

PORTCARE

bag without borders

portable dentist device

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Abstract

This degree project is dealing with medical design, what is actually a backpack. This portable solution is for dentists, what is including the most important and essential tools, instruments for the indispensable oral health.

I was aiming the third worlds countries especially, and remote areas with this project mostly, but it could work also in disaster situations, to make it easier to approach by a doctor team.

The goal was to create something ergonomical and compact solution, what is userfriendly in the same time, to serve doctors needs who are employed by a dental charity organisation.

I have been collecting all the good features from the already existing products, and imported to this backpack.(equipments, batterys, suction units, etc.)

This device is a bridging solution to let the doctors reach remote areas much easier then with the already existing products on the market.

A hard shell bounded from outside, that is protect all the tools from inside, and makes durable and resistant against external influences, from the backside the pad-dings and straps are making more comfortable to carry.

Keywords

DURABLE
ERGONOMICAL PROOF
USERFRIENDLY
WELL EQUIPED
EASY TO KEEP IT CLEAN

Foreword

Special thanks to Stephan Söderholm chief designer DACAT AB. who was giving me external tutorials during the semester, and also to Kalle Klockars who was following my process and giving me nice ideas.

Special thanks also to Eva Jonson who was in charge to sew the backframe support. And last but not least to my uncle Paul Werner, who is a dentist in Germany, was contributed significantly to my design process with ideas and technical helps as well.

Introduction

About aims and goals:

This solution suppose to solve the problem of the transportation of the medical tools. My aim was to take closer the remote areas and the countries of the third world to a doctor team, and let them to approach easier.

Scenario (imaginary story)

John Smith is our main character, he has been born in the USA, and he is 28 years old now. He is a newly graduated student from the Harvard University. He was studying on the dental faculty and got a degree. John is an adventurous person since his childhood, and after the graduation he decided to go to join a charity organization rather, instead of getting the first couple of years experiences in a regular dental praxis.

He was joined to DENTIST WITHOUT BORDERS organization, to the Nepal mission. Personally I would like to make it easier for John to approach this villages and places which are out of every infrastructure, and make it more comfortable and compact against the competitors on the market.

Background

Originally I have been always interrested in medical design, and also to design something „usefull“ for the society and for the world.

The attraction to dentist division has been started when I was in a highscool before the graduation. I spent a half year in Germany by my uncle, who is working as a dentsit. I have been visiting him so many times at his praxis during this time, and been always impressed by the tools and equipments. I saw also the workshop where have been the orthodontic produced. This experiences from my teenager era has been effected so much on my future and my choices as well. Beside a lot of inspirations these are also motivated to choose the designer profession, and make these tools even better.

Luckily at the univerity we got a deeply committed lecturer to the medical design I have been really glad , because we got many task in medical design. I learned a lot about problemsolving, materials and methods during this time, which were increased my knowledge so much.

Before I have choosen topic I have been turn to this teacher and we have had a nice discussion about this topic. He has been supported my idea and he felt also that would be a nice master degree project.

Framing questions

This topic what I have been chosen was giving me a lot of questions. Already at the beginning, and also during the whole design process. I have been categorized the coming up questionst to subgroups, to keep everything clear and understandable in the future as well.

1. User group:

Who is going to use the product?

Ergonomically applied for men or women?

2. Placing:

Is this product is necessarily needed on the market? How could be better than the competitors? Where should be used?

3. Materials:

Which materials would be fine and strong enough to build up this backpack?

4. Technical Parts:

Which place would be the best for the engineering (weight aspects)?

Rechargeable batteries?

5. Sustainability:

Changeable tools?

6. Cleanliness:

Alternative cleaning methods? (Fresnel cooker)

Demarcation:

I wanted to achieve a bridging product, between the developed countries and developing counties, what is picking up all the good solutions from the already existing products and improving with other features. I wanted to make it more compact and suitable for an organization to use this product outdoor as well. During the design process I have changed a few things but the main purpose was the same. These small changes is effected mostly the shell appearance and the tools arrangements.

Implementation

Informations, analysis:

On the first stage I have been starting to get answer to my relevant questions. But during this research phase a lot of new question raised.

At the very first time I have been doing researches on the web to find companies who are producing this kind of medical devices. At the beginning I was very hopeful, to find a lot of existing products and I could get usefull informations from there. But after a while I was disappointed , because I haven't found any usefull information. I thought may I was searching with bad keywords, but after a lot of tryouts suddenly I found a chinese company who had a similar product what i have been looking for. That was the first information and a picture of a product what I could use as a basic upon my design process. One of them is a soft sidebag, one is a trolley suitcase.

