

Supplementary materials

Femtosecond Laser Irradiation to Zirconia Prior to Calcium Phosphate Coating Enhances Osteointegration of Zirconia in Rabbits

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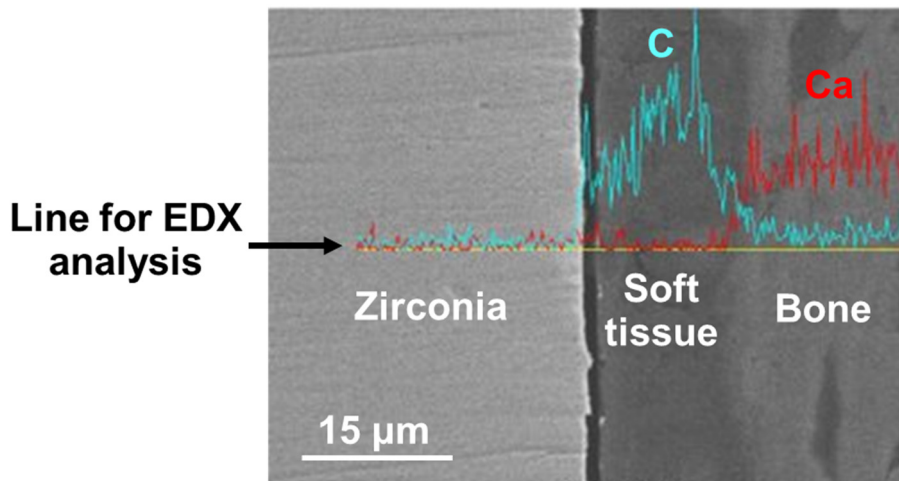


Figure S1. SEM image and EDX line scan profiles (carbon and calcium signals) of the histological section for the bone-implant interface of Group B.

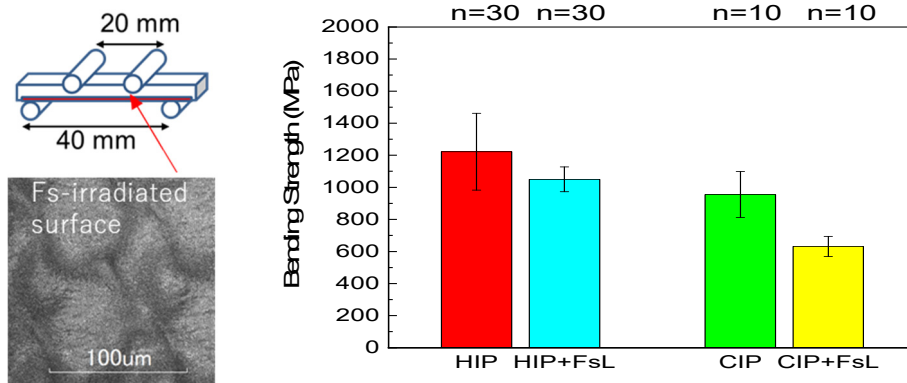


Figure S2. Four-point bending strength for zirconia compacted using the additional HIP technique with and without subsequent FsL irradiation, and using the cold isostatic pressing (CIP) technique with and without subsequent FsL irradiation. The compacted temperature was set at 1350 °C for CIP in ambient air and at 1300 °C for the additional HIP treatment in a 147-MPa Ar atmosphere. The four-point bending strength was measured in accordance with ISO 14704 standard (left). FsL irradiation was made on one of the rectangular surfaces. The FsL-irradiated surface was set on the tension side in the bending test (left). Four-point bending strength of zirconia compacted using the additional HIP technique with subsequent FsL irradiation meets the ISO 13556:2015 standard requirement for zirconia implants (right). Reprinted and slightly modified from [36] Copyright 2017, and [37] Copyright 2019 with permission from Japan Laser Processing Society.

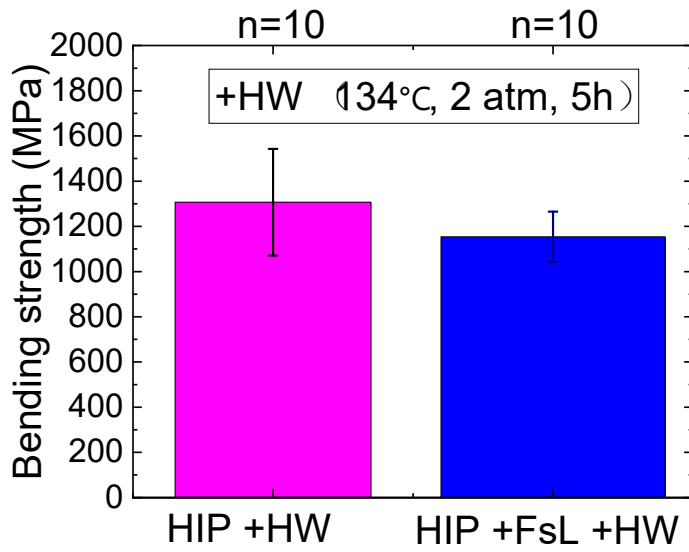


Figure S3. Four-point bending strength for zirconia compacted using the additional HIP technique and subjected to accelerated aging in hot water (HIP+HW) and that compacted using HIP and subjected to FsL irradiation and accelerated aging in hot water (HIP+FsL+HW). Set-up of specimens and four-point bending test were the same as those in Fig. S2. The accelerated aging in hot water was performed in accordance with ISO 13556:2015 standard. After accelerated aging, four-point bending strength of zirconia compacted using the additional HIP technique and subjected to FsL irradiation meets the requirement of ISO 13556:2015 standard for zirconia implants.

