supplied sterile unless package has been opened or damaged.
- This device is packaged and sterilised for single use only. Do not reuse, reprocess or resterilise. Reuse, reprocessing, or resterilisation may compromise the structural integrity of the device and/or lead to device failure which may result in patient injury or illness. Also, reprocessing or resterilisation of single use devices may create a risk of contamination and/or cause patient infection or cross-infection, including, but not limited to, the transmission of infectious disease(s) from one patient to another.
- Before use, check the packaging carefully to ensure that it has not been opened nor damaged in a way that could affect its sterility.
- Do not use this product after the expiration date mentioned on the package.

Before use

- Do not implant products with defects.
- When removing the product from its packaging, be sure to follow asepsis rules.
- If packaging is unintentionally opened before use or damaged, do not use the product.
- Always check the condition of the liquid before carrying out the procedure. Do not use the liquid component if it shows any sign of thickening or premature polymerization. These conditions indicate that the product has not been stored correctly.

Cement preparation

- For controlled and optimal use of the cement, the doses are to be stored at the recommended temperature of 20°C for a minimum of 24 hours before use.
- The duration of the cement working phases depends on the temperature of the room and those of the components, but also on the degree of relative humidity of the operating room. A high temperature reduces waiting, injection and hardening time. A low temperature extends these times.
- Prechilling of bone cement and accessories for at least 24 hours is recommended if a lower viscosity or a prolonged handling time is required. Mixing time is the same as for non-prechilled cement, however application time and hardening time are prolonged.
- The application phases of F20® cement have been determined using injection systems recommended by the manufacturer. They may vary if different systems are used. The recommended mixing time should be followed in order to prevent polymerization from progressing to such an extent that the cement is no longer fluid enough to allow easy transfer into the injection system and proper filling of the bone cavities.
- Additives (such as liquid antibiotics) are not to be mixed with the bone cement, as this will alter cement properties.
- The manufacturer does not recommend any surgical technique in particular; it is the responsibility of the healthcare professional to determine the appropriateness of the F20® cement and specific technique for each patient.

Personnel safety

- The liquid component is a powerful lipid solvent. Do not allow the liquid to come into contact with rubber or latex gloves. Should contact occur, the gloves might dissolve and tissue damage may occur. Wearing a second pair of gloves may diminish the possibility of hypersensitivity reactions.

- The liquid monomer is highly volatile and flammable.
- Make sure the operating room is properly ventilated to eliminate monomer fumes as much as possible.
- Make sure electrocautery devices are not used near freshly implanted bone cements as that could cause the ignition of monomer fumes.
- Caution should be exercised to prevent excessive exposure to the concentrated fumes of the monomer, which may cause drowsiness, irritate the respiratory tract, eyes and even the liver.
- Do not allow personnel wearing contact lenses to be near or be involved in mixing of the bone cement.

Monitoring during application
- During application of the bone cement, radiological control is essential so that the healthcare professional can follow the progress of the filling and stop the procedure if the slightest leakage of cement is detected.
- Use appropriate imaging techniques to verify correct needle placement, absence of damage to surrounding structures, and appropriate location of the injected cement. Use imaging, such as bi-planar fluoroscopy or CT guidance, to assess the ability of the vertebra or the lesion to contain the injected bone cement.
- Avoid over-pressurizing the bone cement, as this may cause the bone cement to leak beyond the site of its intended application. Cement leakage may cause tissue damage, and nerve or circulatory problems. Excessive pressure can also be applied to the injection device, which could cause it to break.
- Leakages may also occur upon injection if the needle is in a vein or if there are undetected micro-fractures.
- The final polymerization stage occurs in situ and is an exothermic reaction with considerable liberation of heat. According to ISO 5833 standard, the temperature can reach up to 95°C. The heat produced in situ during polymerisation can lead in rare cases to modification of structure of the bone. Maintain the patient's position until the polymerization process has been completed, so as to obtain proper stabilisation.

Patient monitoring
- Adverse reactions affecting the cardiovascular system have been attributed to release of methylmethacrylate monomer into the circulatory system. Data indicate that the monomer undergoes rapid hydrolysis into methacrylic acid, and that a significant fraction of the circulating methacrylate is present in the form of free acid rather than methyl ester. Correlation between changes in circulating concentrations of methyl methacrylate / methacrylic acid and changes in blood pressure has not been established.
- Methyl methacrylate may cause hypersensitivity among high-risk persons, which can result in an anaphylactic reaction.