I received a brochure as well a bit later from my uncle from Köln, about one existing product, with this, the scale has been expanded. Now at least I could compare the products.

I have started the observations upon the products. I was writing emails to the chinese company where the chinese devices are coming, and I got an answer from them. We have started to have a conversation about their product. I have been corious mostly to the technical details and arrangement, but of course I have not received so much about it.

With this knowledge what I had from the chinese company, and from the brochure what I had from my uncle I could start with the analysis.

The main difference between these project is the quality and the numbers of the equipments.

The german product has a lot of features. And gives much more freedom for the user. It is including a lot of switch and buttons to navigate between the tools. Its a hard case solution what is quiet hard to carry, and also very heavy (15 kg) this are the weakest points of the german product.

The chinese products, both of them are including just the essential tools what a dentist would need during the surgeries. This is not as heavy as the german one, and maybe easier to carry, because its a sidebag. The bag design is totally diffent, becuae it is not an aluminium hard case, it is covered by textile, and some places with metal plates.

The other tool is not as lightweight as the previous, and it looks very „ industrial“ because all the engineering and parts are in a huge metal box, what is rolling on tiny wheels. This is the weakest product out of the three. It has just bad features if the previous to is the standard, hard to carry, heavy, non well equiped.



German Product

- + well equipped
- + easy to use
- + compact, chargeable

- heavy
- hard to carry



Chinese Product #1

- + easy to use
- + compact

- heavy
- hard to carry
- better to carry



Chinese Product #2

- + easy to use

- heavy
- hard to carry
- better to carry
- not so well equipped

Idea, Sketch:

Idea

After the market survey and the research part came on of the best part of the design process, the ideation and sketching. I have had already ideas about what kind of features do I want to apply to my design using as a basic on the already existing products.

This time the main focus was on the shape of the bag, to find a form what can carry weight durable enough and stiff for using it outside. Fortunately was coming quickly, I have been thinking about my education, at the design era, and I remembered to a course what I have done, it was about sculpture studies. That time we used analogy to create sculptures and shapes. One segment of this course was built on the world of insects. It is just impressive how these small creatures survive almost everything and they are on this planet since almost the beginning. I was starting to observe bugs and insects and collect informations about them, how they armor working, and study the structure as well.

After a lot of study, I have decided this will be ground of my design and I will build up the whole concept on this insect analogy.

From the backside, I was using solutions of the hiking bags. It was a lot of research as well, but I would like to connect this part to the insects too, and finally the backrest got a shape like the insects have on their belly.

I have started to think about how I will arrange the internal components, instruments, and figuring out a place for the heavy parts (compressors, suction units, battery), the drillers and water spray units, and the control panel as well. And against the existing products I was planning to design a storage for the external tools and accessories.

Exterior

The sketching part was the most interesting thing of the entire project. I have got already almost everything in my head, I just needed to sketch them. During this time I have learn a lot about sketching in analog way and also digital way as well.

I have started with bugs. and insects the sketching and I was trying to understand them and pick up the most specific features and try to apply it to the backpack.

At the beginning I had a cube as a basic. The cube is the shape what is where the spaces could well used, for packing. I have taken this standard primitive first, I knew approximately how big space would need me for the parts from inside, and I was starting to shape the cube to get a more organic object.

Basicly I haven't changed so much with the cube, I rounded the edges, gave them a bigger radius and adopting the specific character of the bugs to the middle, what is actually a fracture line all the way own on the surface. Its divided the body into two symmetrical parts, and in the same time it makes much stronger the backpack. In the future that feature gave to the product the main character. I divided the shell for two opening parts. Behind the smaller are the drillers and instruments and a control panel, behind the bigger one the storage got place.

I was thinking a lot about the engineering from inside, how should I place them. That was the biggest challenge in this task.

Arrangement of the internal parts (compressors, battery, decompression tank)



First time I was trying to fix it to a divided steel pipe what was connected to the backframe directly. That wasn't such a good idea, I realized that I am just increasing the useless materials and parallel this also increasing the weight of the backpack. I have decided I am going to use the backframe as a holder element and I will fix each part to that one.

