

Supplementary information

Supplementary methods

Sex and age at death of the nine individuals from Neolithic Mehrgarh (see supplementary Table 1) were assessed in the field and re-evaluated in laboratory according to diagnostic procedures for skeletal features summarized in Buikstra and Ubelaker (1994).

The microtomographic analysis was performed by using the μ CT-scan system set at the University of Bologna (Rook *et al.*, 2004; Rossi *et al.*, 2004). It consists of a 200 kVp, 3 mA, microfocus X-ray tube, a high precision programmable stand, and an X-ray detector. The detector is a thin Gd₂O₂S:Tb phosphor layer (30 mg/cm²) deposited on a 2:1 fiberoptic taper (FOT), optically coupled to a cooled CCD camera. The functional detection area is 30x15 mm². The cone beam geometry with the small focal spot of the X-ray tube (up to 8 μ m) allows the magnification of small samples, increasing the effective spatial resolution. The individual data set consists of a 8 bit volume of 720x720x358 isotropic voxels with a voxel size of 30 μ m.

Volume rendering and imaging were made by means of Amira 3.1 (Mercury Computer Systems Inc.). Measurements were performed on the digital images (microscopic or μ CT-based) using MPSAK 5.0 (Museo Pigorini, Rome) and ImageJ 1.33 (National Institutes of Health, USA) software packages.

SEM analysis (see supplementary Figures 1 and 2) was performed on negative replicas of the surfaces made by silicon elastomers (Provil Novo) and on the positive high resolution epoxy resin casts (Araldite LY-554 and hardener Hy 956) produced from the negative replicas (Fiore *et al.*, 2004).

- Buikstra, J.E. & Ubelaker, D.H. *Standards for Data Collection from Human Skeletal Remains* (Arkansas Archeological Survey Research Series, Fayetteville, 1994).
- Fiore, I., Bondioli, L., Coppa, A., Macchiarelli, R., Russom, R., Kashay, H., Solomon, T., Rook, L. and Libsekal, Y. *Riv. It. Paleont. Stratigr.* **110**, 89-97 (2004).
- Rook, L., Bondioli, L., Casali, F., Rossi, M., Köhler, M., Moyá Solá, S. and Macchiarelli, R. *J. Hum. Evol.* **46**, 347–354 (2004).
- Rossi, M., Casali, F., Romani, D., Bondioli, L., Macchiarelli, R. and Rook, L. *Nucl. Instr. Meth. Phys. Res. B* **213**, 747–750 (2004).

Supplementary Table 1

The drilled crowns represent 0.3% of the permanent tooth sample from the early Neolithic graveyard (MR3) at Mehrgarh, Pakistan (n = 3880 teeth from 225 individuals) and 1.11% of the investigated first (M1) and second (M2) molars (n = 988). 4% of the individuals from the MR3 cemetery possess drilled teeth. None of the 303 deciduous teeth (including 151 deciduous molars) show traces of manipulation.

Drilled teeth from the Neolithic graveyard of Mehrgarh (MR3), Pakistan

Individual	sex	age at death	N affected teeth	total N perforations	tooth	perforation location	mean diameter (mm)	depth (mm)	caries ¹
MR3 7A2	female	20-30 yrs.	1	1	mand. Rt M2	centro-buccal	3.0	3.5	probable
MR3 12	?	adult	3	3	max. Rt M1	centro-lingual	2.0	2.2	probable
					max. Rt M2	centro-mesial	1.9	1.2	probable
					mand. Lt M2	centro-buccal	2.0	1.0	probable
MR3 84.2	?	adult	1	1	max. Rt M1	mesio-lingual	2.0	0.5	no
MR3 90	male	>40 yrs.	1	2	max. Lt M2	mesio-lingual	1.6	1.5	no
						center of the crown	1.3	0.7	no
MR3 177	female	20-30 yrs.	1	1	mand. Rt M2	centro-buccal	3.2	2.8	no
MR3 291	male	20-30 yrs.	1	1	mand. Lt M2	centro-buccal	3.2	2.1	no
MR3 553	?	>40 yrs.	1	1	mand. Rt M1	bucco-distal aspect at the neck	1.7	1.2	no
MR3 561	female	30-40 yrs.	1	1	mand. Lt M2	centro-mesial	2.5	1.5	no
MR3 573	female	30-40 yrs.	1	1	mand. Rt M1	centro-buccal	2.6	2.2	no

yrs. = years; mand. = mandibular; max. = maxillary; Rt = right; Lt = left; M1 = first molar; M2 = second molar