4.3. Other relevant aspect of safety, including a summary of any field safety corrective action (FSCA) if applicable
No field safety corrective actions have been issued for F20®.

5. Summary of clinical evaluation and relevant information on post-market clinical follow-up (PMCF)

5.1. Summary of clinical data related to equivalent device, if applicable
Not applicable. No devices are claimed equivalent.

5.2. Summary of clinical data from conducted investigations of the device before the CE-marking, if applicable
Not applicable. No clinical investigations have been conducted before the CE-marking.

5.3. Summary of clinical data from other sources, if applicable
a) Performance and safety of F20® were evaluated through a first PMCF study performed in 2011.
Population: 20 patients (6 men and 14 women) with a mean age of 59.9 years were included in this study. All patients presented simple or multiple vertebral compression fractures (VCF): most of them (95%, n=19) due to malignant lesions (primitive or secondary tumours) and only 5% (n=1) to osteoporosis. A total of 27 vertebrae were treated.
Surgical procedure: All procedures were vertebroplasties, performed by transpedicular access. No perioperative complications were reported.
Clinical outcomes: *Pain*: Spinal cementoplasty procedures provided a clear alleviation of pain for all patients. At baseline, pain was described as ‘disabling’ (15%), ‘severe’ (80%) or ‘moderate’ (5%). Immediately after the surgery, pain was rated as ‘moderate’ (5%), ‘mild’ (30%) or ‘none’ (65%). At the 6-month follow-up, only very few patients (6%) still reported a

'moderate' pain, while 94% reported 'none' pain.

Function: Spinal cementoplasty procedures provided a clear restoration of function for all patients. At baseline, a majority of patients (75%) described the impact on their function as 'severe', or 'moderate' (25%). Conversely, at the 3-month follow-up, patients evaluated their function as 'normal' (80%) or with 'mild' impact (20%).

Safety: Out of the 27 procedures, leakages were reported in 9 (33%) treated vertebrae, all without sequelae. No other complications were reported.

Conclusion: this clinical study demonstrated efficacity, performance and safety of F20® bone cement on a small population of patients beneficiating from vertebroplasty procedures.

b) Analysis of publications in the scientific literature with F20®.

4 publications in the scientific literature reported outcomes from patients having received F20® in spinal or extraspinal procedures.

In a first study[5], outcomes from a series of 107 patients who underwent 144 vertebroplasty of which procedures were presented. The patients were divided into 2 groups: A group of 56 patients (72 vertebrae), average age of 74.6 ±13.4 years, who received High Viscosity (HV) bone cement to treat osteoporotic (72.6%) or traumatic (44.4%) vertebral compression fractures; A group of 51 patients (72 vertebrae), average age of 75.21 ±.01 year, who received Low Viscosity (LV) bone cement, of which F20®, to treat osteoporotic (84.8%) or traumatic (23.6%) vertebral compression fractures.

Cement leakages occurred in 26 (36%) vertebrae in the HV group and in 45 (62%) vertebrae in the LV group. There was no difference between the groups in the incidence of adjacent fracture following vertebroplasty (6 vs. 17, p=.071). No patients encountered major complications such as cement emboli or neurologic deficit after the surgery. Pain relief following vertebroplasty was reported by patients. Both groups showed improved follow-up pain score (VAS: from 3.0 ±1.69 at baseline to 2.4 ±1.5 at FU, p=0.014), with the patients in the HV group showing a significantly greater improvement in pain compared with the LV group. A pain VAS score ≥ 3 represents moderate pain and hints at minimal pain improvement following surgery. There were significantly fewer patients with a follow-up VAS score ≥ 3 in the HV group compared with the LV group (22 vs. 39, p=.004). Authors conclude that viscosity is an important factor that affects cement leakage and injection volume. Although HV and LV bone cements are safe and effective to treat mid-to-high level thoracic vertebral compression fractures, HV cement is preferable in terms of cement leakage, injection volume, and postoperative pain relief.