I would like to place the heavy stuffs to let it easy to carry. I had a research as well where is the most comfortable to carry the weight. I have been talking to a physiotherapy, and I have been asking him, where is the place on our body what can stand a big load for long time, if we are talking about to carry a backpack? He mentioned me to focus the weight mainly to the hip of the body, that part of the human body is mostly able to carry heavy weights.

I have been calculating the weight factor, and he was right. I will have approximately 12-15 kg weight, what I have to place it to the backpack. The engineering is the heaviest part, so that should go to the hip.

The frame from the backside is the soul of the whole backpack this bracing the whole product. When I was trying to get the shape of it, first time I was looking for possible materials. I was putting there a list of the possible solutions, I have been thinking of :glass fiber, carbon fiber, plexi glass, moded plastic. I have studied all those materials features, prices, and strength, weight. I have chosen the carbon fiber solution because that was the strongest and the lightest, and has the the best durability from all of them. It has just one negative feature, it is a very expensive material.

I had the material for the frame, I needed a shape that is fit to the shell. At the beginning I kept it like simple straight plane, with thickness, after a while a realized, that I would need some extra shape to have it stronger. I have changed the flat frame idea to a double bended surface, what is almost following the bodyline from the neck till the buttocks.

Now I have the back support and the shell in the computer, I have started to deal with the straps and the padding to cover the back frame. There is also a big research behind it, I had a lot of tryout of different patterns of the back support, different shapes forms, finally I have chosen the one which was remind me to a bug. That was the second aspect actually, the first one was the ergonomically view.

I let a small gap in between the two foam .

I wanted to let the air replaced during the someone is wearing the backpack. from one side is a cooling feature and also saving materials.

I added similar lines for the straps as the hiking bags have, I felt these parts are also important.

Interior

By this I have been struggling so much with control panel, and the arrangement of the tools. At the very first time I was treating everything just in scale without any detail, just to find the right place for them. Time be time it went well, and got everything clear. I was adding the 2 different speed driller 1 tartar remover, and one extra water-spray to the kit. I have been using already existing products as a schema.

The control panel was the second task front of me, to keep everything clear and understandable for the user, and also let it to make it clean easily. I had a lot of different ideas about the layout of the control panel and ideas for the knobs as well.

The holder for the instruments is following the shape of the shell from inside and gived more stability for them. I got the final piece after a lot of sketch work it turned out to be nice.

After finishing the lower part I have dealing with the upper part. This is the storage part, actually here can store: cotton wools, needles, disinfection liquids, external hand tools, cables for charging the battery, bits, UV lamp, and other optional equipments)

First time I wanted to have them in a case for giving more freedom for the user, but after the sketching I have realized, they can get access to this field as well during the surgeries without any problem, so I have decided I will not divided the upper part, instead I will put there the storage as a part of the bag. (On the previous sketching the storage was separated)

I rather chosen the storage bin solution adopted to the bag, this kind of solution also turns back to the insects and using their analogy. Its easy to use and don't need two hands to open it, just flip it up and slide it down to a ditch, and it doesn't prevent the user to get access to other bins.

For the UV lamp let some place on the side the user can easily snap it to a hole and keep it stable. This is the same closing an opening system with the storage bin as well. On the other side the cables and wires got some place, with this order I could keep the symmetry of the bag, and keep the most weight in the middle aligned to the backbone.

After the first sketching stage I had a tutoring with Stephan, we were discuss about the current statement, and got some nice feedbacks and advices how to continue this project.

Final Sketches.

Since I had almost all the details and feature what I wanted to put to this bag, I have started to build up everything in 3D.

The pack appearance was not so hard I have followed my old sketches and got the shape after this. The problems were with the small details to get them well. It was a time consuming process.

PORTCARE

- + well equipped
- + easy to use
- + compact
- + easy to carry
- + ergonomical
- + chargeable battery

- heavy



Modeling

When I got all the blueprints, I was looking forward companies to help my by the prototyping. That was also one of the hardest point during the design process. After the tutoring with Stephan I received from him a design company who had a well equipped workshop for the sewing part and and also a workshop where they could produce the shell with vacuum technology. I met to the chief of this company, who was luckily originally Hungarian as me, so the communication went fluently. I was show him the idea and the purpose and I have been talking about the imagined workflow of the prototyping.

