Reply

We are very happy to hear that our review article entitled “Diagnostic problems in two-dimensional shear wave elastography of the liver” will be acceptable for publication in World Journal of Radiology after adequate revision. We have tried to revise our manuscript in line with the suggestions made by the Editor-in-Chief and two reviewers, as follows.
We have displayed the revised part in red.

To the Editor-in-Chief

Thank you very much for your kind comments.

1) To your first comment concerning “Reverberation artifact”, we have added briefly the mechanism of this phenomenon, as follows;
   “(P.5) Reverberation artifacts arise when the US signals reflects repeatedly between two interfaces of largely different acoustic impedance, resulting in delayed echoes returning to the transducer at regular intervals, This can lead to reverberation artifacts on grayscale US image [33]. The same phenomenon of the push pulse is considered to occur between the liver capsule and the transducer.”
2) To your second comment concerning “Motion artifact”, we have added the following description according to your comment;
   “Motion artifacts give rise to the characteristic image of a colorless area or an extremely reddish area in the cursor.”
   We have added “the reddish part (x) of the cursor is also unreliable” on the legend of Figure 5.
3) To your third comment concerning “The easiest way to measure SW values under this condition is to perform 2D-SWE through the least deformed hepatic surface possible”, we agree with your opinion “Compared with the motion and reverberation artifact, the measuring error caused by reflection and refraction on the rough surface of cirrhotic liver is ignorable.” It is true that this measuring error is minimal compared with the other artifacts, but, theoretically speaking, this error exists. Thus we have nuanced our expression, as follows;
   “(P.6) Although the measuring error is not so significant, it is recommended to measure SW values through the least deformed hepatic surface possible”.
4) To your fourth comment concerning “SWE of liver tumors”, we understand your opinion “—it is possible to achieve the measurement inside tumor”. We consider that SW value measurement inside tumor is not so accurate due to refraction of shear wave at the liver parenchyma-tumor border. However it is absolutely true that there is no other

way than the direct SW value measurement of the tumor under US image. Thus, we have changed our description as follows;

"(P.7) Although, the SW value measurement inside the tumor is not highly accurate, this measurement is considered to be still valuable for judgement of relative stiffness of tumor and surrounding liver. "

5) To your fifth comment concerning "Tracking US beam-related problem", we have added a representative image in Figure 9, according to your suggestion.
6) To your final comment concerning Figure 1, we have revised our Figure 1 according to your suggestion "the direction of push pulses should be along with the ultrasound beam".

To reviewer 1

Thank you very much for your kind comment on our manuscript. We have revised our manuscript in line with your suggestions. We have added a short description about computer simulation analysis in page 6, between "Mechanisms underlying US artifact-related problems in 2D-SWE determined by a computer simulation model" and "2D-SWE in diffuse liver disease" (description (1): see below).
Additionally, we have made a short description of the strength of computer simulation analysis in Discussion (P.8), between "This review has an important strength in that it has a theoretical analysis not found in similar trials reported in the literature." and "It ensures that unfavorable factors, such as technical errors, differences in US machines used and different levels of 2D-SWE experience, or influence biased by additional clinical data, do not interface in this analysis." (description (2): see below).

Our added description (1) is below;

"US scanners reconstruct US images on the assumption that sound passes through all parts of the human body in a straight line and at a constant velocity, and apply this assumption to all scanning planes. Actually, however, these sound velocity in the human body varies with the composition of the tissue scanned. When a plane containing tissues with different velocities is scanned, sound refraction occurs at the interface of the tissues, according to Snell's law (See later in "Discussion"). Computer simulation analysis helps understand the global images of refraction in the plane, measuring the degree of refraction at each point of the interface, not only in grayscale US image but also in 2D-SWE image.

Our description (2) inserted in Discussion is below;

Computer simulation model yields a purely theoretical analysis. In the case of gray-scale US images, the sound refraction produces artifactual images, because the US scanner displays each point at the appropriate distance determined by the time taken for the echo to return to the transducer in the direction in which the transducer is pointing at the time, even when the US beam is refracted. In the case of 2D-SWE as well, the US scanner reconstructs 2D-SWE images on the assumption that SW passes horizontally in a straight line, without deviation, and the US scanner displays SW velocity mapping on the basis of data measured by tracking pulses (determined by the time/distance). Computer simulation model enables us to calculate accurately and automatically the degree of refraction at each point, and understand the global image of refraction in the plane. This method is especially useful for understanding the global mode of refraction at the curved interface (tumor-surrounding tissue interface or surrounding tissue-irregular hepatic surface interface). (Figure10) [52-54]. In short, it ensures that unfavorable factors, such as technical errors, differences in US machines used and different levels of 2D-SWE experience, or influence biased by additional clinical data, do not interfere in this analysis.

Finally, we have provided more explanation the legend of Figure 7, to help understand our intention.
We added abbreviations.

To reviewer 2

Thank you very much for your deep comments (the same comments as those by Editor-in-Chief).
Please see our comments described above.

We hope that our revision is satisfactory, and our revised version will be acceptable for publication in World Journal of Radiology.

Sincerely yours,
Hiroko Naganuma