Cazzato and his team[6] were the first to publish outcomes of F20® cement used in extraspinal cementoplasty. 66 lesions were treated in 51 patients. Cement distribution within the lesion was rated as excellent in 17 cases (25.7 %), satisfactory in 32 cases (48.6 %) and unsatisfactory in 17 (25.7 %) cases. Local pain palliation at one month was significant for 31 (47.0 %) and mild for 28 (42.4 %) lesions. In 7 (10.6 %) patients, pain was unchanged, but it never worsened as compared to the preoperative status. Limb functionality improved significantly in 27 (42.2 %) lesions and mildly in 19 (29.7 %) lesions. It remained unchanged in 16 lesions (25.0 %) and worsened in 2 (3.1 %). The only variable affecting function of the limb was the dimension of the lesion since a size ≤ 3 cm was predictive for better functional improvement ($p < 0.05$). One major complication involved cement leakage into the elbow joint space with subsequent permanent limitation of arm extension. However, this loss of function did not require surgical extirpation of the leaked cement. The most common minor complication encountered was asymptomatic cement leakage (39.4 %). Another minor complication (1.5 %) encountered was a self-limiting hematoma along the needle pathway.

The same team published, 1 year later[11], outcomes from a series of 25 patients with differentiated thyroid cancers and metastatic bones. Overall, 54 lesions (mean size 57.4 ±36.4 mm) were treated. 42 lesions received additional radiation therapy (30 Gy in 10 fractions). Lesions were located in the spine (29.6%), pelvis (46.3%), upper or lower limbs (5.5%) and into scapula/sternum/ribs (16.6%). Most of the affected bones were located in weight-bearing districts (62.9%). Median follow-up was 4.6 years. No fractures or nervous system injuries were noted during the entire follow-up. Only 1 serious complication was reported: a symptomatic PMMA leakage occurring along the rib following T6 vertebroplasty and requiring surgical extirpation. 1 minor complication was noted in 1 patient: mild and persistent pain due to inflammation of the shoulder joint, managed conservatively.

[11] Cazzato RL, Bonichon F, Buy X, Godbert Y, de Figuereido BH, Pointillart V, Palussiere J. *Over ten years of single-institution experience in percutaneous image-guided treatment of bone metastases from differentiated thyroid cancer*. EJSO 41 (2015) 1247e1255. DOI: 10.1016/j.ejso.2015.06.005

More recently, outcomes of extraspinal cementoplasty were reported in patients presenting with acetabular fractures[12]. In total, 140 procedures were carried out on 129 patients (80 women) presenting most often breast cancer (40.3%). Intra-articular leakages were observed during 8.6% of procedures and extra-articular cement leakage in 41.1% of procedures. The median overall survival of the series at 20.7 months was analysed. At that time, 18 treated lesions (16.2%) showed occurrence or worsening of acetabulum fracture (OWAF) (4 worsening and 14 new fractures). In the whole population, the 3-year OWAF-free survival probabilities was 86% in patient with all tumour locations filled, while it was 73% in patients without any filling of at least one location. Patients with OWAF had a significantly lower survival rate compared to patients without. Notably, in the population of breast cancer patients, all patients with OWAF had died compared to 53.8% of patients without OWAF. Authors conclude that intra-articular leakages were significantly associated with pre-existing articular fractures and that the cement filling, even incomplete, of all acetabulum areas significantly decreased the risk of OWAF.

5.4. Overall summary of the clinical performance and safety

F20® bone cement is a product issued from a well-known technology which has been used in interventional radiology and neurosurgery for many years. It allows successful stabilisation of fractured vertebrae or of metastatic extra-spinal bone lesions, leading subsequently to clinical benefits for the patients such as pain alleviation and improved quality of life. Claims for performance and safety of F20® have been verified and confirmed against outcomes from published series in scientific literature, and from Post-Market Clinical Follow-up (PMCF) studies, as described above.

5.5. On-going or planned post-market clinical follow-up

Teknimed has implemented and is currently conducting a post-market clinical follow-up to confirm clinical performance, and safety outcomes for all its Spine bone cements products, including F20®. A first interim analysis of the cohort of patients with F20® has been performed in September 2022. Summary of main outcomes is presented below.

Title: Safety and Clinical Performance Assessment of Bone Cements and Injection Systems used in Spine Surgery - A Post-Market Clinical Follow-Up

Population: 52 patients (43 women and 9 men) were already included at the date of this interim analysis, with a mean age at time of surgery of 77.6 years ±9,4 (min 52; Max 97). A majority of them (92%, n=48) suffered from osteoporotic vertebral compression fractures, and 2 patients (4%) suffered from benign and 2 (4%) from malignant symptomatic lesions, equally located in thoracic (51%) or lumbar (49%) area.