He was impressed and really liked the project of mine, and he was asking around in the company and forwarded my sketches to the other leaders. I had to wait for the decision. During this time I made my sketches more perfect and clear for a possible prototyping. After a week I received a mail from him, unfortunately their company couldn't support this project in any way. I have been a bit upset after this news but I was continuing the seeking of companies. After a while I found another firm, they were producing and selling component materials and plexi glasses. I turned to them with my sketches and I have asked them about support. Unfortunately I have received also a negative response , so I had to do everything by myself. As the schools possibilities are not so wide I had to reduce my expectation of the model, so I have decided to do a nonworking 1:1 scale model for the examination and for the exhibition.

I made the frame from MDF wood with vacuum box technologie, then I got the desired bending of the frame. After I started to make the shell. This made out from modeling foam and I have been using hand tools to get the wanted shape. I have followed my blueprints and I got an exact shape at the end. On the second stage I have started to paint it. I did the painting works at the school as well.

With the sewing parts one of my friend helped me out, because I am not so familiar in that field. We went together to buy the necessary fabrics zippers yarns and foams for the sewing, after that she was starting to sew the back part of the backpack. We had to meet quiet often to talk about the current statement, and decided it how it should go forward, and measure it to the back piece all the time. She finished very nicely that part, it was almost looked like a professional made one. I needed to assemble it, and it was done.

Result

After all I made done this project. A lot of work behind me. The end result is represent my aims and goals in the same time. This hard shell backpack is contain all the parts what a dentist need.

The main focus was on the function by this design and the usability, and also the durability as well. This product is meeting all the requirements what I gave at the beginning.

We can follow on the pictures how does the product look.

I have been paying extra attention to highly detail the control panel and to place the water and the spit tank to a visible place.

I have chosen the white color for the exterior, for the shell, because it is easier to keep it clean, made out from a vacuum sucked plastic, with 3,5 mm thickness. Originally the frame would be opening by a zipper. I have added black and dark grey colors for the back piece and for the straps. The logo and the control desk color is the green, which is quiet common by the dentists.

The padding fixed to the frame by screws and a piece of metal plate to keep the bag stable, and I have used strong Kevlar yarn straps, to have it more durable.

From inside the engineering is fixed to the back frame as well by screws, and they are located at the hips. I put the power button and the power switch above of the control desk to don't disturb the doctors during the process. These buttons are standards I haven't redesigned them , controllpanel is also mounted on a bended metalpiece.

The buttons made out from plastic and they have white color. I have added green colors to signs on the panel to let them visible. I divided 3 different division of the control desk. and one knob is for choosing programs. There is a possibility to choose between the internal tools, or there is another stand where you can connect external tools also (UV lamp, External Pedal...)

The first field includes the buttons for the internal tools, drillers(two different), and tartar remover, waterspray

The second field is for the external tools(UV lamp, pedal, extra lamp) and also you can follow the condition of the battery.

The third field is for switch on or switch off the water or the spit suction

Under the control desk there is a hole where the cables going inwards. They are rolled on a cylinder from inside and a spring keeps tension.

The control panel is fixed to the back piece and to the shell as well.

From above, there is the storage chamber. What is an optional feature only. I wanted to apply to my design because I felt that important as well. Normally just a driller is not enough for a treatment, also needs extra tools as well.

That's why I made a storage there. The storage frame is connected to the back piece and made out from plexi glass. I made for chambers with different sizes to give

more freedom to pack there the tools and accessories. They are closed with a metal plates, these are opening upwards and there is a small gap, created on the side of the plexi glass, where you can let it slide down, to get access for the contains. After using it is easy to close, because it is just snaps back to the standard condition.

The scale model really represent the size of the backpack and the dimensions, and also the small details are also visible.

And also I have to talk about the using. Normally when a doctor team approaching a village or places they are doing it with truck or any other vehicles. They are able to charge up the battery from the car battery, after when it is get ready for use they are leaving the truck and doing the surgeries, After the treatment they can return back to the truck and get fresh water to the waterspray and remove the spit from tank and recharge the battery, and this is an iterative process.

Reflection

It was one of my best project ever, I have been putting a lot of energy to work it out. At the beginning it wasn't so easy to catch up the pace.

I have been dealing so much with the details and keep everything simple. As long as not a "daily" product it was kind of hard to find similar projects on the market. I had to work out almost everything on my own.

