**Background/purpose** Detection of approximal caries may be difficult using conventional methods including visual inspection (VI) and radiography. The purpose of this *in vitro* research was to evaluate the efficiency of light-emitting diode (LED) and laser fluorescence (LF) devices, and radiographic and visual examination in approximal caries diagnosis. **Materials and methods** One hundred and fifty-six approximal regions were evaluated. All approximal regions were investigated using LED and LF tools after radiography and VI were performed. Histological evaluation of teeth was performed using stereomicroscopy. The area under the receiver operating characteristic curve and accuracy, specificity, sensitivity values calculated regarding approximal caries diagnose. **Results** The specificity of the bitewing examination was higher for both T1 and T2 thresholds (0.97 and 0.99, respectively), and the LF device showed better sensitivity at each threshold compared with the other devices used for caries diagnosis (0.94 at T1 and 0.79 at T2). The receiver operating characteristic curves presented that the LF device was more successful than the other techniques at T1 threshold and VI was better than the other caries detection methods at T2 threshold. The kappa values for interobserver agreements were 0.43 (LF pen), 0.33 (LED device), 0.55 (VI), and 0.75 (bitewing examination). **Conclusion** The ability of bitewing radiography to identify sound surfaces was better than that of the other methods. The LF device was the most sensitive tool for detecting approximal surfaces with caries, followed by the LED device.