Surgical procedures: Procedures were mainly vertebroplasties (67%). Some kyphoplasty (n=8, 15%) and pedicular screw augmentation (n=9, 15%) procedures, and 1 extra-spinal osteoplasty (n=1, 2%) were also performed. Investigators assessed the filling phase as 'easy' and the device handling/usability as 'good' in 100% (n=52) of the procedures. No perioperative complications were reported.

Clinical outcomes. *Pain*: Cementoplasty procedures provided a clear alleviation of pain for all patients. At short-term FU (2 ±1.5 months), mean pain level decreased from a level of 8.32 ±1.5 at baseline to a level of 3.47 ±1.6 at FU, on a 10-point scale.

Function: The global Oswestry Disability Index (ODI) score decreased from a mean value of 66.5 % at baseline to a mean value of 44.4% at follow-up. This difference of 22.1% is above the minimum of 10% for the difference to be considered significative per ODI calculation rules.

Satisfaction: At 2-month FU, from the 20 questionnaires collected, 91% (n=18) patients were satisfied of their surgery and 85% (n=17) already reported an improvement and 15% (n=3) a stabilisation of their health status.

Safety: 1 serious adverse event was reported which consisted in persistence of pain and oedema on adjacent T12 vertebra (index vertebroplasty was on L1 vertebra). A new vertebroplasty was performed on T12 which resolved the event without sequela. This adverse event was qualified as "not related" to the device and as "possibly related" to the procedure by the investigator.

Conclusion: This mid-term outcomes analysis demonstrates that F20® is an effective and safe device relevant to be used in procedures requiring spinal cementoplasty with a bone cement.

[12] Hesler MC, Buy X, Catena V, Brouste V, Kind M, Palussière J, Crombé A. *Assessment of risk factors for occurrence or worsening of acetabular fracture following percutaneous cementoplasty of acetabulum malignancies*. European Journal of Radiology 120 (2019) 108694 DOI: 10.1016/ j.ejrad.2019.108694

6. Possible diagnostic or therapeutic alternatives

People with severe pain from vertebral compression fractures are traditionally treated with nonsurgical treatment including a reduction in activities, medications, and bracing. The first aim of conservative therapy is to control the pain. Therefore, medications such as bisphosphonate (alendronate and zoledronic acid), acetaminophen, and nonsteroidal anti-inflammatory drugs (NSAIDs) are often recommended in relieving pain. Muscle relaxing drugs for nerve/bone pain are often prescribed. Importantly, opioids should only be used for very short periods of time (1-2 weeks) for acute pain. Moreover, braces are also used to reduce pain as the rigid style of the back brace limits spine-related motion at the level of the fractured vertebra and thus allows bone healing.

7. Suggested profile and training for users

Medical devices should only be used in an adapted environment and by qualified healthcare professionals (surgeons, interventional radiologists) having a sound knowledge and full mastery in preparation techniques specific to such products. Preparation techniques may be acquired from qualified distributors. The healthcare professional is responsible for any complications or harmful consequences which might result from an erroneous indication or operative technique, an improper use of the equipment and/or a failure to comply with the safety rules provided in the instructions for use. Neither manufacturer nor qualified distributor can be held responsible for these complications.
Percutaneous cementoplasty procedures should only be performed in medical settings in which emergency decompressive surgery is available.

8. Reference to any harmonized standards and CS applied

Standard reference	Standard revision	Standard title	Applicability
> General standards			
EN ISO 13485	2016/A11: 2021	Medical devices -- Quality management systems -- Requirements for regulatory purposes	Fully whenever applicable
EN ISO 14630	2012	Non-active surgical implants -- General requirements	Fully whenever applicable
EN ISO 14971	2019 / A11: 2021	Medical devices -- Application of risk management to medical devices	Fully whenever applicable
EN ISO 14155	2020	Clinical investigation of medical devices for human subjects — Good clinical practice	Fully whenever applicable
EN 62366	2015 / A1:2020	Medical devices – Application of usability engineering to medical devices	Fully whenever applicable
XP S99-223	2020	Medical Device – Benefit / Risk management	Fully whenever applicable
> Product standards			
ISO 5833	2002	Implants for surgery — Acrylic resin cements	Fully whenever applicable
ASTM F2118	2014	Standard test method for constant amplitude of force-controlled fatigue testing of acrylic bone cement materials	Fully whenever applicable
ISO 2859-1	1999/A1: 2011	Sampling procedures for inspection by attributes — Part 1: Sampling schemes indexed by acceptance quality limit (AQL) for lot-by-lot inspection	Fully whenever applicable
> Biocompatibility standards			
EN ISO 10993-1	2020	Biological evaluation of medical devices — Part 1: Evaluation and testing within a risk management process	Fully whenever applicable
EN ISO 10993-2	2006	Biological evaluation of medical devices — Part 2: Animal welfare requirements	Fully whenever applicable
EN ISO 10993-5	2009	Biological evaluation of medical devices — Part 5: Tests for in vitro cytotoxicity	Fully whenever applicable