I have been writing down a lot of questions at the beginning which were answered during the the design process. I feel sorry that I couldn't get any contacts with charity organizations, I have tried so many times to text for instance the DENTIST WITHOUT BORDERS, or the TRINITYCARE FOUNDATION to get some knowledge about equipments what they are using on a mission, because they are working mostly "outdoor" not in a regular dentist surrounds. Unfortunately I haven't got any response from these organizations so I had to ask normal dentists about the tools and equipments. I have been writing down my questions and turned to my dentist back in my home country and ask her. She was very surprised that I have chosen this medical theme for my master thesis work, and sent me lot of informations, about the tools.

Mostly these doctor teams have 3-4 member and they can share the work between themselves, as the pack is quiet heavy it should carry by a man. I couldn't reduce so much the weight factor so might be it will not be so comfortable to carry by a women.

This product could easily compete with the others because its been taken all the good features from them and also has been supplemented with the storage chamber what is not included by the others, and also ergonomically better than the competitors.

The field of use are also quiet wide. Could use by a charity organization, or by the army. The materials are not so cheap what I have used for this product, but also the internal tools are not cheap as well. For me the most important thing was to design a product which has good quality in materials and could used long time as well. And the durability was an important aspect of this design.

The engineering was also a relevant question at the beginning It has been solved during the process I found a nice place for it close to the hips. What was a reasonable place for them because they had to be close to the equipments.

The question of the electricity support also has been solved by the chargeable batteries, It is an optional solution of course but the tools could work with regular power support as well. The user can recharge this battery from the car power sources or using regular electricity support.

The element which constitute the backpack are changeable and fixable as well, but as I mentioned before I have used stiff and good quality materials, which are providing the long life for this device.

The cleanliness was also a relevant question at the beginning. At the first time I would use a Fresnel Lens based disinfection chamber what is using the sunlight to heat up for instance liquids. It is a simple foldable shape what could get place in the backpack as well. I left that idea but just for now. It could work but these could be big project itself as well, and I wanted to focus to the backpack only. Instead of this disinfection system I have used disinfection liquids and designed them a storage at the upper part of the bag.

I learned a lot during this project, I mean my visual communication skills, my hand drawing skills are improved a lot as well. I have been introduced to the basic of the modeling and painting as well, these are my personal remarks after this project. My project was well received by the teachers, the only problem was just, they were missing a scenario behind the product, and I haven't detailed so much my design process I have been speaking just what I achieved and forgot to mention it about how.

Nevertheless they were satisfied whit my design work, and highlighted the visualization skills of mine.

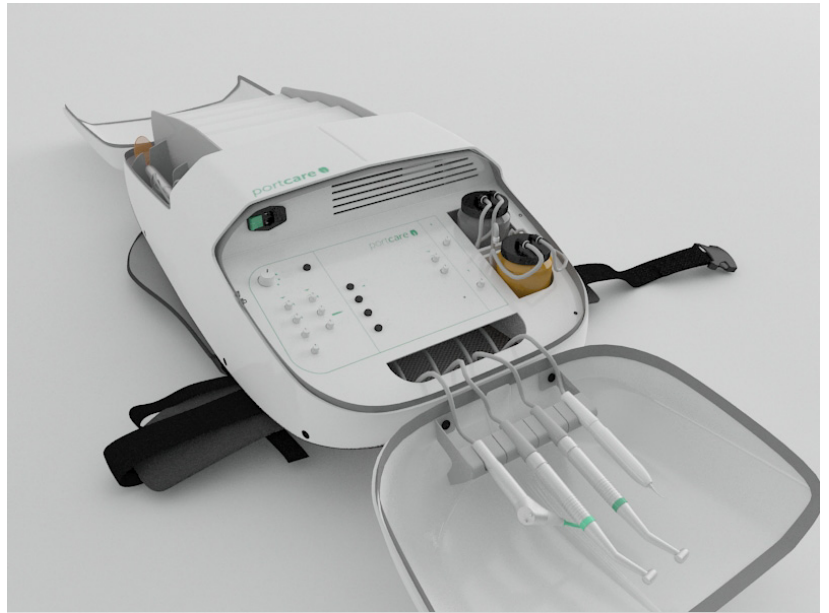
I have started my presentation with a short introduction of the project I have been

talking around my aims and my goals, at the very beginning. after this I showed a rendering of the device in an environment. On the next slide I was review a person who is the potential user of the device and I have been talking about his personality,The following slide was about a market survey and review of my researches , I stopped by this point a bit and detailed the collected pictures good and bad features as well. By the next slides I was showing them places where the product could used. Places from Africa, South America, Asia, disaster areas, and also an army scene. And then came the scenario part where the user in mission, these slide are presenting the storyboard as a cartoon, or comic. The next two slide were about the inspiration of the bag, I showed some photos about insect which were effected the design process of mine. After this was coming the detailed pictures about the device, and showed all the functions and features. I was concentrating to show up everything of the bags features and functions. Before the closing slide, I was showing the control panel display, and been talking about the functions.

