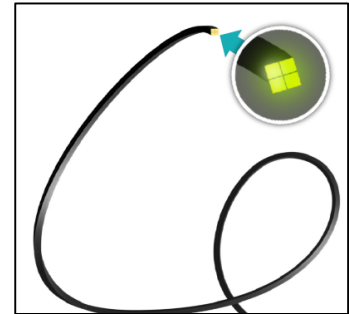


Needle-size imaging device transmits high-res images from deep inside the body



Z-Square, a new start-up by BIU scientists, has developed a micro-endoscope made of flexible, square-shaped optical-fibers that carry 3D high-res images of internal organs and enable treatment during minimally-invasive procedures



Lights, camera, action

“A-growing number of thera-nostic MI (minimally-invasive) procedures are performed routinely worldwide in areas of the body which have never been reached before. As healthcare institutions and insurers continue to search for more cost-effective care solutions that shorten hospital stays and minimize surgical trauma and recovery time, the increasing trend of MI procedures is likely to become even more widespread. “Nevertheless, doctors are still facing the unresolved challenge of poor visibility in these procedures,” explains Dr. Asaf Shahmoon, CEO of Z-Square. “Existing endoscopes are costly and too big to manoeuvre, and there is a need for smaller, more advanced endoscopes for various applications. Moreover, it’s very difficult to transmit high-resolution images through a thin fiber” says Shahmoon. “When an image travels around the curve of a fiber it gets distorted. “We identified a growing unmet need for a new type of optical fiber that can transmit high quality images without jeopardizing resolution”, he says.

“Our core technology is an ultra-slim, bio-compatible, highly flexible, disposable endoscopic device. It is based on an innovative fiber - the smallest in the world, to our knowledge,” he says, “which can transmit light-based information from the tiniest regions of the body in the form of high-quality images. The high resolution is retained despite the curved shape of the fibers,” says Shahmoon with pride.

The micro-endoscope is intended for visualization and treatment for both underserved and served markets, in such fields as ENT, cardiovascular, urology, gynaecology, arthroscopy, pulmonology, colonoscopies, and laparoscopy.

How to square a circle

“We decided that the fiber should have a square shape,” explains Shahmoon. “This saves time in design and manufacturing, and enables us to produce a diverse range of endoscopes at relatively low costs. Apparently, being square has some cool advantages!”

About the inventors

Dr. Asaf Shahmoon, CEO Z-Square, earned his PhD in electrical engineering at BIU and co-founded the company together with Prof. Zeev Zalevsky, a serial start-up launcher; vice dean of the electrical engineering faculty at BIU; and an expert researcher at BINA on optical super-resolution, biomedical optics, and nano-photonics. The initial research was performed by BINA scientists. BIRAD – Bar Ilan’s tech transfer unit – made the connection with the RAD Biomed incubator, and is currently funding the development. The company is seeking investment for the next development stage.



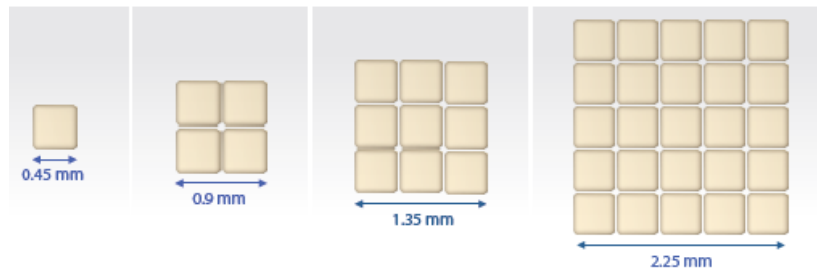
The technological platform is based on a modular *plug-and-play* concept of square tubes, 0.45 mm in diameter, serving as the building blocks for each endoscopic device. Z-Square's line of micro-endoscopes range in size according to the type of procedure. Some devices need only a single fiber, while others require a cluster of 2X2, 3X3 or 5x5 tubes. "There is also an option of leaving empty spaces for injecting medications," says Shahmoon, "which provides an effective means of treatment."

A picture worth 1.2 million pixels

"Our innovation required creative thinking.

In order for a camera to fit into the body easily, it would have to be really small.

However, there is a limit to how small such a camera can be made," says Shahmoon. "So, instead of a tiny camera, we designed a super-thin fiber which carries images **outside** the body. A camera is affixed to the endoscope handle, and is attached to the clustered fibers inserted in the body. Once the image hits the fibers, it is transmitted to the camera outside the body in real time, and processed to enhance the image by high-res imaging."



Constructed of highly flexible material, the Z-Square endoscope is easy to manoeuvre even in tight areas, requiring only a tiny incision for insertion in the body. "Each fiber offers additional features and enhanced performance," the CEO explains. "We are able to generate a 3D- HD (high-definition) image and apply advanced features such as multifocal imaging, which significantly enhances quality. By using multiple fibers we get a full 360° panoramic view of the area."

Z-Square technology has reached resolutions that were unachievable until now, increasing the physician's field and depth of view, and offering superior diagnostic and treatment accuracy. There is also an integral defogging mechanism so that the device does not need to be removed and cleaned during medical procedures. Additionally, the fibers are disposable so there is no need to sterilize them – another huge benefit.