EN ISO 10993-10	2021	Biological evaluation of medical devices — Part 10: Tests for irritation and skin sensitization	Fully whenever applicable
EN ISO 10993-11	2018	Biological evaluation of medical devices — Part 11: Tests for systemic toxicity	Fully whenever applicable
EN ISO 10993-12	2021	Biological evaluation of medical devices — Part 12: Sample preparation and reference materials	Fully whenever applicable
EN ISO 10993-17	2009	Biological evaluation of medical devices — Part 17: Establishment of allowable limits for leachable substances	Fully whenever applicable
ISO 10993-18	2020 / A1: 2022	Biological evaluation of medical devices — Part 18: Chemical characterization of materials	Fully whenever applicable
EN ISO 10993-23	2021	Biological evaluation of medical devices — Part 23: tests for irritation	Fully whenever applicable

> Labelling and packaging standards

EN ISO 14698-1	2003	Cleanrooms and associated controlled environments — Biocontamination control — Part 1: General principles and methods	Fully whenever applicable
EN 556-1	2001 / AC:2006	Sterilization of medical devices. Requirements for medical devices to be designated "STERILE". Part 1: requirements for terminally sterilized medical devices	Fully whenever applicable
EN 556-2	2015	Sterilization of medical devices — Requirements for medical devices to be designated ''STERILE" — Part 2: Requirements for aseptically processed medical devices	Fully whenever applicable
EN 868-5	2018	Packaging for terminally sterilized medical devices — Part 5: Sealable pouches and reels of porous materials and plastic film construction — Requirements and test methods	Fully whenever applicable
EN 868-7	2017	Packaging for terminally sterilized medical devices — Part 7: Adhesive coated paper for low temperature sterilization processes — Requirements and test methods	Fully whenever applicable
EN ISO 11607-1	2020	Packaging for terminally sterilized medical devices — Part 1: Requirements for materials, sterile barrier systems and packaging systems — Amendment 1	Fully whenever applicable
EN ISO 11607-2	2020	Packaging for terminally sterilized medical devices — Part 2: Validation requirements for forming, sealing and assembly processes — Amendment 1	Fully whenever applicable
EN ISO 15223-1	2021	Medical devices. Symbols to be used with medical device labels, labelling and information to be supplied. General requirements	Fully whenever applicable
EN ISO 20417	2021/CORR :2021-12	Medical devices — Information to be provided by the manufacturer	Fully whenever applicable
ASTM D 4169	2022	Standard Practice for Performance Testing of Shipping Containers and Systems	Fully whenever applicable
ASTM D 4332	2022	Standard Practice for Conditioning Containers, Packages, or Packaging Components for Testing	Fully whenever applicable
ASTM D 4728	2017	Standard Test Method for Random Vibration Testing of Shipping Containers	Fully whenever applicable
ASTM D 5276	2019	Standard Test Method for Drop Test of Loaded Containers by Free Fall	Fully whenever applicable
ASTM D 999	2008	Standard Test Methods for Vibration Testing of Shipping Containers	Fully whenever applicable
ASTM F 1929	2015	Standard Test Method for Detecting Seal Leaks in Porous Medical Packaging by Dye Penetration	Fully whenever applicable
ASTM F 88	2021	Standard test method for seal strength of flexible barrier materials	Fully whenever applicable
ASTM F1886 / F1886M	2016	Standard Test Method for Determining Integrity of Seals for Flexible Packaging by Visual Inspection 1	Fully whenever applicable
ASTM D 6653 / D 6653 M	2021	Standard Test Methods for Determining the Effects of High Altitude on Packaging Systems by Vacuum Method	Fully whenever applicable

ASTM D642	2020	Standard Test Method for Determining Compressive Resistance of Shipping Containers, Components, and Unit Loads 1	Fully whenever applicable