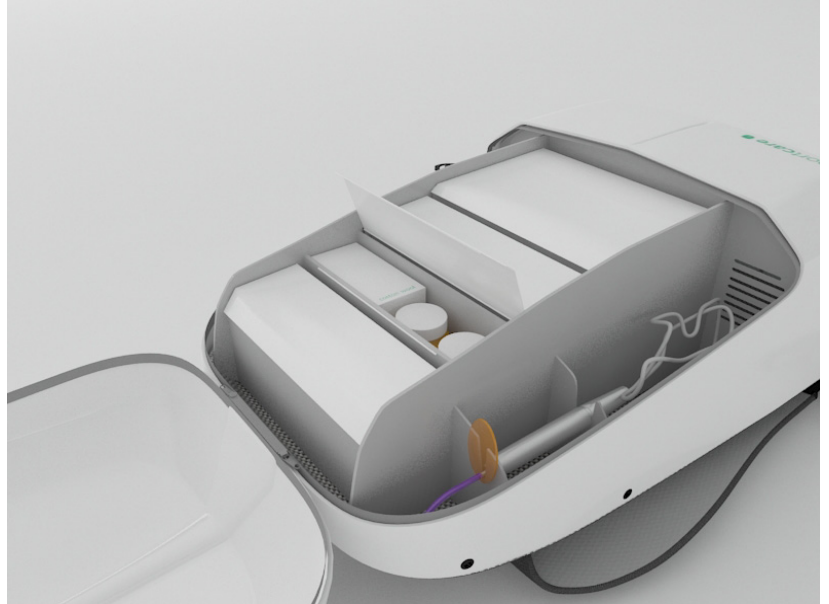
I have fixed the missing parts what they were missing from the examination and I put to the public presentation.

Pictures

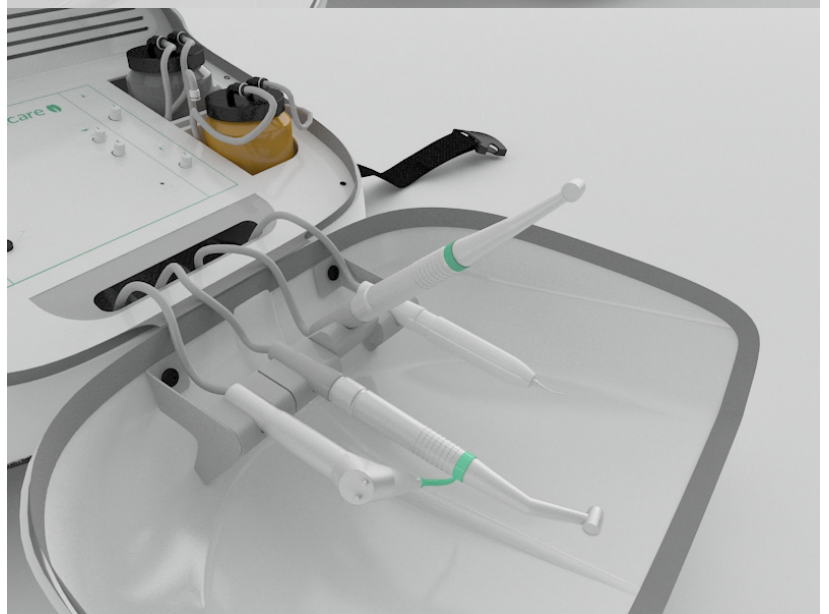
Open condition, You can get access to all the tools in the same time.



The storage could open very easy just crack it up and you can get access for instance the cotton wool...



The driller holder is fixed to the body of the shell, you get access to this tools if you bend them up.



Sources

The pictures from underneath 2. 3. on the 7th page I received from:

Best Dent Equipment Co., Limited

Address: No. 303 Liya Ju, Fuli Plaza, Dashi, Panyu, Guangzhou 511430 China

Factory Address: A3 Building, Lianyi Industrial Zone, Dashi, Panyu District, Guangzhou 511430 China

The first picture from the top, from the 7th page made by Paul Werner at the Köln Dentist Exhibition 2011