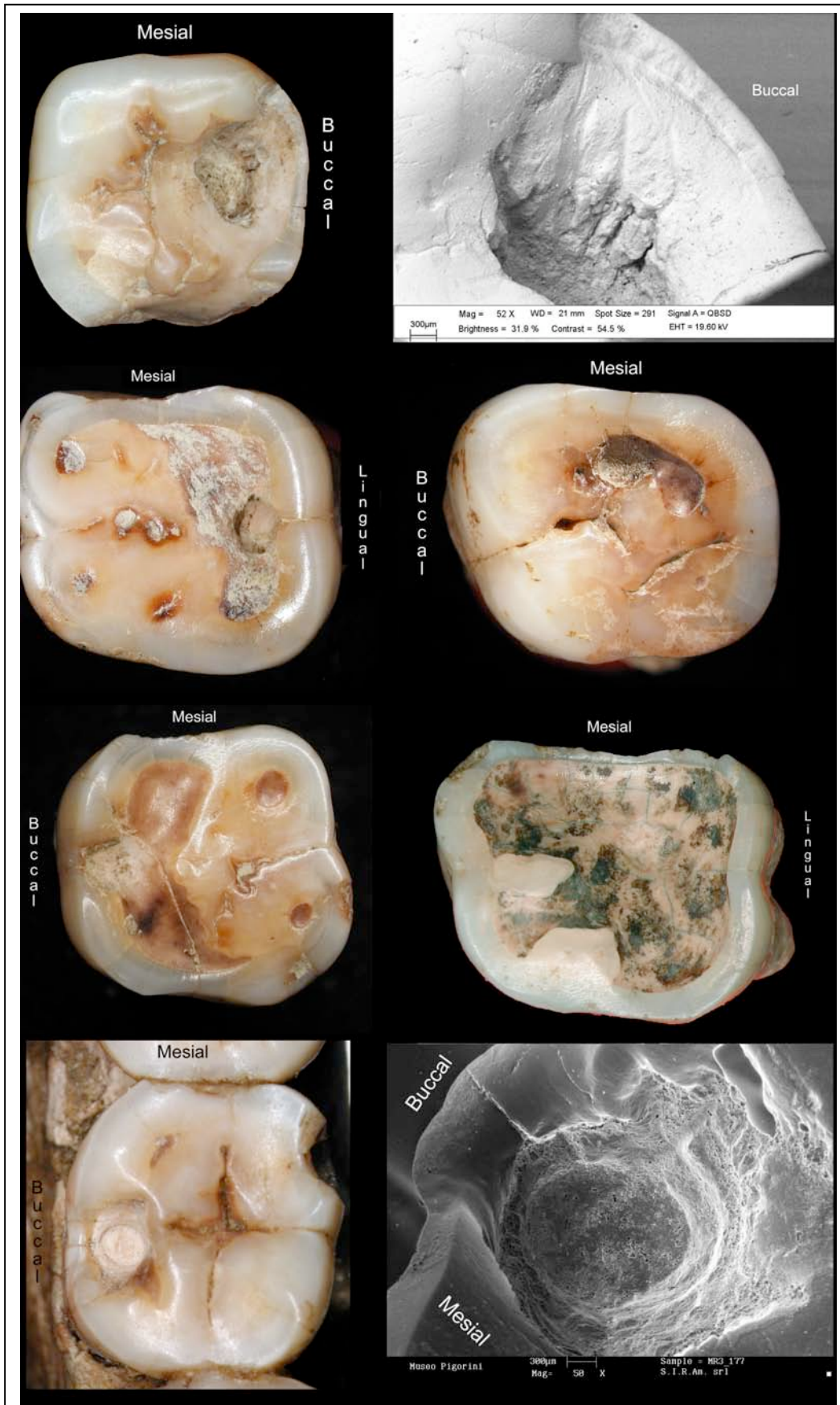
¹ Dental caries prevalence at Neolithic Mehrgarh is 1.42% (ref. 6 in the text).

Supplementary Figures (1 and 2)

Note that some minor scratches on the enamel and dentine surrounding and external to the perforations (e.g., on the mesio-lingual side of MR3 291 in supplementary Figure 2) may be post-excavation damage related to removal of the original silty sediment and/or calcite/quartz crystals filling the fissures. These can be distinguished from ancient marks by their morphology (Gilbert and Richards, 2000; Fiore *et al.*, 2004).

Fiore, I., Bondioli, L., Coppa, A., Macchiarelli, R., Russom, R., Kashay, H., Solomon, T., Rook, L. and Libsekal, Y. *Riv. It. Paleont. Stratigr.* **110**, 89-97 (2004).
Gilbert, W.H. and Richards, G.D. *Anat. Rec. (New Anat.)* **261**, 2

Supplementary Figure 1



Upper left □ MR3 7A2.
Mandibular right second molar.
Occlusal view with centro-buccal perforation.

Upper right □ MR3 7A2. SEM
of the mesio-buccal wall of
mandibular right second molar.
Note the additional, more
perpendicular marks by a micro-
tool along the cavity's wall.

Second row left □ MR3 12.
Maxillary right first molar.
Occlusal view with centro-lingual
perforation.

Second row right □ MR3 12.
Maxillary right second molar.
Occlusal view with centro-mesial
perforation.