> Microbiology standards

EN ISO 11737-1	2018/A1: 2021	Sterilization of medical devices — Microbiological methods — Part 1: Determination of a population of microorganisms on products	Fully whenever applicable
EN ISO 11737-2	2020	Sterilization of medical devices — Microbiological methods — Part 2: Tests of sterility performed in the definition, validation and maintenance of a sterilization process	Fully whenever applicable
EN ISO 11138-1	2017	Sterilization of health care products — Biological indicators - Part 1: General requirements	Fully whenever applicable
EN ISO 11138-2	2017	Sterilization of health care products — Biological indicators — Part 2: Biological indicators for ethylene oxide sterilization processes	Fully whenever applicable
ANSI / AAMI ST72	2019	Bacterial endotoxins — Test methods, routine monitoring, and alternatives to batch testing	Fully whenever applicable

> Gamma sterilisation standards

EN ISO 11137-1	2015 / A2:2019	Sterilization of health care products — Radiation — Part 1: Requirements for development, validation and routine control of a sterilization process for medical devices	Fully whenever applicable
EN ISO 11137-2	2015 / A1: 2022	Sterilization of health care products — Radiation — Part 2: Establishing the sterilization dose	Fully whenever applicable

> Ethylene oxide sterilisation standards

EN ISO 11135-1	2014 / A1: 2019	Sterilization of health care products — Ethylene oxide — Part 1: Requirements for development, validation and routine control of a sterilization process for medical devices	Fully whenever applicable
EN ISO 10993-7	2008 / A1: 2022	Biological evaluation of medical devices — Part 7: Ethylene oxide sterilization residuals	Fully whenever applicable

> Aseptic processing standards

EN ISO 13408-1	2015	Aseptic processing of health care products — Part 1: General requirements	Fully whenever applicable
EN ISO 13408-2	2018	Aseptic processing of health care products — Part 2: Filtration	Fully whenever applicable

9. Revision history

Revision number	Date issued	Change description	Revision validated by the Notified Body
1.0	SEP 2022	Creation	☐ Yes, language: English ☑ No
1.1	04 JAN 2023	Update following clinical R1 of questions under initial MDR review: - Addition of EMDN nomenclature code instead of MDR codes - Update of Intended population (Adult) - Addition of rates of occurrence for the “other side effects”	☑ Yes, language: English ☐ No

A summary of the safety and clinical performance of the device, intended for patients, is provided on next page.

SUMMARY of SAFETY and CLINICAL PERFORMANCE (SSCP) for PATIENTS - English Version
F20®

Document revision: 1.1
Date issued: JAN2022

This Summary of Safety and Clinical Performance (SSCP) is intended to provide public access to an updated summary of the main aspects of the safety and clinical performance of the device. The information presented below is intended for patients or lay persons. A more extensive summary of its safety and clinical performance prepared for healthcare professionals is found in the first part of this document.

The SSCP is not intended to give general advice on the treatment of a medical condition. Please contact your healthcare professional in case you have questions about your medical condition or about the use of the device in your situation. This SSCP is not intended to replace an implant card or the Instructions For Use to provide information on the safe use of the device.

1. Device Identification and general information

1.1. Device Trade Name: **F20®**

The medical device has also the following private labels:
OPTICEM SPINE / SINPLUS S / OSTEOFLEX / VERTOCURE / FRX-CMT / OSTEOFIX / MVX+ / VERTERO / MV CEM / K CEM / META+ / POLYCEM / OSTEO+ / VERTEB24 / Z4+ / STR12 / X CEM / CMV / INVICTUS BONE CEMENT.

1.2. Manufacturer name and address(es):

TEKNIMED S.A.S.		
Headquarters 8, rue du Corps Franc-Pommiès 65500 Vic en Bigorre France	*Production and facilities* 11-12, rue d'Apollo - ZI de Montredon 31240 L'Union France	*Distribution site (labelling)* ZI de la Herray 65500 Vic en Bigorre France

1.3. Basic UDI-DI: **376017704B03CW**

1.4. Year when the device was first CE-marked: **2010**

2. Intended use of the device

2.1. Intended purpose

F20® is a bone cement. It can be injected directly into a vertebra (vertebroplasty). It can be injected into a vertebra with a small inflatable balloon (kyphoplasty). It can be injected into a bone lesion outside the spine (extra-spinal cementoplasty or osteoplasty).