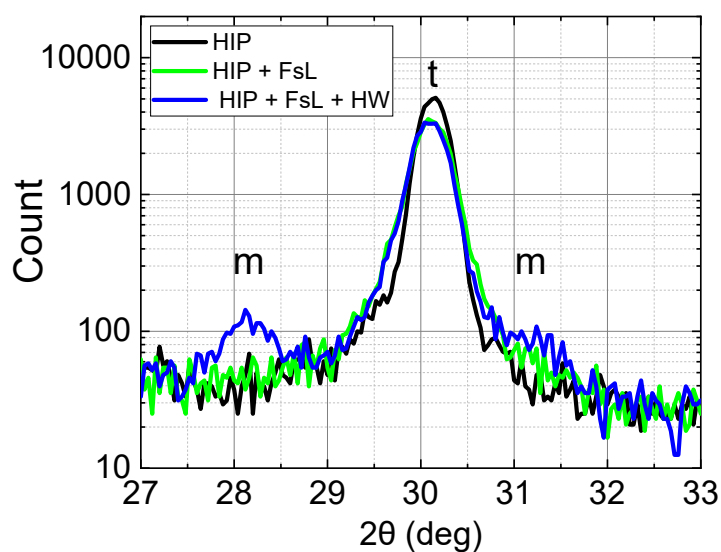


Figure S4. X-ray diffraction (XRD) patterns for zirconia compacted using the additional HIP technique (HIP), and that subsequently subjected to only FsL irradiation (HIP+FsL) or both FsL irradiation and accelerated aging in hot water (HIP+FsL+HW). The labels “t” and “m” indicate the tetragonal and monoclinic crystal phases, respectively. The monoclinic and tetragonal phases were identified based on the data from The International Centre for diffraction data (ICDD) 01-070-8379 (Baddeleyite, syn) and ICDD 01-081-1544 (Zirconium Oxide), respectively.

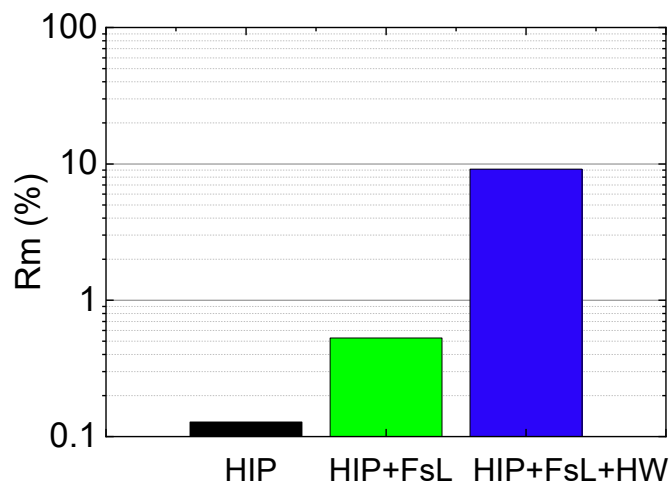


Figure S5. Monoclinic crystal phase ratio R_m for zirconia compacted using the additional HIP technique (HIP), and that subsequently subjected to only Fs irradiation (HIP+FsL) or Fs irradiation plus accelerated aging in HW (HIP+FsL+HW). Each R_m was calculated from the XRD peak areas for monoclinic and tetragonal phases using ref. [38]. The peak areas for monoclinic and tetragonal phases were analyzed using XRD analysis software (PDXL, Rigaku Co., Tokyo, Japan) with ICDD 01-070-8379 (Baddeleyite, syn) and ICDD 01-081-1544 (Zirconium Oxide), respectively. The R_m data for HIP+FsL were reproduced from [36]. The R_m values meet the ISO 13556:2015 standard requirement for zirconia implants.

Table S1. Weibull parameters of four-point bending strength in Fig. S2 for zirconia compacted using the additional hot isostatic pressing (HIP), and those subsequently subjected to FsL irradiation (HIP+FsL). Weibull parameters for “HIP+FsL” meet the requirements of ISO 13556:2015 standard for zirconia implants.

	HIP	HIP+FsL
Weibull modulus, m	6.2	14.1
Weibull scale parameter (MPa)	1316	1085
Number of specimens	30	30

Table S2. Number of fractured specimens after cyclic fatigue test in accordance with ISO 13556:2015 standard for zirconia implants reproduced from [37].

	HIP	HIP+FsL
Number of tested specimens	5	5
Number of fractured specimens	0	0

References

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