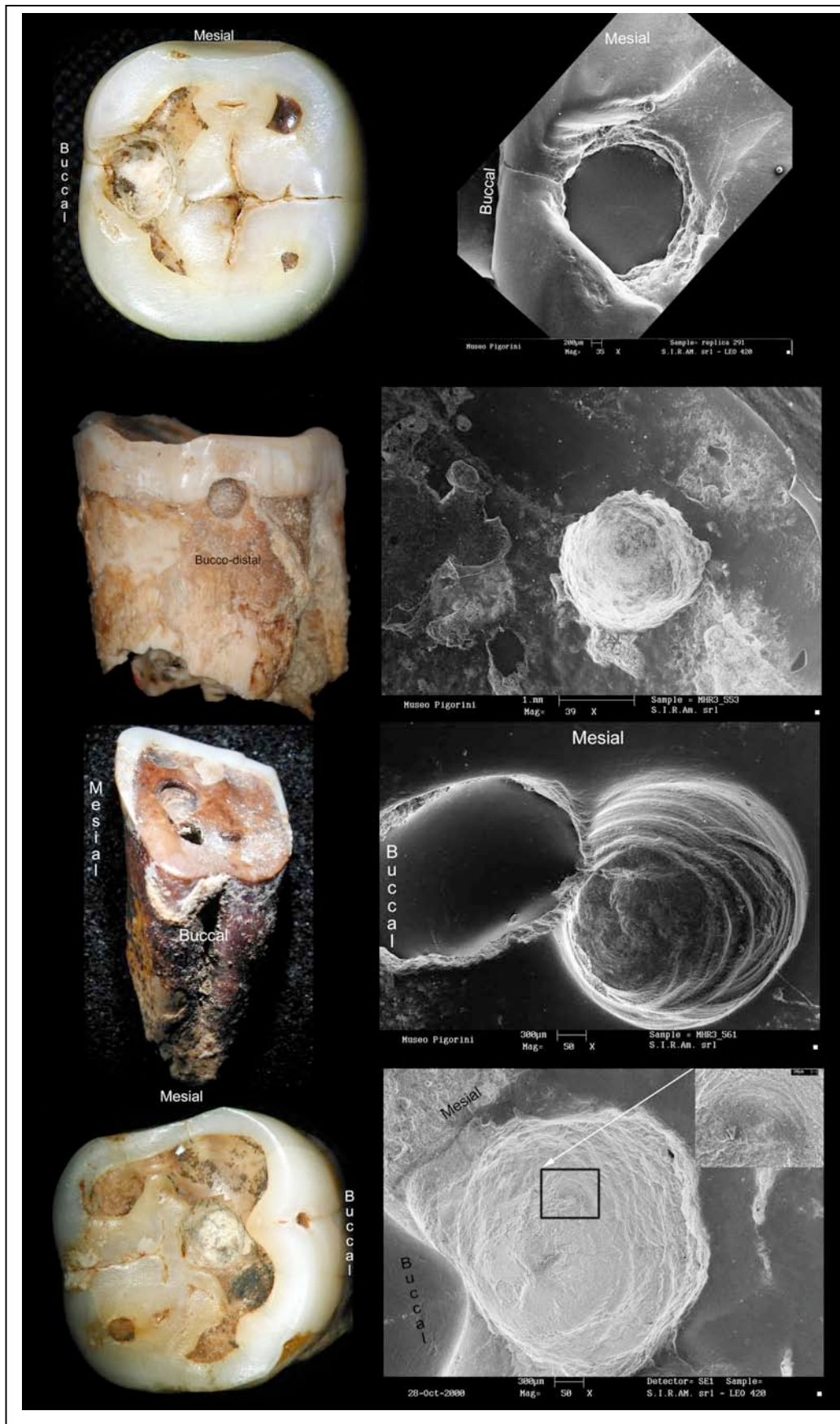
Third row left □ MR3 12.
Mandibular left second molar.
Occlusal view with centro-buccal
perforation.

Third row right □ MR3 84.2.
Maxillary right first molar.
Occlusal view with mesio-lingual
perforation.

Bottom left □ MR3 177.
Mandibular right second molar.
Occlusal view with centro-buccal
perforation.

Bottom right □ MR3 177. SEM
of the centro-buccal perforation of
mandibular right second molar.

Supplementary Figure 2



Upper left □ MR3 291.
Mandibular left second molar.
Occlusal view with centro-buccal perforation.

Upper right □ MR3 291. SEM
of the centro-buccal perforation
of mandibular left second
molar.

Second row left □ MR3 553.
Mandibular right first molar.
Bucco-distal view with cervical
hole.

Second row right □ MR3 553.
SEM of the bucco-distal
perforation at the neck of
mandibular right first molar.

Third row left □ MR3 561.
Mandibular left second molar.
Oblique bucco-lingual view of
the occlusal surface with
centro-mesial perforation.

Third row right □ MR3 561.
SEM of the centro-mesial
perforation of mandibular left
second molar.

Bottom left □ MR3 573.
Mandibular right first molar.
Occlusal view with centro-buccal
perforation.

Bottom right □ MR3 573.
SEM of the centro-buccal
perforation and additional SEM
detail of the deep mesio-lingual
wall of mandibular right
molar.