2.2. Indication(s) and intended patient groups

F20® is used to treat vertebral fractures (fractures of the vertebrae due to excessive pression on the vertebral body, painful compression fractures). It is also used to treat cancerous lesions outside of the spine (painful secondary extra-spinal bone lesions resulting from primary metastatic cancers).
Target population:
- Adult patients with fractures of vertebrae due to bone loss (osteoporosis), lesions (benign or malignant tumour), or trauma.
- Adult patients with cancerous lesions outside of the spine.

2.3. Contraindications

- Procedures other than those stated in the INDICATIONS section
- Disorder related to blood clot formation (coagulation);

- Severe conditions that affect heart and/or lungs (cardiopulmonary disease);
- Fractures of vertebrae which are not stable;
- Damaged vertebra (compromise of the vertebral body or of the pedicle walls);
- Intolerance to constituents of the product (hypersensitivity or allergy);
- Patients clearly improving on other treatment not using F20®;
- Use in prevention (prophylactic) in patients having spine disorders without fracture (metastatic or osteoporotic patients with no evidence of vertebral fracture);
- Not enough data are available on some categories of patients. F20® cannot be used in children. F20® cannot be used in breast-feeding or pregnant women.

3. Device description

3.1. Description of the device

F20® is an acrylic bone cement. It can be injected directly into the damaged bone through the skin (percutaneous use). It is used to stabilise damaged bones (vertebra for example). The result is an effective and rapid pain relief for the patient.



This bone cement is made of two sterile components: a powder and a liquid. They need to be mixed at the time of use.

Composition	% (w/w)
POWDER – 25.8g	
PMMA (Polymethylmethacrylate)	19.2
Methylmethacrylate/styrene copolymer	35.3
Benzoyl peroxide (BPO)	0.5
Zirconium oxide (ZrO_2)	45
LIQUID – 9.2g	
MMA (Methylmethacrylate)	99.3
N, N dimethyl-p-toluidine (DMPT)	0.7
Hydroquinone	20ppm

The powder is made of polymers (polymethylmethacrylate - PMMA). It also contains an additive to start the hardening reaction (Benzoyl peroxide - BPO). Another product is added to appear dark on X-ray images (Zirconium dioxide – ZrO_2).

The liquid is made of monomers (methyl-methacrylate - MMA). An additive is added to start the hardening reaction (N, N dimethyl-p-toluidine - DMPT). It helps to control the reaction and the generated heat. A last additive (hydroquinone) is used in very small quantity. It avoids any premature hardening reaction during storage.

During surgery, powder and liquid are mixed. A liquid mixture is obtained. It becomes harder and harder over time. It finally becomes fully solid at the end of the reaction. Injection must be done when liquid. The final hardening phase occurs inside the bone.

F20® expected lifetime is 10 years. At the end of this expected lifetime, the cement does not need to be removed and does not need any maintenance. The cement can remain in place all lifelong, unless a medical complication would require a new surgery.

The product (powder and liquid) is supplied sterile.
It is a single use product.

4. Risks and warnings

Contact your healthcare professional if you believe that you are experiencing side-effects related to the device or its use or if you are concerned about risks. This document is not intended to replace a consultation with your healthcare professional if needed.

4.1. Remaining risks and undesirable effects

- Leakage of bone cement outside the treated bone. They are frequent and rates up to 56% have been reported in the literature, and up to 33% in a clinical study with F20® (Cf. section 5.3 below). These leakages are almost always asymptomatic. Yet, in some cases, when the cement penetrates into the vascular system, leakages can result in embolism of the lung and/or heart or other clinical sequelae (rates up to 1.5% reported in the literature, none concerning F20®).
- Unexpected or unintended effect to blood circulatory system (cardiovascular system) (also known as Bone Cement Implantation Syndrome). It includes chest pain, a more rapid heartbeat (tachycardia), signs of severe respiratory distress, and death. They may be due to a reaction to the hardening of the cement (MMA monomer release during polymerization), and/or excessive heat release (exothermicity), and/or to too much pressure applied during cement injection.
- Some patients suffered from fracture happening during the surgery (perioperative fractures), such as: fracture of ribs, or of other part of the vertebra (patients suffering from diffuse osteopenia or osteoporosis), in particular during thoracic vertebroplasty procedures, due to the high pressure exerted downwards while the needle is being inserted; Fracture or collapse of a vertebra adjacent to the one injected due to an osteoporotic disease (up to 23% of cases in the literature but none with F20®).

- Leakages without consequence (up to 39%) have been observed. 1 patient (1.5%) had limitation of movement (elbow). Infection have been observed (4%). New fracture (2%) in case of big lesions have been observed (secondary fractures in case of huge metastatic extra spinal lesions). Transient nerve injury has been observed (0.6%).

Other side effects include:

- Allergy to one of the bone cement constituents (rate up to 1.4% have been reported in the literature);

Any serious incident occurring in relation to the device must be reported without delay to the health care professional.

4.2. Warnings and Precautions

No warning and precautions for patients. This device is only used by healthcare professionals.
Patients with intolerance to bone cement components should mention it to their surgeon.

4.3. Summary of any field safety corrective action (FSCA) if applicable

None. No FSCA have been issued since the release of F20® on the market.

5. Summary of clinical evaluation and post-market clinical follow-up

5.1. Clinical background

F20® bone cement comes from a safe technology. It has been used in surgery for many years. It treats fractured vertebrae. Patients have pain alleviation. Patients have improved quality of life. Performance and safety have been shown by clinical studies.

5.2. Clinical evidence for CE marking

A clinical study has been done in 2011 in France. It evaluated performance and safety of F20®.
It included 20 patients (6 men and 14 women, mean age of 59.9 years). All patients had fractures (simple or multiple vertebral compression fractures, most of them (95%) due to tumoral lesions and due to osteoporosis in only 1 patient). A total of 27 vertebrae were treated.

All procedures consisted of a percutaneous injection of cement into a vertebra. No complications occurred during the surgery. The procedures provided a clear relief of pain for all patients. Before the surgery, pain was described as 'disabling' (15% of patients), 'severe' (80%) or 'moderate' (5%). Immediately after the surgery, pain was rated as 'moderate' (5%), 'mild' (30%) or 'none' (65%). 6 months after the surgery, only very few patients (6%) still reported a 'moderate' pain, while 94% reported 'no' pain. Spinal procedures provided also a good restoration of function for all patients. Before the surgery, a majority of patients (75%) described the impact on their function as 'severe', or 'moderate' (25%). 3 months after the surgery, patients evaluated their function as 'normal' (80%) or with 'mild' impact (20%). Out of the 27 procedures, leakages were reported in 9 (33%) treated vertebrae, all without sequelae. No other complications were reported. This clinical study showed that the product is effective and safe.

A second clinical study is on-going.
It includes to date 52 patients (43 women and 9 men, mean age of 77.6 years old). A majority of them (92%, n=48) suffered from osteoporotic vertebral compression fractures, and 2 patients (4%) suffered from benign and 2 (4%) from tumoral lesions. No complications occurred during the surgery.
The procedures provided a clear relief of pain for all patients. 2 months after the surgery, the mean pain level has decreased of 5 points on a 10-points scale, as compared to the level before the surgery. Likewise, the function was restored for all patients. The disability level decrease by 20% on a scale of 100% (100% being the more disabled level). 91% of patients were satisfied of their surgery and 85% reported an improvement and 15% a stabilisation of their health status. Only 1 serious complication was reported: a persistent pain and a build-up of fluid in the body's tissue (oedema) on a vertebra adjacent to the one injected. A new vertebroplasty was performed on the adjacent vertebra which resolved the event without sequela. To conclude, F20® is effective and safe.

5.3 Safety

Teknimed is always doing clinical studies (scientific literature reviews, international safety database reviews and clinical follow-up studies). They document and evaluate the benefits and risks of the product.
Main risks during spine surgery have been identified: leakage outside of the bone, unexpected or unintended effect to blood circulatory system, fracture (ribs, posterior parts of the vertebra, or pedicles).
Main risks during surgery outside of spine are identified: leakage outside of the bone, infection after the surgery, new fracture (secondary fracture), and transient nerve injury.

6. Possible diagnostic or therapeutic alternatives

Patients who don't want to be treated with F20® have alternatives. They can reduce their activities. They can use medications. They can use bracing. The first aim of these alternatives is to control the pain. Different medications are often recommended in relieving pain (bisphosphonate (alendronate and zoledronic acid), acetaminophen, and nonsteroidal anti-inflammatory drugs (NSAIDs), as well as muscle relaxing drugs for nerve/bone pain). It is important to use opioids only for very short periods of time (1-2 weeks). Braces are used to limit motion of the spine. It allows bone to heal.

7. Suggested profile and training for users

Product should only be used in clinics or hospitals. It should be used by qualified health care professionals (radiologists, surgeons). They need to be expert in surgery using bone cements.